TWENTY-FIFTH ANNUAL REPORT

OF THE

New York State College of Agriculture

AT

CORNELL UNIVERSITY

AND THE

Agricultural Experiment Station

Established under the Direction of Cornell University

ITHACA, N. Y.

1912

PART II

TRANSMITTED TO THE LEGISLATURE JANUARY 15, 1913

ALBANY
J. B. LYON COMPANY, PRINTERS
1913

CORNELL

Rural School Leaflet

[FOR BOYS AND GIRLS]

Published monthly by the New York State College of Agriculture at Cornell University, from September to May, and entered as second-class matter September 30, 1907, at the Post Office at Ithaca, New York, under the Act of Congress of July 16, 1894. L. H. Bailey, Director

ALICE G. McCLOSKEY, Editor

ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

Vol. 5 ITHACA, N. Y., NOVEMBER-DECEMBER, 1911 No. 2

BOYS AND GIRLS

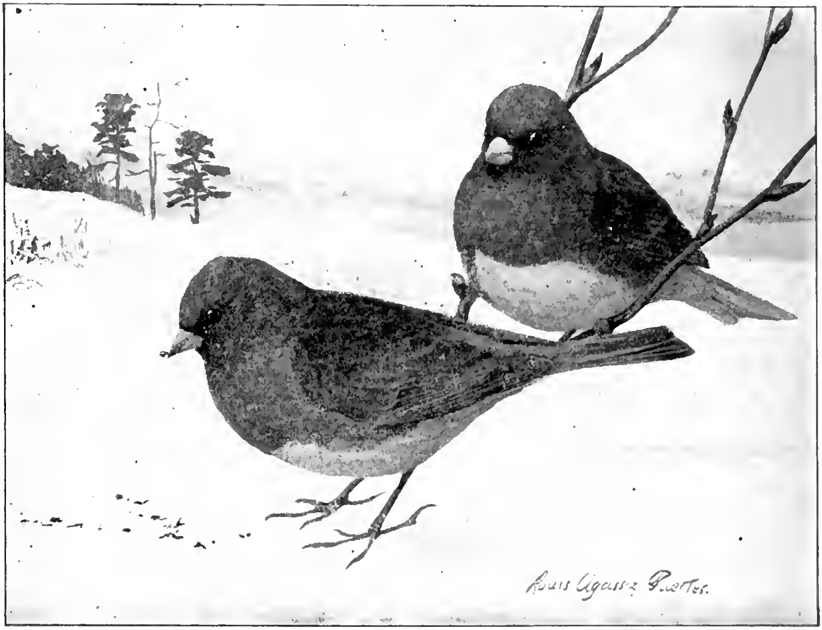
THE EDITOR

It is night. Wild, deep winds are out and rain falls on the great white road beyond my door. The leafless vines strike against my window. The old house is filled with strange sounds, but to me they are not lonely sounds. I have loved these outdoor voices through all the years, and in truth I find them goodly company. When they speak to me by roaring down my chimney or by splashing on my great white road or by shaking the slender vines against my window, I answer them in a deep, glad way, so full of freedom do I feel and so full of joy.

To-night I am letting the sweeping winds take me to the homes of boys and girls in country places. The young folk cannot see me, not one, but

I can see them even by very dim light. Some are rosy and round; some are pale and thin; some are tall; some are short; some are cheerful; some sad; some very good-natured — and how we like to have them about; some very "grouchy," and, indeed, we do not want them about. Then there are the boys and girls who are busy and happy, useful to every one — boys and girls who do something for the family each day, making themselves necessary in the home. And still others? Oh, they will wake up soon, for this is no world for selfish, idle folk.

Now all who are not among the idle ones will read this Leaflet and follow at least one of the suggestions made for boys and girls living in the country.



The junco, a winter bird

Are you interested in poultry? Begin this year to make plans to raise some of your own. Father and mother will be glad to help, and you can take your problems to Professor Rice here at the State College and get many helpful suggestions from him.

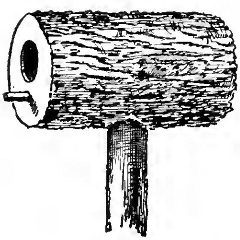
Do you like bird study? Ask your teacher to let you see the September Leaflet for teachers, and read what is said on this subject. All boys and girls in New York State will this year study the following birds: The hen, downy woodpecker, robin, bobolink, redstart, red-eyed vireo, blackbird, marsh wren, turkey, and owl. The older boys and girls should get into the habit of keeping a record of the birds they see. I wish every one of you would try to find some book on birds, either in the school library or in your homes, and read the descriptions of the birds you are to study this year. It will help you in identifying some that are unfamiliar to you.

The downy woodpecker

Build a bird house. In the illustration you will see one kind. The birds will like it as well as a very handsome one. They do not approve of fresh paint, and the birds that will build their nests in houses will not care for one in which the doors are too large.

Things to remember in constructing bird houses.— The houses should be built on poles or buildings in somewhat secluded places, and the majority of birds prefer a house not more than twelve feet from the ground. The size of the doorway is important. For the wren and the chickadee the opening should be an inch auger hole, and for the other birds that build in houses it should be one and one-half inches. Some birds, such as the martins, tree swallows, and pigeons, like to live near one another. For these birds a little apartment house may be made, allowing floor space six by six inches for each pair. There should be but one door to each compartment. Be sure to build a bird house and have it in place by next February.

Are you interested in the weather? In the sky by day or night? In sunlight and in wondering about your shadow as it stays with you while the world is light? In the teachers' Leaflet for September there is a lesson on storms. Ask your teacher to help you to understand what is happening in cloudland when the storms come. I think the study of weather is best of all. I hope that while you are out studying the weather you will begin to wonder about the sky and the hills, the rivers and the far-away mountains, the mystery of the far-away starlight. As soon as you begin to wonder, you will begin to ask questions and to find out something about the outdoor things that have a never-ending interest for thoughtful boys and girls.



A bird house

We want you to learn to be in tune with the weather. The strong people of the world have loved the rain as well as the sunshine; they have loved the plains as well as the hills; they have been at home in the great outdoors in company with sweeping winds. You, too, must find these real things that, I think, have helped to make men and women great and deep.

You will find in this Leaflet a letter that I hope you will answer. Thousands of boys and girls in New York State write to us very often, and since you are not idle you will take advantage of the opportunity to correspond with some one in your State College. This year your letters will be written to the young man who sends a letter to you in this Leaflet. If you should come to know him, as you may some day, you will find that he cares very much for the outdoor world and for all that country life gives. He also cares very much for boys and girls and is looking forward to your letters. He may not be able to answer all letters personally, but whenever a Leaflet for boys and girls is sent out you will find in it his letter to you. Address all letters to Mr. Edward M. Tuttle, College of Agriculture, Ithaca, N. Y. Ask your teacher to let you write a letter each month to Mr. Tuttle during your English period. To all who write three letters, we shall send a picture.

SUNLIGHT AND SHADOW

WILFORD M. WILSON

" A splash of blue, a sweep of gray,
Some scarlet patches on the way
Compose the evening sky."

" Sunset that screens, reveals,
Enhancing what we see
By menaces of amethyst
And moats of mystery."

What makes the sunset red, the sky blue, the grass green, or the scarlet spot on the blackbird's wing? And why is our shadow with us all day long when the sun shines? These are hard questions; but we live under the blue sky, we see the sunset colors almost every evening, and we never can get away from our shadow while the sun is shining, no matter how fast we run. Would you like to know something about light, shadows, and colors? Some persons think that children cannot understand such things; but let us try.

Sunlight has in it every color you can think of except black, which is not a color at all but the absence of all colors; and the strange thing about sunlight is that when all the colors you can think of are mixed together in the right proportion as they are in sunlight, they make white. White is all colors mixed together and black is no color at all.

Sunlight comes to us from the sun in little waves or ripples called rays. The finest waves or ripples that we can see are blue, and the coarsest are red. Some of the waves are so fine and some are so coarse that they do not affect the sight nerves in our eyes. The coarse ones are called dark rays, or heat rays.

If you drop a stone into a pool of quiet water, you will see the little waves or ripples run out in all directions, forming circles, the center of each being the place where the stone fell; but if you look closer, you will see that each little wave moves away from the center in a straight line. Light waves move away from the sun in all directions in straight lines in just the same way; but when they strike an object, as a tree or a building, they are stopped, and thus on the opposite side of the tree or building we see its shadow. Many harbors along the ocean are closed in by great walls of stone or concrete except for a small gateway through which the ships enter. These walls are called breakwaters, and they stop the waves of water as they roll in from the ocean in much the same way that a building stops the waves of light and casts a shadow. We might call the quiet water behind a breakwater a water shadow.

There are some things that do not stop these little light waves, and that therefore do not have any shadow. Can you think of anything that will not cast a shadow when the sunlight falls on it? What about glass? Although glass is hard and rather strong, the little light waves pass right through it. Anything that stops the light waves is called opaque, and anything through which the light waves will pass is called transparent. How many transparent things can you think of? How many that are opaque?

If you drop a stone into a pool of quiet water the little waves will run out in circles quite fast; but how fast do you suppose the little light waves run out from the sun? What is the swiftest moving thing you can think of in the world? An express train, perhaps. How far will it go while you count ten? If you count right along it may take you about 5½ seconds. Try to count ten in 5½ seconds. In that time an express train would travel 500 feet. Do you know of an object about 500 feet from your schoolroom? In the 5½ seconds while you count ten and an express train is going 500 feet, the little light waves running out from the sun travel a million miles.

How can I help you to think of a million miles? Suppose you were to get on an express train going 60 miles an hour, and you traveled on and on, night and day, month after month, never stopping for coal or water all through this year and nearly eleven months of next year, you would have traveled just a million miles. But the distance you would travel on an express train going 60 miles an hour in one year and eleven months, these little waves of light travel in 5½ seconds, just while you count ten.

QUOTATIONS

" Passengers on the Cosmic sea,
We know not whence nor whither;
'Tis happiness enough to be
In tune with wind and weather."—*L. H. B.*

" Great is the sun, and wide he goes
Through empty heaven without repose;
And in the blue and glowing days
More thick than rain he showers his rays.

* * * * * * * * *

" Above the hills, along the blue,
Round the bright air, with footing true,
To please the child, to paint the rose,
The gardener of the World, he goes."
Robert Louis Stevenson

" One morning, very early, before the sun was up,
I rose and found the shining dew on every buttercup;
But my lazy little shadow, like an arrant sleepy-head,
Had stayed at home behind me and was fast asleep in bed."
Robert Louis Stevenson

" Late lies the wintry sun a-bed,
A frosty, fiery sleepy-head;
Blinks but an hour or two; and then,
A blood-red orange, sets again."
Robert Louis Stevenson

LETTER TO BOYS AND GIRLS

Dear Boys and Girls of the Open Country:

Sometimes the longing to be a boy again and to be out in the country comes to me very strongly. Of course that is not possible, so the next best thing is to write to country boys and country girls. That is why I am writing to you to-night. You look upon me as a stranger now, but during this year I hope we shall become great friends. You in your farm homes and I in this busy office where I am in touch with hundreds of boys and girls, should have much to tell each other that will be interesting and helpful.

When you read this letter Old Winter will be here. If you are the young folk I think you are, you do not mind it. You love the snow and the cold. What fun to slide and skate and build forts and have battles! Then, when twilight comes, how good it is to go into your homes leaving behind the great white world, and entering a room in which fathers and mothers and sisters and brothers and friends are sitting around a great open fire. Have you ever heard the message of the fire? What boy or girl has not lain in a half-doze, watching through dreamy eyes the flames as they leap and dance, and building — oh, such wonderful plans? Let us, you and I, imagine ourselves watching the flames and planning things for you to do during these winter days. How many have a good start because they did something this summer? You remember the many suggestions made in the April-May Children's Leaflet last spring? Are you keeping a note-book for out-of-door records as suggested? Have you some one finished piece of work to your credit? If you have, write and tell me about it.

I hope you are studying about the out-of-door world in your school this year. Let each one try to make a special study of at least one thing. One may choose birds, another poultry, another trees, another fruit, still another grains. Speaking of grain, is your school planning to have a Corn Day this year? January 27 is the day, and, though there were a large number of schools in which Corn Day was celebrated last year, we want twice as many this year. Your school will be one, I know.

Let me tell you just a bit of the history of corn, or maize as it is sometimes called. It was first grown by the Indians. When the white men came to America from England, the Indians taught them how to raise corn. Fishes were used for manure. Sometimes pumpkins and melons were planted with the corn. The Indians used to store their corn in "corn-barns," made by digging a basin-like hole in the ground and lining it with clay. The sides were a foot or so higher than the surface of the ground, so that the water could not get in, and the roof was made of logs, limbs, brush, and sod. So you see corn was grown a long time ago, and by a people whom we seldom think of as doing much farming.

Now, on Corn Day each one of you should have ready to take to school the finest ten ears of corn that he can find. They should all be the same kind of corn, and all as nearly alike as possible. A good sample is uniform in size, shape, color, and variety. Make your Corn Day a big day in the school. Decorate the room. Ask your parents and neighbors to come. Have some selections about corn read and recited. Have the girls cook and serve some of the corn foods suggested in this Leaflet. Above all, have a good corn show. Get a farmer in the neighborhood to judge the corn and find out who has the best sample of each kind. Learn all you can about corn, and take away with you the feeling that on this same day many other children all over the great State of New York have had a Corn Day, too.

After the exercises are all over, save the prize samples of each kind of corn and send them to us for our Children's Corn Show during Farmers' Week, February 19–24. If possible, have the school pay the express, for we have very little money for our work with boys and girls. Address the corn to Edward M. Tuttle, College of Agriculture, Ithaca, N. Y., and send it before February 15.

Suppose that all by yourself you had raised the sample of corn you take to school on Corn Day. Then suppose your sample took first prize. Wouldn't you be pleased! Begin now to get ready to grow your corn sample for next year. Save some good seed. Test it to see whether it sprouts well. Choose a piece of ground, and when spring comes go to work and raise a prize sample for next year. Girls like to grow things as well as boys. There is no reason why that first prize should not be won by a girl.

This is a long letter and it is time for me to stop. Read everything in this Leaflet carefully. I know you will be interested in all that is said about poultry. Perhaps some of you would rather raise chickens than corn. All right. It doesn't make so much difference what you do, but it matters how you do it. When you make up your mind to do a thing, stick to it until it is done in the best way possible.

Write to me soon, for I am eager to hear all about your work and your play — what you are most interested in, some new thing you have learned, whether you truly love the great, free, open country of which you are a part. You are indeed fortunate to live there, so close to Nature with all its mysteries that are revealed to the patient, reverent seeker. In the next Leaflet I shall write again. By that time I hope you will feel that I am,

Truly your friend,

Edward M. Tuttle

SELECTING CORN

ARTHUR W. GILBERT

When selecting ears of corn for breeding or exhibition purposes, one should have in mind a well-defined ideal type of ear. In general, this type of ear should be one that will give the greatest yield of mature corn. The following suggestions apply primarily to dent corn, but they may be made to apply to flint or sweet corn as well:

1. *Shape of ears.*— A perfect ear of corn should be full and strong in the middle part, indicating a strong constitution. It should retain this size to near the tip and butt, thus forming as nearly as possible a cylindrical ear.

2. *Butts of ears.*— The rows of kernels should extend well down over the butts of the ears, thus giving an ear of better appearance and containing a higher yield of grain. The shank, or the part of the stalk that is attached to the ear, should not be too large and coarse. Swelled, open, or badly compressed butts, as well as those having kernels of irregular size, are objectionable.

3. *Tips of ears.*— The tips of the ears should be well filled out, indicating a type of corn that will easily mature. The rows of kernels should extend in a regular line to the extreme tip of the ear.

4. *Shape of kernels.*— The shape of the kernels is very important. They should broaden gradually from tip to crown, with edges straight, so that they will touch the full length, and should be wedge-shaped without coming to a point. Kernels of this shape will fit close together and thus insure the highest possible yield of grain that can grow on the cob. If the kernels have this wedge shape, no wide spaces will be found between the rows. Such spaces are always objectionable.

5. *Proportion between corn and cob.*— There should be a large proportion of grain as compared with the amount of cob. This will be the case with ears having deep kernels. A large ear does not necessarily indicate a heavy yield of grain, and it is objectionable in that the cob, being large, contains a considerable amount of moisture which, drying out slowly, injures the grain for seed purposes.

6. *Color of grain and cob.*— Good corn should be free from admixture. White corn should have white cobs and yellow corn should have red cobs.

7. *Trueness to type or race characteristics.*—The ears selected for an exhibit or for breeding purposes should be uniform in size, shape, color, indentation, and size of kernel. They should also be true to the name of the variety.

CORN FOODS FOR CORN DAY

FLORA ROSE

Corn Meal Mush

1 cup corn meal
$5\frac{1}{4}$ cups water
$\frac{1}{2}$ teaspoon salt

Mix the corn meal with 1 cup cold water. Add $4\frac{1}{4}$ cups boiling water. Add salt. Cook over direct heat for 5 minutes. Set over hot water and cook for 1 hour or longer. Corn meal mush is better if cooked for several hours.

Corn Meal Gems

1 cup thick sour milk
$\frac{1}{4}$ level teaspoon soda
1 beaten egg
$\frac{3}{4}$ to 1 cup corn meal
1 level teaspoon butter or lard or drippings, melted
1 cup white flour mixed with 1 level teaspoon baking powder

Mix soda and sour milk. Add egg, melted butter, flour, and corn meal, and stir thoroughly. Pour into well-buttered gem pans and bake in medium hot oven for about 25 minutes.

Corn Pudding

1 can corn
or
1 pint grated fresh corn
1 cup milk
2 eggs
2 level teaspoons butter, melted
salt, pepper

Mix all ingredients. Pour into a buttered baking dish. Set the dish in a pan of water and bake until the custard is firm. A knife blade run into the custard shows the firmness.

Indian Pudding

1 quart milk
$\frac{1}{2}$ cup yellow corn meal
3 eggs
$\frac{1}{4}$ teaspoon salt
1 teaspoon cinnamon
1 teaspoon allspice
2 teaspoons ginger
1 cup seeded raisins
$\frac{1}{2}$ cup finely chopped suet
or
$\frac{1}{4}$ cup butter
$\frac{1}{4}$ cup brown sugar
$\frac{1}{4}$ cup molasses
or
all sugar or all molasses

Scald half the milk. Mix corn meal with 1 cup of remaining milk and add gradually to the scalded milk. Cook for 5 minutes or until it thickens, stirring constantly to prevent lumping. Add the remainder of the milk and beaten eggs—the suet, sugar, molasses, salt, and spices. Pour into buttered baking dish and bake slowly for 3 hours. If butter is used baking may be completed in 2 or 2½ hours. An hour after the baking begins a cupful of seeded raisins sprinkled with flour may be stirred in.

Johnny-cake

1	cup sour milk	1½	cups white flour
½	level teaspoon soda	3	level teaspoons baking powder
2	eggs	½	cup Indian meal
¼	cup shortening, melted	¼	teaspoon salt
½	cup sugar		

Mix soda and sour milk. Add beaten eggs, shortening, sugar, white flour mixed with baking powder, Indian meal, and salt. Pour into shallow buttered pan and bake 20 to 30 minutes.

HENRY D. THOREAU

How many boys and girls have ever heard of Henry D. Thoreau? Ask your teacher to read what is said of this great naturalist in the Teachers' Leaflet for September. Have some one in your class read the following extract from Thoreau's Journal:

" *Jan. 3. Monday.* It is pleasant when one can relieve the grossness of the kitchen and the table by the simple beauty of his repast, so that there may be anything in it to attract the eye of the artist even. I have been popping corn to-night, which is only a more rapid blossoming of the seed under a greater than July heat. The popped corn is a perfect winter flower, hinting of anemones. For this little grace man has, mixed in with the vulgarness of his repast, he may well thank his stars. The law by which flowers unfold their petals seems only to have operated more suddenly under the intense heat. It looks like a sympathy in this seed of the corn with its sisters of the vegetable kingdom, as if by preference it assumed the flower form rather than the crystalline. Here has bloomed for my repast such a delicate blossom as will soon spring by the wall-sides. And this is as it should be. Why should not Nature revel sometimes, and genially relax and make herself familiar at my board? I would have my house a bower fit to entertain her. It is a feast of such innocence as might have snowed down. By my warm hearth sprang these cerealious blossoms; here was the bank where they grew.

" Methinks some such visible token of approval would always accompany the simple and healthy repast. There would be such a smiling and blessing upon it. Our appetite should always be so related to our taste, and the board we spread for its gratification be an epitome of the universal table which Nature sets by hill and stream for her dumb pensioners."

POULTRY LESSONS

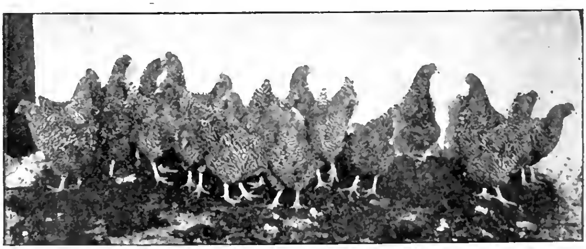
I. IMPROVING THE QUALITY OF POULTRY

JAMES E. RICE

We should aim to retain purity of breed and vigor of our stock, and to have high-grade market quality in our poultry and eggs. By so doing, the profits may be greatly increased and the losses reduced because the selling value of the product will be increased. We shall also get more pleasure and satisfaction out of our occupation because we shall take pride in the improvement made. The difference in price between poultry and eggs that are attractive and those that are unattractive is enough to warrant great care in breeding for improved quality.

A flock of miscellaneous colors and types such as is often found on the average farm. Cockerels of this sort are of no value as breeders and are poor ornaments

Some of the reasons why pure-bred poultry is more desirable than common stock are: 1. Pure-bred fowls lay eggs that are more uniform in size, shape, color, and texture of shell. Uniform eggs sell for a higher price. 2. They are more likely to breed true, that is, the chickens will grow up to be like their parents. 3. They are more uniform in shape and size of body and in color of skin and shanks, therefore more attractive and more profitable when placed on sale. 4. They are more attractive as a flock, because they are similar in appearance. It is worth while to keep poultry that looks well. 5. They furnish a larger income because eggs for hatching and stock for breeding can be sold at prices considerably higher than for market purposes. 6. They are more satisfactory, because, other things being equal, they may be expected to give better results in feeding, hatching, and rearing, due to the fact that



A flock of pure-bred Barred Plymouth Rocks. Note the beauty of a flock like this as compared with a flock of mixed breeds they are more nearly alike as to rate of growth, size, temperament, activity, and the like.

What can we do to improve our poultry?—Any boy or girl who is old enough to take care of chickens can improve the quality of poultry in two ways: First, by keeping only pure-bred stock and by selecting, mating, and taking proper care of them; second, by selecting and using only the right kind of eggs for hatching. Both of these things should be done, but either one alone will be likely to result in sufficient improvement to warrant the effort of doing it. We should keep a pure breed instead of common mongrel fowls. This is within the reach of all. It is neither difficult nor expensive to secure in any neighborhood a few pure-bred fowls or their eggs. With these a small start can be made. Each year more and more pure-bred chickens can be reared to take the place of the common fowls until all the flock are pure-bred.

Find out for yourself, by trying, whether it will pay better to have a pure breed of poultry. Remember, however, that not all pure-bred fowls are good fowls. Whether we have pure-bred or mongrel stock they must be strong, vigorous, and healthy.

II. SELECTING AND KEEPING EGGS FOR HATCHING

James E. Rice

One of the easiest ways to increase the money-earning value of poultry is to improve the quality of their eggs. The best customers usually are willing to pay a higher price for eggs of superior quality. Frequently this difference in price is as high as five to ten cents a dozen. Each hen in a good flock should lay on the average ten to eleven dozen eggs a year. If the eggs are of such quality that they will sell for even two cents more a dozen than ordinary eggs, this would mean a net difference of about twenty-five cents a hen in a year. This extra price is nearly all clear profit, due to the uniformity in size, shape, and color of the eggs.

The eggs that bring the highest price will depend somewhat on the market (see Lesson XI). We must first find out what kind of eggs will bring the highest price and pay the largest profit in our market, and then produce that kind only.

There are several things that we can do which will help to improve the selling quality of the eggs:

1. We should keep a pure breed of poultry that will lay eggs as nearly as possible the right size, shape, and color to meet the requirements of our market. Such fowls cost little, if any, more to keep than fowls that lay an inferior quality of eggs.

2. Only those eggs should be used for hatching that are of best market type as to size, color, and texture. Pure-bred fowls will be likely to lay eggs similar to the eggs from which they were hatched. In other words,

the kind of eggs we select for hatching will determine the kind of eggs that will be laid by the chickens that are hatched from the eggs.

When eggs from the same variety of fowls are compared, the size of an egg apparently determines to a considerable extent the size of the chicken that will hatch from it. Therefore, if we wish to have chickens of good size we must set good-sized eggs. Hence, we see that there are at least two good reasons why all the eggs that are selected for hatching should be full size, perfect in shape, and of the right color and texture.

Eggs for hatching should weigh at least two ounces and should not exceed two and one-half ounces each. They should be perfect in shape so that they will pack well in the shipping case, that is, so that they will

Groups of eggs showing the various sizes and shapes that are obtained from almost any flock. All the eggs in the same row were laid by one hen. Note that the eggs laid by one hen have a characteristic shape. Only uniformly shaped eggs should be marked as first class

fill the compartments without danger of breakage from top or side pressure. They should be uniform in color, that is, each egg should be of one color and the right color over its entire surface, and all the eggs should be of the same color. The two colors that are most in demand are pure white and pure brown. There are many degrees of white and of brown in eggs, which will be seen only when the eggs are carefully examined in a good light.

The texture of the egg shell should be smooth, hard, and free from transparent spots when examined with a tester. Eggs having defective shells are not so likely to hatch well or to produce strong chickens.

Eggs for hatching should be kept in a moist, cool place not over 50° to 60°, and for not more than a week or ten days if it can be avoided. They should be turned every day or two, and should be kept covered so as to prevent too rapid evaporation.

Selecting eggs for hatching is interesting and useful work for any boy or girl to do. It will also prove profitable work. How many will do it and do it well?

III. HATCHING THE EGGS

CLARA M. NIXON

Every one who has tried to set and care for a hen so that a good brood of healthy chickens will hatch, knows that it is no slight task. We need education for this as well as for other lines of work. Let us see what we can learn in the following lesson:

The hen.— You will probably have the hen all ready to receive the eggs when they arrive. She should be of moderate size. If too heavy, she may break the eggs; if too small, she can cover a few only. She should be quiet and peaceable, a hen that may be handled without being frightened, and one that is likely to pay strict attention to business.

Do not trust the hen with valuable eggs until you are sure she intends to sit. It will be better to give her two or three other eggs (china eggs will do) and let her sit on these for two or three days. She will probably be more contented on the nest she has chosen for herself, if it be a suitable one.

In case you must change the hen to another place, go quietly after dark, lift her gently, and put her on the nest that has been prepared. Give her two or three eggs, one at a time, and let her place them under her breast as best pleases her. If she clucks contentedly, and snuggles the eggs cozily under her feathers, she will usually sit on this nest. It is best, however, to put a crate or well ventilated box over the nest. The top should be high enough not to disturb her while sitting, but not high enough to allow her to stand comfortably. If she sits quietly for two or three days, she will probably stay, and you may give her the eggs. Keep the crate over her for a few days longer, allowing her to get off the nest every day for exercise, food, and water, but have her go back in a reasonable time.

Sitting hens should be separated from the rest of the flock and placed in some quiet, cool retreat

The nest.— Have the nest comfortable, clean, and free from lice. It should be large enough for the hen to change her position on the nest and to turn her eggs, but not so large that the eggs will move out of the warm hollow under her breast. First, place some earth in the bottom of the box, then enough bright clean hay to make a good nest; the hen will fix the curve of the nest to suit herself. She feels safer in a somewhat dark, secluded place, and it is best to humor her.

Care of the hen.— The hen has undertaken a very confining task, which will last three weeks. This is a long time. For twenty-one days and nights the patient hen must stay in almost the same position. If you do not think this is tiresome, watch her when she first comes off the nest. She can scarcely stand. The least we can do is to have things as well prepared for her comfort as we can. Plenty of whole grain (corn and wheat are best), clean, fresh water, grit, and a dust bath should be placed where she can reach them, and she should be allowed to exercise every day if she wishes. Be sure to dust a little insect powder into her feathers occasionally. This is a wise precaution, even if you do not find any lice. In case she should break an egg, clean up the nest as well as you can, and wash off the badly smeared eggs in lukewarm water. They will not be likely to hatch if not cleaned.

If the hen seems irritable when the eggs begin to hatch, the oldest chickens may be taken from the nest as soon as they try to get from under the hen, wrapped in a piece of flannel, and kept in a warm place until the others are out. This will keep the hen more quiet, and she will not be likely to kill the younger chickens in the nest, or to leave the nest before the remaining eggs are hatched. If the hen is quiet, it is best not to disturb her while the eggs are hatching. The nest box must be deep enough to prevent the chickens from jumping out.

With careful attention to the instruction given, you should have good success with the eggs.

IV. BROODING AND CARE OF THE CHICKENS

CLARA M. NIXON

When the eggs are hatched, as they should be by the end of the twenty-first day, take the hen and chickens from the nest and put them in the coop you have prepared for them.

The coop.— The coop should be large enough so that the hen can move about, and high enough so that she will not strike her head. If it has no floor, set the coop on a platform of boards. This will help to keep out the rats and weasels, as well as to keep the coop dry. The separate floor is more easily cleaned and dried. The coop should be slatted in front, but closed on the other sides; it should have a roof that will keep out the rain. It should face the south and be placed on clean land on which no chickens have recently been reared. This is a precaution against disease. Everything should be clean, thoroughly disinfected with a coat of whitewash, and kept dry. *Dampness is fatal to young chickens.*

During hot weather a shelter against the heat should be arranged on the south side, unless the coop is located in the shade. The coop should be turned over often and the floor set up on edge, so that the sunshine may dry and cleanse every part.

Care of the hen and chickens.— It is better to keep the hen in the coop for a few days, for she will then be likely to return to it. Let the chickens

The first meal. After chicks have been hatched for 24 to 36 hours they will begin to hunt for food. Feed little and often. Provide fine grit and pure water at all times and a clean grass sod for pasturage

run if the weather is fine; they will not go far from the hen. In case the winds are cold, a little yard covered on the sides with coarse muslin instead of chicken wire will give protection. As soon as the chickens can run well, the hen may be allowed her freedom in fine weather, but she should be fed near the coop. In rainy weather it seems best to keep the hen and chickens out of the wet.

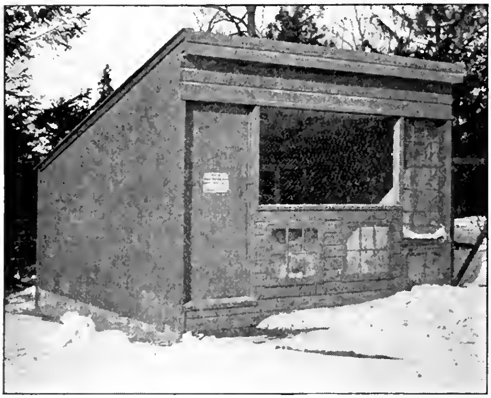
Enemies and disease.— Be sure that the hen and chickens are free from lice. A wise precaution against these pests is to apply a little fresh lard to the hen's body under the wings. An equal quantity of scotch snuff mixed with the lard makes it more effective. A liberal application of kerosene and whitewash to the inside of the coop several days before the hen and chickens are placed in it will be a wise precaution against red mites.

In case of the mysterious disappearance of the chickens, look for cats, rats, crows, hawks, weasels, and other thieves. Crows and hawks catch the chickens in the daytime, when they are roaming about. Rats and weasels often get into the coop at night, and may destroy an entire brood in one visit. Cats are often enemies. Your pet cat may be the one to eat your chickens. Watch her until you know she is to be trusted. The loss from disease will be greatly decreased if the chickens are always well cared for and well fed and if their coops are kept clean.

V. FALL PREPARATIONS FOR WINTER EGGS

JAMES E. RICE

The early fall months should be one of the busiest seasons of the year for the boy or girl who is taking care of poultry. It is a most delightful time to work out of doors. In the North when fall comes we feel the hibernating instinct of squirrels. We enjoy " snugging up " as the days get shorter and the frosts remind us that winter is coming. We know from experience how good it feels at this time to be comfortable. The hens feel the same way. Notice how they seek the shelter of bushes, fences, and buildings. They know full well that this is no time to lay eggs or to rear a brood of chickens. Therefore, what they do is perfectly natural and excusable, from a hen's viewpoint: they stop laying. Hens everywhere do the same; that is why eggs are always high-priced at this season of the year and later. In New York State the season of low egg production is October, November, and December.



A cheap and very satisfactory type of hen house. It is neat and warm and gives opportunity for fresh air for the birds

Did it ever occur to you that hens commence to lay less about the last of June each year, when the days begin to get shorter, and that they naturally begin to lay more about the first of January, when the days lengthen? They apparently know by the amount of daylight and of sunshine when a more favorable or less favorable season is approaching.

Hens lay well only when they are comfortable and happy. The happy, singing hen is the laying hen. That is why great care is necessary in the fall to get fowls into congenial winter quarters early. There are many ways of doing this. One is to provide them with a cheerful, cozy, clean house in which they can be sheltered from the wind, have plenty of sunshine and fresh air, and at the same time have an opportunity to run out of doors. On the snow? Yes! Yes! A hen does not mind cold feet if she can have her own way. In some respects, hens are like human beings. It is not so important for a hen to go out of doors each day the year round, as it is for her to know that she can if she wants to. Hens will not lay well unless they are contented, and freedom helps to make them contented.

There are many things to be considered in making a home for hens. The word *home* instead of *house* is used because many expensive houses are not hen homes; they may look all right but they are too high or too dark or too damp or too dirty. The home of a hen should be low, dry, bright, and clean, and have neat nests in which the birds can hide their eggs. In fact, there are so many things to say on the subject of hen homes that it would take a whole book to describe them. You would better ask the College of Agriculture at Cornell University to send you Bulletin 274, which describes several ways for building hen homes. Read it thoroughly, and if your hen house is not a hen home see whether you can make it over into one. Do it now.

VI. WINTER QUARTERS FOR THE PULLETS

C. A. Rogers

As the fall advances and the leaves on the trees fall to the ground, it is time to get the season's flock of pullets into cozy, warm quarters where they can spend the winter in comfort. This is a time when the chickens should be given careful attention, for when exposed, the cold nights and occasional snow flurries soon put a stop to their growth and development. It is also a critical time, for under favorable care they should soon begin to lay.

Before putting the pullets into winter quarters, the houses should be thoroughly cleaned and disinfected. New litter should be put in and all signs of disease destroyed

The pen.— Choose, then, a corner of the barn or shed that can be partitioned off into a pen of the desired size; or, better still, build a small house purposely for the pullets. If you have fifteen fowls, build the house eight feet wide and ten feet long. If there are twenty-five fowls, make the house twelve feet wide and twelve feet long. Be sure to build it on a dry place that is protected from the cold winds as much as possible. Have the front face the south in order to get all the warmth of the sun's rays.

Fresh air and sunlight.— These are two very important factors. Both should be provided through windows on the front (south) side. A small window may be made near the top, into which is fitted a cloth curtain frame. During the daytime in pleasant weather this curtain should be removed or swung on hinges or fastened up out of the way, thus letting in the sunshine and fresh air. At night when closed, the muslin cloth keeps the house warmer and still allows abundant circulation of air. In addition to the cloth curtain there should be a glass window with six- by nine-inch panes for the houses mentioned. For best results this window should be placed one and one-half feet above the floor, with the longer dimension up and down.

Warmth.— Next in importance is the warmth of the pen, on which depends largely the coziness of the quarters. One of the easiest ways to secure this is to line the walls with paper and board up roughly. In addition to this, if the roof is high build a loose ceiling at a height that allows plenty of headroom. Fill the space above with straw.

Dryness.—The straw not only makes the pen warmer, but also keeps it drier. Dryness is equally as important as warmth. With the three walls made tight with paper, the ceiling filled with straw, and a nice deep litter of straw or hay chaff on the floor, the fowls will be comfortable and contented. Such conditions always add to the number of eggs in the egg basket.

Roosts.— Make the inside arrangements neat and convenient. Small poles or two-by-four sticks of lumber make the best perches. All perches should be on the same level, because fowls seek to roost on the highest if some are higher than others. The scrambling for the higher places often results in injury to some fowls and always causes disturbance. The best height for the perch is about two and one-half feet above the floor.

Nests.— By natural instinct hens seek a secluded place in which to lay eggs and this should be provided. They will be likely to lay more eggs when satisfied with their surroundings. An easy way to make such a nest is to fasten a box on the side wall at about the same height as the perches, leaving a small opening at the side of the box toward the back wall through which the hen enters and from which the eggs can be gathered. The nest is very inviting when kept clean and filled with fresh straw or hay.

Freedom.— Fowls should be given their freedom in winter as well as in summer. This is particularly desirable when the house opens into a dry barnyard in which the fowls can roam about and pick up bits of food left by the other animals.

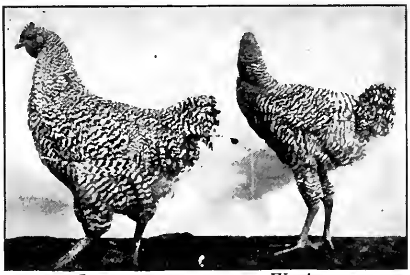
Cleanliness.— The pen *must* be kept clean. The health and comfort of the fowls depends very largely on this. Do not wait until the litter becomes wet and filthy, but change it as soon as it begins to pack. Provide a small box of screened coal ashes or road dust in which the hens can dust. This will help to keep the lice off their bodies. Whitewashing the house will help to keep the lice in check; if necessary, put kerosene on the perches and over the nest boxes, refilling the nests with clean bedding. The whitewashing is very desirable, since it makes the pen lighter and cheerier, and kills most of the vermin.

In the above ways the pullets at a very small cost can be made comfortable for the winter. The one thing above all others which young poultry raisers should remember is: *Provide your fowls with wholesome surroundings and they will make it worth your while to keep them.*

VII. ELIMINATING UNPROFITABLE CHICKENS

JAMES E. RICE

In nearly every flock of chickens or fowls there are good ones and poor ones; in some flocks there are very good ones and very poor ones, and occasionally there are flocks in which there may be found greater extremes than these. Very likely the good ones are profitable and the poor ones are kept at a loss. If we are to make money from our fowls or chickens we must not keep any that are not profitable.



Cockerels

Every chicken should be looked upon as a living machine for transforming food into chicken meat or eggs. Unless we have a good machine we cannot get good results from the food. In the case of many flocks of chickens a division may be made into three groups: (1) Chickens that are growing or laying; (2) chickens that are not growing nor laying; (3) chickens that are losing weight and not laying. All three of these groups are eating valuable food, and if we keep all of them together they will probably eat more than they earn. If we dispose of the third group the others may pay expenses. If we remove the second and third groups, the first group alone should pay a good profit. We shall have one-third as much work to do in caring for those that remain, and the chickens will have two-thirds more room. Moreover, the flock of good chickens by themselves will look far more attractive, will grow better, lay better, and will be less likely to suffer from disease than they would be if kept with the others.

There are several types of unprofitable chickens that should not be kept:

1. A chicken of any breed or age that shows signs of sickness or weakness. All such should be removed at once and doctored, or killed and burned. Prompt action may prevent further trouble. Delay is almost certain, in the end, to have serious results for the rest of the flock.

2. Old hens that may still be well and strong. Generally it does not pay to keep hens after they are two or three years old unless they are strong and especially valuable for breeding purposes. Fowls should be marked so as to indicate their age.

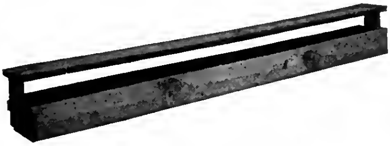
3. Surplus cockerels are unprofitable boarders. It is a common mistake to keep too many males. This is frequently due to a natural desire to avoid killing desirable breeders, and with a hope that if they are retained they may be sold alive for high prices. After they become large enough for market most cockerels do not make enough growth to pay for the food they eat. They also injure themselves or others by fighting. The room they occupy, the food they eat, and the labor they require might better be bestowed on early hatched pullets. They should seldom be allowed to go into winter quarters. They usually fail to grow well in cold weather, and occupy valuable space that should be used by better stock. They are unable to wrestle with larger individuals and generally remain undersized.

Careful grading of all stock as to size, age, breed, vigor, and purpose for which it is kept is one of the most important factors in the successful handling of poultry. This is second in importance only to the elimination of the undesirable members of the flock. This policy should be practiced persistently and continuously from shell to maturity.

VIII. FEEDING THE CHICKENS

CLARA M. NIXON

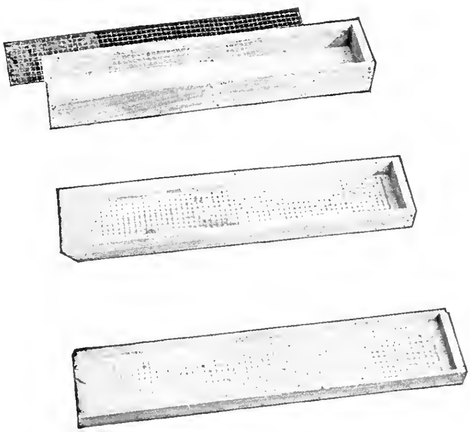
The food.— The egg yolk is enclosed within the body of the chicken just before hatching, and may supply nourishment to the chicken after it leaves the shell. For this reason chickens should not be fed until they are thirty-six hours old. The first meal may be of equal parts of bread crumbs and rolled oats, moistened with some milk or water to make the food crumbly but not wet. Sprinkle over this food a little fine sand or grit, fine charcoal, and some finely shredded clover, lettuce, or chickweed leaves. Mix with the food a little well-burned bone or some bone meal. After the first few days, hard-boiled egg may be added in the proportion of one part of egg to eight or nine parts of the bread and rolled oats. In addition to the moist food, a grain food should be given. A mixture of three pounds cracked wheat, two pounds corn (finely cracked), and one pound pin-head oatmeal, rolled oats, or hulled oats is good. A dry mash may be left before the chickens at all times, but only as much should be given at one time as will be eaten in a day. If any of the mash becomes dirty it should be taken away from the chickens. The mash may consist of four pounds wheat bran, three pounds wheat middlings, three pounds corn meal, three pounds sifted beef scrap, and one-half pound bone meal, well mixed together. Beef scrap that is not perfectly good and fresh should never be used.



Troughs for feeding large chickens

For chickens four weeks old or over, the bran may be reduced to three pounds. Cottage cheese may be given in addition to the other foods, but not in large quantities. It may cause bowel trouble if the chickens get too much at first. *All foods should be sweet and clean, never mouldy or sour.* Make all changes in ration gradually.

The feeding.— Care should be taken to have the hen well supplied with whole grain and large grit. The chickens should be fed often at first, usually five times a day. The moist food may be given in a shallow dish or on a bit of clean board, and should be taken away as soon as all the chickens have had enough. The first few days, they will probably eat but a small amount of grain, and it may be scattered in a shallow dish containing a little dry mash made according to the directions given above. After two or three days, the dry mash by itself may be fed in the dish, and the grain scattered on the ground or floor. Two other meals of the moist food may then be given, the other feedings being of grain. The dry mash may be left where the chickens can get it at any time. After the first week, the bread and rolled oats need not be given, but a little of the mash mixture may be moistened and given instead.



Chick feed-trays of different sizes

As the chickens grow older the number of meals may be less, and the grain of larger size. At four or five weeks of age they will be able to eat whole wheat, hulled oats, and larger cracked corn. Then if they have a large range and the weather is favorable so that they may run about, they need only two meals of grain and one of moist mash a day. They can always come back to the dry mash if they get hungry. Beginning with the first meal green food should be supplied, but the hen will soon teach the chickens to peck tender pieces of clover and the like if she is allowed to range with the brood.

An outdoor hopper for feeding mash, grain, grit, and bone meal

When the chickens are about eight weeks old, the grain and ground food may be fed from a large feed hopper from which they may help themselves at any time. The grain mixture may consist of equal parts of wheat and cracked corn. The chickens should also have free access to cracked bone, fine grit, screened oyster shell, and charcoal.

Give plenty of fresh, clean water in a vessel into which the chickens cannot jump. Ordinarily a water fountain is used for the purpose.

A serviceable water fountain can be made from a pint basin and a tomato can that does not leak. Cut half-inch notches in the edge of the can on opposite sides. Fill the can with water, cover with the inverted basin, then turn the whole thing over, holding basin and can tightly together. The water will run into the basin, but not overflow. If the basin does not become full enough cut the notches higher.

IX. FEEDING FOR WINTER EGGS

C. A. ROGERS

Does it ever occur to boys and girls that fowls are fond of a variety of food? This is especially so when the weather becomes cold and they are shut up in their pens. Then they are away from the fields where in summer they can nearly gain a living on the bugs, scattered grain and seed, and grass. It is true that they will subsist, even in the winter, on corn and water given them at irregular intervals, but under such care they cannot lay eggs. Notice how much better you feel after eating a meal of wholesome, well-cooked food that you like. Fowls are just as partial, and respond when well fed. There is no one method of feeding that can be applied equally well under all conditions. The method described in the following paragraphs, however, may be followed to advantage under many conditions and may also serve to suggest ways of improving your present practices.

Morning feed.— In the morning the fowls are hungry and ready to work for their breakfast. It is well to let them keep as busy as possible. Work keeps them warm, healthy, and contented. With this in mind, scatter mixed grains in the litter. Be rather sparing of the feed in the morning, so that the fowls will not quickly obtain their fill, but will continue to work and hunt for the grain for the greater part of the forenoon. This grain should be a mixture of all the kinds grown on the farm. They may be mixed in the proportion of three pounds corn, two pounds wheat, and one pound oats, to which may be added, if available, one pound buckwheat and one pound barley. Fresh water should be given to the chickens every day.

Noon feeding.— At the midday meal is the best time to provide those appetizing mixtures so greatly relished by the fowls and so successful in helping to produce eggs. Take the scraps of meat, bread, and vegetables, or oatmeal, from the table, mix them with corn meal, wheat bran, and wheat middlings. Moisten the mass with skimmed milk until it is crumbly. When skimmed milk and table scraps are not to be had, take a pail of cut alfalfa or clover hay and pour boiling water on it, allowing it to steam. Feed when it is still warm. A portion of this steamed alfalfa added to the noon mash gives it a pleasant, appetizing odor. A little salt and pepper can also be added to the mash, in about the same proportion as would be used in your own food. When it is not convenient to make a moist mash, the same ground feeds may be fed dry in a hopper that should be left open during the afternoon. A good mixture for this purpose is: six parts corn meal, six parts wheat middlings, three parts wheat bran, five parts meat scraps, one part oil meal. The best results will be obtained if the hens eat about one-third of the ground feed mixture to two-thirds whole or cracked grain. At noontime as much green food (beets, cabbage, or lettuce) as the fowls will clean up before the following noon should be given. At this time see that the oyster-shell and grit hoppers are filled. When it is impossible to follow the practice of feeding three times a day, the scraps and green food should be given with the morning feed.

Night feeding.— Fowls go to roost very early, making it necessary for them to eat before sundown. This requires feeding in the latter part of the afternoon, while they can still see to pick up the grain. When given the opportunity, a fowl will go to roost with its crop rounding full of grain, which it gradually digests during the night. This process of digestion warms the body and keeps it more comfortable. An empty crop is a poor bedfellow for the fowl. The same grains can be fed at night as in the morning, but in large quantities so that some will be left over after the fowl's appetite has been entirely satisfied.

X. FATTENING POULTRY

W. G. KRUM

By fattening we do not mean filling a fowl's body with a large deposit of oily fat such as is often found in old hens, but producing large, soft muscles with sufficient fat so that when cooked, they will be tender, juicy, and of fine flavor. Not only does this improve their quality for home use, but they will sell in good markets for a much higher price a pound.

The best way to fatten poultry is to restrict exercise by placing them in slatted coops about two feet square, having the bottom slatted or covered with one-half inch mesh wire cloth. This will hold four to six fowls or eight to ten young birds.

Shutting birds up in coops or small pens is very satisfactory when fattening them. The coops should be arranged in the shade. By means of troughs, wet mash may be fed three times a day

The fattening coop should be located in a cool, shady place in hot weather and in a comfortable place in cold weather.

The fowls should be thoroughly dusted with lice powder, as fowls infected with lice do not fatten well. Neither do fowls or chickens of low vitality fatten readily.

Poultry should not be fed for twenty-four to thirty-six hours before feeding the fattening ration. The ration should then be fed sparingly at first. Afterward they should be kept eating well by feeding only as much as they will clean up in ten to twenty minutes. If they have more than they can digest for a meal or two they lose their appetite, fail to grow well, and may lose weight.

Feed fowls or mature young stock three times daily for about two weeks, this being as long as they will do well under this heavy feeding.

A good ration consists of three pounds corn meal, three pounds buckwheat middlings, three pounds oat flour, one pound beef scrap, and a little charcoal. These are mixed with sour skimmed milk or buttermilk (the latter preferred) to the consistency of batter, which is then allowed to stand and sour twelve hours before feeding.

Ten pounds of feed usually require seven to nine quarts of milk. The oat flour may be obtained of manufacturers of oat flakes or oatmeal. Flour middlings may be used in the place of oat flour, although it is not quite so satisfactory a food.

It is usually best in fattening broilers to give this ration morning and night only, giving at noon a light feed of cracked corn and wheat.

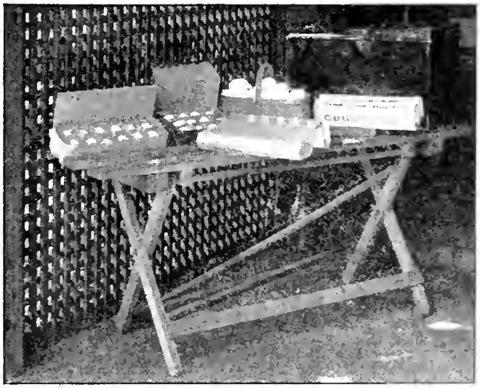
When stock fattened in this way is shipped to market the packages should always be marked, "Milk Fed." This will secure the best prices.

XI. GRADING AND PACKING EGGS FOR MARKET

E. W. Benjamin

In order to sell eggs most profitably, you should know how to grade and pack them for market.

As soon as the eggs are gathered, sort out all the soiled ones and clean them. If they are only slightly stained, use a cloth moistened in vinegar; if they are badly soiled, use scouring soap or similar substance. Do not soak the eggs in water, as the liquid will pass into the interior of the egg, carrying undesirable flavors. Washed eggs will not keep so well as clean, unwashed eggs, therefore it is better to keep the washed ones for home consumption and use them while they are fresh.



First-class eggs may be enclosed in neat cartons and delivered to private customers. Prices well above market quotations are often obtained for this grade of eggs

The market eggs should be kept in a cool place and sold at intervals of not more than one week. These eggs should be carefully sorted and packed. To grade the eggs, make two groups according to size. The first group should contain eggs each weighing two ounces or more, that is, one and one-half pounds or more per dozen. The second group should contain eggs weighing less than two ounces each. The grading will be easier if you weigh a few eggs of two ounces each and use them as samples. Practice will enable you to select the eggs of various grades without weighing them.

From each group of eggs take out those having approximately the same color (either uniform white or uniform brown), and a uniform shape and size. After all the eggs of small size, poor color, and abnormal shape have been taken out, you will have two grades of first-class market eggs for which you should be able to secure higher prices than the ordinary market will pay. Egg dealers in New York City have been known to pay ten cents more a dozen for the large eggs than for medium size eggs of the same color. They have also paid five to fifteen cents more a dozen for the uniformly white eggs than for mixed colors of the same size. The eggs that go into the cull grade may be sold for nearly market prices.

The best grade of eggs that you are producing for the wholesale trade should be packed in an ordinary thirty-dozen case if express shipments are to be made. You may be able to have some private customers in the city who look to you for their regular egg supply. This class of trade is not difficult to secure if your eggs are of superior quality. The same grade should be sold each time to the same customer, so that he will become educated to appreciate superior grades in eggs. Consumers are usually glad to pay a premium for eggs of reliable quality. A little care and interest on your part will give you a profitable business all your own, which will afford some of the best profits and pleasures of farm life.

Remember the following: (1) Breed and grade your fowls so that they will lay eggs that are uniform in size, shape, and color, and of the quality that will best suit your customer; (2) gather the eggs daily; (3) carefully clean all soiled eggs; (4) sort the eggs into at least two grades; (5) neatly pack the firsts in cartons, or other attractive packages, which will command a considerable increase in price; (6) furnish your customer each time with a uniform grade of eggs.

Cleaning the eggs is a good occupation for the children. Soiled eggs should never be offered to a customer

CORNELL

Rural School Leaflet

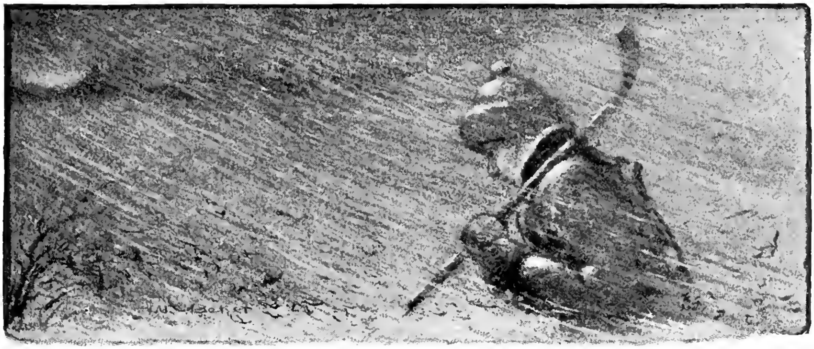
[FOR BOYS AND GIRLS]

Published monthly by the New York State College of Agriculture at Cornell University, from September to May, and entered as second-class matter September 30, 1907, at the Post Office at Ithaca, New York, under the Act of Congress of July 16, 1894. L. H. Bailey, Director

ALICE G. McCLOSKEY, Editor

ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

Vol. 5 ITHACA, N. Y., JANUARY-FEBRUARY, 1912 No. 3



SNOW STORM

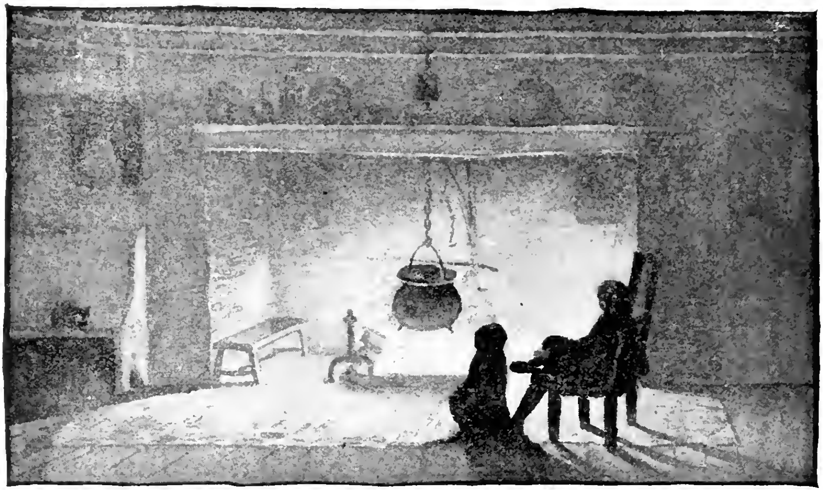
" With windy haste and wild halloo
the sheeting snow comes down
And drives itself through bush and swale
and leagues of stubble brown.
Blessings on the waiting fields when
the sheeting snow comes down."—*L. H. B.*

From Thoreau's " Walden "

" Meanwhile also came the chicadees in flocks, which, picking up the crumbs the squirrels had dropped, flew to the nearest twig, and placing them under their claws, hammered away at them with their little bills, as if it were an insect in the bark, till they were sufficiently reduced for their slender throats. A little flock of these tit-mice came daily to pick a dinner out of my wood-pile, or the crumbs at my door, with faint flitting lisping notes, like the tinkling of icicles in the grass, or else with sprightly *day day day*, or more rarely, in springlike days, a wiry summery *phe-be* from the woodside. They were so familiar that at length one alighted on an armful of wood which I was carrying in, and pecked at the sticks without fear."

BOYS AND GIRLS

The Editor



Midwinter is a good time to sit around the fire, the while we pop corn and crack nuts and think about the very active days that are ahead. No matter how hard the wind blows, we do not care. The snow and the sleet make music against our window panes. The creaking of ice-laden limbs on the trees beyond the door sounds good to us, for we are not grumblers about the weather. I wish that the 75,000 boys and girls who will probably read this leaflet would decide at once to separate themselves from the ranks of the weather grumblers. There are some persons, you know, who find winter too cold and summer too warm, spring too rainy and autumn too gloomy; and indeed these persons are nearly always joyfully anticipating the next season and finding fault when it comes. The thing to do is to like the season that is with us, and when we tune our spirits to the weather we are very sure to like it.

As soon as every one decides that midwinter weather is good, every face about the fireside will become cheerful; for to stop grumbling about one thing will help us to stop finding fault with many things. Cheerful persons can accomplish a great deal more than those who are surrounded by gloom, and they do much good. Let us cultivate cheerfulness.

Now we are ready for work. If we do not begin at once, spring will be upon us and we shall not be ready for it. First we shall look over the seed catalogs. I always like to plan my garden long before it is time to plant. Every young person on the farm ought to have a garden of his own this year, either for pleasure or for profit. Suppose you look through all the catalogs you have at home and see what it will be possible for you to grow. Then make your decision as to what you would like best to grow, if you have limited space and have to do all the work yourself. In this leaflet you will find many suggestions for your gardening.

It may be that you will not find any seed catalogs in your home. If not, plan to ask your teacher to let you write a letter during your English period to some seed house, for catalogs to be sent to the school. Then the boys and girls can take them home and look them over on winter evenings.

Talk over plans for a school garden. On every school ground there should be a garden. If there is no space for it belonging to the school, perhaps a farmer living near will let you have a small piece of ground. A number of boys and girls working a piece of ground under the direction of the teacher will learn many things that will be of value in the home garden.

Read what a little girl tells, on page 215, of a rural school garden. I think the success of the garden that Florence Ware describes was due to the fact that the trustee, the teacher, and the patrons of the school all took an interest in it. Don't you believe that fathers and mothers are interested in any new kind of school work when they understand that it will help to educate the boys and girls? I do.

Another thing that I want you to consider this winter night, as you sit around the fire, is that one of the first essentials to a successful life is to have orderly habits. A neat room at home, a neat desk at school, a neat appearance, all mark a self-respecting young mind. These things depend on one person, but an orderly home and grounds and an orderly school and grounds depend on a number of persons working together. Boys and girls can help a great deal. Let us know what you do this springtime to make the home grounds and the school grounds look better. Make some plans while you watch the firelight.

A subject of which boys and girls never tire is bird study. Since we have learned that nearly all birds are of value to farmers, we ought to know how to attract them to our neighborhood and how to protect them. Have you built a bird house as suggested in the last leaflet? When will the birds return? Which will be with us first?

Let us take a new interest in the spring migration this year. Long ago boys and girls would see one or two birds, a robin and a bluebird, perhaps, and then would rarely notice any of the others as they came silently into the fields and the woods near their homes. Now, however, many young persons have a real interest in all the birds that come back. We hope that this year you will know when to look for certain birds. On page 205 is a table that will help you in getting ready to watch the spring migration intelligently. Who will be the first one to see a grackle, a cowbird, a red-winged blackbird, a bobolink? Ask your teacher to keep on the blackboard a record of all the pupils who see the first birds. Perhaps some night before you go to sleep, you will hear the wild geese honking. This is a very wonderful sound and I would not have you miss it. Commit to memory what Burroughs has said of wild geese on page 205, and the stanzas of poetry about the bobolink on page 206. Ask your father or your mother to read aloud to you " The Birds of Killingworth," by Longfellow, and learn why

"A new heaven bent over a new earth
Amid the sunny farms of Killingworth."

And we must not forget the great plant world that announces the coming of spring. The hills begin to change color; the twigs take on richer tints and shades; the pussy willows find their way to the teacher's desk; skunk cabbage blossoms; and such is the way of the wood, that perhaps hepaticas will greet us before the snow has gone.

BIRD STUDY

In the study of birds let us remember the following:

We need the birds and the birds need us. Students of the subject tell us that birds have prevented invasions of aphids, caterpillars, potato beetles, cutworms, white grubs, and many other pests. We need more birds on the farm, for locusts destroy our wheat, wireworms destroy our corn, caterpillars destroy our trees and fruit, and other insects do much harm.

Do all that you can to attract the birds to your farms and gardens. Build bird houses, hang a meat bone or some suet on a tree, and scatter seeds on the snow; protect the birds from cats, particularly at nesting time.

Find out all you can about some bird that has a special interest for you — the bobolink, perhaps. Then when you see it again this year, you will be ready to make some observations of it that you never made before. In order to be a real naturalist one must study the out-of-door things, not books; but every naturalist will be helped in his study by reading what other naturalists have learned.

Look over the list of the birds that will come back in the spring, and decide which one you want most to see. When will it come? How much can you learn about it before it comes?

The bobolink will be late, arriving in May. You must try to see him this year. Ask your teacher to read you the poem " Robert O'Lincoln," by William Cullen Bryant.

"I hear the wild geese honking
From out the misty night,—
A sound of moving armies
On-sweeping in their might."—John Burroughs

Arrival of Birds

Feb. 15 – Mar. 10	Purple grackle
	Rusty grackle
	Red-winged blackbird
	Robin
	Bluebird
Mar. 10–20	Woodcock
	Phoebe
	Meadow lark
	Fox sparrow
	Cowbird
Mar. 20–31	Wilson's snipe
	Kingfisher
	Mourning dove
	Swamp sparrow
	Field sparrow
April 1–10	Great blue heron
	Purple finch
	Vesper sparrow
	Savanna sparrow
	Chipping sparrow
	Tree swallow
	Myrtle warbler
	American pipit
	Hermit thrush
April 10–20	Yellow-bellied woodpecker
	Barn swallow
	Yellow palm warbler
	Pine warbler
	Louisiana water thrush
	Ruby-crowned kinglet

THE BOBOLINK

Size: Smaller than a robin, larger than a sparrow.

General color: Above black, marked with patches of white and buff; below black, unmarked. The female is sparrow-like — yellowish brown streaked with darker.

Distinctive features: The general color, black with white markings on the upper parts, will distinguish the male.

QUOTATIONS

"Bobolink! that in the meadow,
Or beneath the orchard's shadow,
Keepest up a constant rattle
Joyous as my children's prattle,
Welcome to the north again!
Welcome to mine ear the strain,
Welcome to mine eye the sight
Of thy buff, thy black, and white.
Brighter plumes may greet the sun
By the banks of Amazon;
Sweeter tones may weave the spell
Of enchanting Philomel;
But the tropic bird would fail,
And the English nightingale,
If we should compare their worth
With thine endless, gushing mirth."— *Thomas Hill*

"A flock of merry singing-birds were sporting in the grove;
Some were warbling cheerily, and some were making love;
There were Bobolincon, Wadolincon, Winterseeble, Conquedle,—
A livelier set was never led by tabor, pipe, or fiddle,—
Crying, "Phew, shew, Wadolincon, see, see, Bobolincon,
Down among the tickletops, hiding in the buttercups!
I know the saucy chap, I see his shining cap
Bobbing in the clover there — see, see, see!"

"*The O'Lincoln Family*," *by Wilson Flagg*

Bobolink

LETTER TO BOYS AND GIRLS

Dear Boys and Girls:

HOW many of you, as the days are growing longer and longer, are beginning to watch for those signs of spring that tell us Nature is waking from the long winter's sleep? A warm day now and then, a gentle spring rain, pussy willows, the snowdrops, grass turning green, the first robin, that sweet, clean smell of new-turned earth. In yourselves, too, something is swelling and growing, a happiness to be alive and a desire to be up and doing. It is the time of preparation, the planning time. Everything depends on a right start and so it is good to make plans.

I wonder what each one is planning. Won't you write and tell me? Many boys and girls have already written. The postman has been bringing big mails lately. He asked me the other day how I came to have so many letters.

" They come from boys and girls all over New York State," I said, " I wish you might read some of them. They tell of interesting things."

" What things? " he asked.

Then I told him how some of you had celebrated Corn Day in your schools, with exercises and a corn show; and how the best corn was coming here for our Farmer's Week exhibition, February 19–24, where he might see it if he had time to stop.

" Did the children raise the corn they brought to school? " said the postman.

" Not very many of them this year," I answered, " but I know that next year much of the corn will be raised by the children themselves. A large number have already selected their seed and are planning to test it to see whether it sprouts well. Then they will get a small piece of ground and prepare it carefully, so that the soil will be smooth, mellow, and free from stones, weeds, or rubbish. They will next plant the corn and will take care of it faithfully all summer long. When harvest time comes they will cut and husk the corn and, selecting the finest ears, will keep them in a safe place until Corn Day next January."

" But not every child will like to grow corn," remarked the postman, as he prepared to leave.

" Of course not," said I, " there are lots of other things for them to do. For instance, a great many boys and girls are interested in poultry. I know of several already who have started keeping a few hens. We have told them in the leaflets all about selecting eggs for hatching, taking care of the little chickens, feeding, watering, and housing them as they grow older, and grading the eggs for market. We have told them why it pays to keep a pure breed of poultry. In the next few weeks I expect to hear from many boys and girls who are going to make poultry-keeping their occupation for this year."

The postman was very much interested.

"Tell the children that if they write to you I'll see that every letter is delivered safely," he called as he went on his way.

Besides raising corn, or keeping poultry, or planting a tree, or studying birds or flowers or fruit, there is another thing that, it seems to me, will appeal to many of the boys and girls who read this letter. A garden is one of the most interesting places in the world, be it a vegetable garden or a flower garden. Why wouldn't it be a fine piece of work for a boy or a girl to take care of a home garden this summer? Besides the joy of being out of doors and of raising things, there will be the pleasure of contributing to the family something that they will be glad to have. Many fathers are too busy with the field crops and the stock, and mothers with the house and dairy, to have time for the garden. I am sure, however, that they like fresh fruit and vegetables, and that they will let you have a piece of ground for a garden all your own. Ask them about it. Perhaps your father will find time to plow it for you. Whether he does or not, if you make up your mind to do this piece of work this summer, and to see how well you can keep the table supplied, read what I have written in this leaflet about a home garden, and then go to work and make a success of it. Don't give up, even if there do come times of discouragement. You will be doing something worth while, and therefore worth fighting for. At hard times just grit your teeth and make it go. I hope I shall hear from a great many boys and girls who are going to take care of a home garden this summer. Write me about it.

Another thing that I know will interest you boys and girls is that each time a leaflet comes out, it will contain the best letter I have received from a boy or a girl. The first one is in this leaflet. Let us see who will have the best one next time.

I hope you will all read this leaflet carefully. There are many interesting things in it that I have not been able to tell you about in my letter.

Write to me soon. Every boy and girl who reads this letter is going to take some one piece of work for the summer and do it well. I feel sure of this, and I know you will not disappoint me. Learn all you can about the out-of-doors, about wind and rain and sunshine and starlight and flowers and fruit and trees and birds and animals. When you find something that interests you, write and tell me about it. Above all, be sure and don't forget what I said about a home garden.

Your friend,

Edward M. Tuttle

A CHILD'S LETTER

NORTHVILLE, N. Y., *November* 15, 1911

Dear Mr. Tuttle:

I am going to write a few lines and thank you for the leaflets I received a while ago. And maybe you would be glad to hear what we have been doing in our school yard. We have made drains, and trimmed the trees, and raked up the leaves, took out stones, piled up the wood that was lying in the yard. We have several trees in our school yard.

They are different kinds. One is apple. Most every one likes that tree. There are ash and pine too. There are thirty trees in all.

We have a very large school yard. We planted flowers last year, and vegetables. Some vegetables were lettuce, carrots, radishes. They grew up big enough for the children that brought their dinners to eat them. The color of our school house is red. It is very pleasant and our teacher is very neat. I am going to write you three letters and see if I receive a picture from you. Good by.

Truly yours,

Marion Ellsworth

" In the elder days of Art,
Builders wrought with greatest care
Each minute and unseen part;
For the gods see everywhere.

" Let us do our work as well,
Both the unseen and the seen;
Make the house, where gods may dwell,
Beautiful, entire, and clean."

Henry Wadsworth Longfellow

CLEANING-UP DAY

The Editor

The boys and girls in every school district should decide to have a cleaning-up day both inside and outside the building. The teacher will help as soon as you are willing to do your part, and your parents will also be interested.

Perhaps for your lesson in English your teacher will allow you to make a list of things that would improve the inside of the building, with suggestions for such improvements. Decide which of these you can make yourselves, and which would need to be made by the trustees. Do your part first and then write to the trustees asking them to consider at the next school meeting whether the other improvements can be made.

Next, list all the needed repairs on the outside of the building. Can you make any of the repairs?

Your teacher may be willing to go out some day with the older pupils to discuss what might be done to make the grounds more attractive. Make a list of the things you would like to have done. Discuss such improvements at home. Your parents will probably have some suggestions. They will help if you do your part.

The following should be considered in the list of improvements to be made inside and outside the school:

1. *Cleanliness.* (a) Floor; (b) walls; (c) desks, chairs, seats, and the like; (d) windows; (e) blackboards, erasers; (f) entry or cloak room; (g) stove and wood box.

2. *Order.* Brooms, mop, dustpan, and the like hung in the most inconspicuous place instead of lying about on the floor. Who will bring a hammer and a few nails and make this change? Are the desks in order and the ink bottles in good condition?

3. *Health.* (a) Dust. The germs of many diseases are carried by dust. Keep all the dust that you can out of the schoolhouse. If you have been using a feather duster it should be burned. A damp cloth is the best thing to use and this should be washed frequently. (b) Drinking water. Will the boys make a place for the water pail so that it will not stand on the floor? Will some one provide a cover for the pail? Does each child keep his own drinking cup in his desk? Do all the boys and the girls know that many diseases are carried from one child to another by the use of a drinking cup in common? (c) Outhouses. Both health and decency demand that all outhouses be kept in good condition. Should some one from the State College visit your school, would he find that the boys and the girls in your district are self-respecting? (d) Remove all rubbish heaps as soon as it thaws.

4. *The school building.* Make observations on the outside of the schoolhouse. Consider paint, blinds, steps, eaves troughs, roof.

5. *The school grounds.* Note fences, paths, and condition of trees.

It may be that this leaflet will go into many rural districts in which all of the foregoing suggestions have been carried out long ago. If your schoolhouse is neat and attractive inside and out; if the grounds have been planted; if the fences are in good condition; if the outhouses are cared for; if you work with your teachers to keep things in shape — we shall be glad to have you write and tell us. If you are just beginning to consider having better surroundings at school, write to us as soon as you make any improvements.

6. *At home.* Last year Professor Warren made the following suggestions for improving the home surroundings: (a) Clean up old machinery, boards, and the like. (b) Pile all the lumber that is worth saving in one place. (c) Pile all the lumber and rubbish that is good for firewood only in one place. (d) Cut out the dead limbs in the trees in the yard, but do not prune the trees too severely. (e) Repair all the leaky eaves troughs. (f) See that all the door latches in the house work easily. If the doors stick so that they will not open, fix them. (g) Repair the door steps. (h) Arrange the garden so that all work can be done with horses. (i) Plant a few flowers or shrubs from the woods in the yard. Put them in groups but not in the center of the lawn, which should be kept clear so that it will be easy to mow and will look better.

NOTES

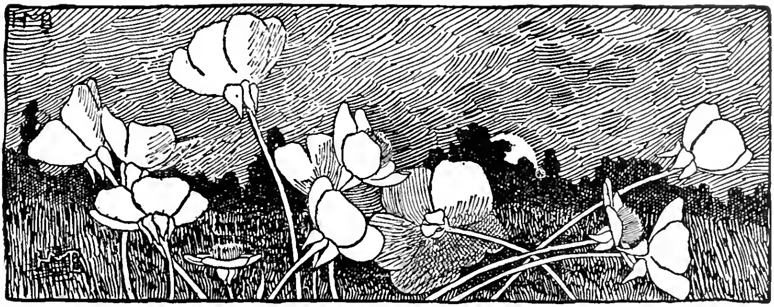
The three subjects following have a special message for boys and girls. "The Spirit of the Garden" is for older pupils. Read it many times, then in a garden of your own try to find the spirit.

The next subject, "A Rural School Garden," is for the younger boys and girls. Try to have a garden at your school this year.

Both the older and the younger pupils should read "A Home Garden." Have the best home garden this year that you have ever had. Write to Mr. Tuttle about it.

"The garden is a lovesome thing, God wot;
Rose plot,
Fringed pool,
Ferned grot,
The veriest school of Peace;
And yet the fool
Contends that God is not.
God not! In gardens! When the eve is cool!
Nay, but I have a sign,
'Tis very sure God walks in mine."

GARDENS



"Soft o'er the poppy fields of sleep,
The drowsy winds of dreamland creep."—*Robert Loveman*

THE SPIRIT OF THE GARDEN

L. H. Bailey

I step from the house, and at once I am released. I am in a new realm. This realm has just been created, and created for me. I give myself over to the blue vault of the sky; or if it rain, to first-hand relationship with the elements,— for can I not touch the drops that fall from some mysterious height? I am conscious of a quick smell of the soil, something like the smell of the sea. I hear the call of a bird or a faint rush of wind, or catch a shadow that passes and is gone. There is a sudden sensation of green things tumbled over the ground. I feel that they are living, growing, aspiring, sensitive.

Then the details begin to grow up out of the area, every detail perfect in its way, every one individual, yet all harmonious. The late rain compacted the earth; but here are little grooves and cuts made by tiny rills that ran down the furrows and around the stems of the plants, coalescing and growing as they ran, digging gorges between mountainous clods, spreading into islanded lakelets, depositing deltas, and then plunging headlong toward some far-off sea,—a panorama that needs only to be magnified to make those systems of rivers and plains and mountains the names of which I sought so much in my old geography days.

Soft green things push up out of the earth, growing by some sweet alchemy that I cannot understand but that I can feel. Green leaves expand to the sun; buds burst into flowers; flowers change to fruits; the pods burst, and berries wither and fall; the seeds drop and are lost,— yet I know that nature the gardener will recover them in due season.

Strange plants that I did not want are growing here and there, and now I find that they are as good as the rest, for they spring from the same earth yet are unlike all others, and they too will have their day and will die away and in some mysterious process will come again. Insects crawl here and there, coming from strange crevices and all of them intent. Earthworms heave their burrows. All these, too, pass on and die and will come again. A bird darts in and captures a flying insect; a dog trots across the farther end of the plot; a cat is hidden under the vines by the wall. A toad dozes under a bench; he will come out to-night.

It is all a drama, intense, complex, ever moving, always dying, always re-born. I see a thousand actors moving in and out, always going, always coming. I am part of the drama; I break the earth; I destroy this plant and that, as if I were the arbiter of life and death. I sow the seed, I see the tender things come up and I feel as if I had created something new and fine, that had not been seen on the earth before; and I have a new joy as deep and as intangible as the joy of religion.*

Quotations

"The nature-desire may be perpetual and constant, but the garden-desire returns with every new springtime."—*L. H. B.*

"The satisfaction of a garden does not depend upon the area, nor, happily, upon the cost or rarity of the plants. It depends upon the temper of the person. One must first seek to love plants and nature, and then cultivate that happy peace of mind which is satisfied with little. He will be happy if he has no rigid and arbitrary ideals, for gardens are coquettish, particularly with the novice. If plants grow and thrive, he should be happy; and if the plants which thrive chance not to be the ones which he planted, they are plants nevertheless, and nature is satisfied with them. We are apt to covet the things which we cannot have; but we are happier when we love the things which grow because they must. A patch of lusty pigweeds, growing and crowding in luxurious abandon, may be a better and more worthy object of affection than a bed of coleuses in which every spark of life and spirit and individuality has been sheared out and suppressed."—*L. H. B.*

"The man who worries morning and night about the dandelions in the lawn will find great relief in loving the dandelions. Each blossom is worth more than a gold coin, as it shimmers in the exuberant sunlight of the growing spring, and attracts the bees to its bosom. Little children love the dandelions: why may not we? Love the things nearest at hand; and love intensely. If I were to write a motto over the gate of a garden, I should choose the remark which Socrates made as he saw the luxuries in the market, 'How much there is in the world that I do not want.'"—*L. H. B.*

*NOTE.—We gratefully acknowledge the permission to use "The Spirit of the Garden" from "The Outlook to Nature," published and copyrighted in 1905 by The Macmillan Company.

A RURAL SCHOOL GARDEN

Florence Ware

(A Young Gardener)

On January 29, 1909, we celebrated Corn Day here at our school, with appropriate exercises. During the exercises our trustee spoke to us. We enjoyed all he said, but the part that interested us the most and for which we felt the most thankful was his plan to rent a piece of ground near the school, for us to use as a school garden. He said he would divide it into plots four feet by twenty feet and give each of us a plot to work, as our own little garden, and would give us twenty-five cents each with which to buy our seeds. He asked each of us to raise one hill of corn on our plot, and he offered a prize of one dollar to the pupil who raised the best corn. We bought our seeds early in the spring of James Vick's Sons, of Rochester.

In April the ground was plowed and divided into plots. The plots were numbered and each child drew a number, and then the children went out and each claimed the plot that had the number corresponding with the number he drew.

On the afternoon of May 6, Arbor Day, we planted our gardens. We planted vegetable and flower seeds, and set out little plants called fire-bush around the whole garden. Mrs. Sarah White gave us these plants, and many thanks we extend to her for them as they were very beautiful Just before we started to work our gardens, Miss Rhodey said she would give a prize of fifty cents to the pupil over eight years of age, and fifty cents to the pupil under eight years, who had the best-arranged garden and the best-growing garden by the last day of school.

We watched very eagerly for the seeds to come up. The first to appear were the radishes on May 13; then on May 16 lettuce began to come up, and then beets, flowers, and other plants.

On May 17 we planted our corn and it came up on May 24. The corn we used for seed was obtained by our trustee in the eastern part of our State. It was a very fine-looking ear of corn. But in our experience we did not produce as good corn as the seed. I think the reason is this: In the corn plant the blossom is on the top and contains stamens which produce the pollen. The ear of corn bears the pistils (silk). The pollen drops down to the ear on the silk and nourishes the kernel. If the pollen does not drop on the silk, kernels will be lacking. Pollen floats in the air and drops on the silk. It will float from one field to another. As each of us had but one hill of corn and the field adjoining was not a cornfield, there was not enough pollen floating in the air to drop on the silk and nourish the kernels, and I think that is the reason we did not all have well-developed ears of corn.

On June 11, the last day of school, we had a picnic and exercises. We invited the people of the neighborhood. There were about one hundred and twenty-five present. Dr. H. J. Webber, of the College of Agriculture, Cornell University, spoke to us on "School Gardening and Agriculture." Doctor Webber and School Commissioner Stickle judged our gardens, and they thought they were so nice that they each gave twenty-five cents for a second prize.

Robert Fargo won the first prize and Adelbert Simmons the second of those over eight. John Jenner won the first prize and Samuel and Nathan Hancock won the second of those under eight.

At this time Mr. W. F. Pratt offered prizes of sixty cents and forty cents on second and third best corn, and thirty cents and twenty cents on second and third best gardens, to scholars over eight years of age, and thirty cents and twenty cents on second and third best gardens to scholars under eight years of age, to be given the second week of school in the fall. We felt very grateful to him for this offer.

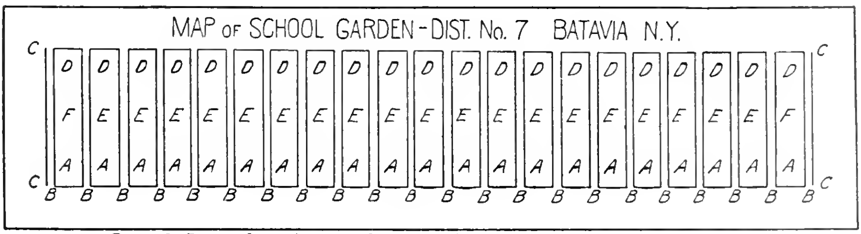
During vacation we went to our gardens about every two weeks. We would take home some vegetables and flowers. Sometimes Miss Rhodey went with us. Once when she went we took a lunch, and after we had hoed our gardens and watered our flowers we went over on the school yard and played games and ate our lunch. When school opened in the fall we found our gardens growing nicely. The second week of school, Mr. C. E. Shepherd and Mr. W. H. Young judged our gardens. The prizes of sixty cents and forty cents for the second and third best corn were won by Susie Dart and Florence Jenner. The prizes of thirty cents and twenty cents to those having the second and third best gardens were won by Stella and Agnes Mekowska and Marguerite Bonney. Thirty cents and twenty cents to those under eight years of age were won by Edwin Hagen and Raymond Green.

We next took up our best vegetables and flowers and shrubbery, and made an exhibit at the Genesee County Fair. We received many compliments on our exhibit, and received first premium of five dollars.

As the Education Department at Albany wished a picture of our garden, pictures were taken of it and one was sent to the department.

Now as "Jack Frost" was putting in his appearance we took up what was left in our gardens; some things we took home, others we gave to a couple of poor families in town. We saved some of our cornstalks and corn to use for decorating to-day.

We certainly enjoyed our first year's experience in school gardening. We made many mistakes, we will admit, but we did the best we knew how, and shall try another year to profit by the mistakes we made in the past year.



A-Plots B-Paths C-Hedges D-Corn E-Vegetables & Flowers F-Flower Bed

EXPLANATION OF MAP

Our school garden is located on Ellicott Street Road, two miles from the village of Batavia. The garden is one hundred twelve feet long and twenty feet wide. This is divided into plots four feet by twenty, with a path one foot wide between them. Each child under ten years of age has one plot, and each child over ten years of age has two plots to work. This year we have grown vegetables and flowers on them.

A HOME GARDEN

EDWARD M. TUTTLE

To the boy or girl who has decided to keep a home garden this year, the following suggestions will be helpful:

1. Make up your mind to do the best you can with the piece of ground available, no matter what its size may be. If you may have all you want, it is better not to take more than you can easily handle.

2. If possible, plan the garden so that the rows may be long even if more than one thing is planted in a single row. If you can drive, plan the garden so that horse tools may be used. At any rate, plan for wheel hand tools.

3. Begin early in the spring to put the soil in shape.

4. Clear off all weeds, stones, brush, and other rubbish.

5. Spread a good coating of manure on the surface before stirring.

6. Plow or spade the manure in thoroughly.

7. Work the soil until it is level and smooth and mellow. It is easier to cultivate before than after planting the seed.

8. Read the article on soils in this leaflet, so that you will understand when and why to cultivate.

9. Plant whatever you like to plant in your garden. Have a good variety. Plan for a succession of such things as peas, radishes, lettuce, and the like. A table showing time and depth of planting is given in this leaflet.

10. Talk about the garden with your father and your mother. They will be glad to tell you and to show you about it; but you must do the real work yourself.

11. Tend your garden faithfully. Never let the weeds get a start. Thin the plants in order to give them room. Study your garden. You

will learn more by careful observation in one week than by reading for a year.

12. Do not be afraid to have some flowers in your vegetable garden. Fill in empty places with them. Make every foot of ground produce something useful or ornamental.

13. When you gather your vegetables, put them up in attractive packages for the house. It helps you and it helps the others to do this. We like things better when they are good to look at.

14. If a disease or an insect is injuring your plants, find out what it is and how to get rid of it. Do not stop until you have conquered.

15. Live in your garden. Love it. Know everything in it so well that you could tell it somewhere else in any stage of growth.

16. Remember that perseverance brings success; that study brings mastery; and that while you are learning many new things yourself, you are also doing a definite piece of work that contributes to the welfare of others.

17. It is much better that you use your own originality on your garden. However, if you meet problems that you cannot solve, write to the State College and we shall be glad to help you all we can.

18. If you have time to read and want to know more about gardening, a good book to own is "The Manual of Gardening," by L. H. Bailey, published by The Macmillan Company.

GARDENING

THE SOIL

EDWARD M. TUTTLE

The soil serves as a support for plants and also furnishes them with food and water. Plants take in food through the tiny hairs on their roots. The food must be in solution in water, that is, it is dissolved or melted, we might say. Therefore, water is important to the plant because it carries food, as well as making up a large part of the plant structure. One of the main reasons why we cultivate crops is to keep the right amount of water in the soil. Too much water drowns the plant; too little starves it.

When a soil is in a state of good cultivation, fine and firm, yet mellow, the grains of soil lying close together form tiny tubes between them. Water rises in these tubes just as it does in a small glass tube when you place one end in water. When the soil water reaches the surface of the ground, the heat of the sun causes it to evaporate, in the same way that a little water left in a pan in the sun will disappear. If we want to keep the water in the soil we break the little tubes. This is done by stirring, or cultivating, the surface to a depth of two or three inches. Then the ground looks dry on top, but beneath it is moist and will stay that way a long time if we keep the surface stirred. Should it rain, the surface is porous and soft and the rain sinks into it like water into a sponge. But as soon as it stops raining the water begins to go out again unless we stir the surface and keep the little tubes from forming. So it is easy to see that if the soil is not too wet we should cultivate whenever the surface gets packed so that the tubes are formed, no matter whether there are weeds to kill or not. If you want to test this, leave a little strip of your garden uncultivated. Pull the weeds and leave the earth unstirred. At the end of the season you will find that this strip is hard and dry, and the plants on it have not grown so well as those on the rest of your garden.

If the soil in your garden is too wet, some of the water must be taken out. A certain amount will evaporate from the surface if it is left packed; but the best way is to drain the soil from below by digging ditches here and there, or by laying tile drains, which are short sections of clay pipe placed end to end in the bottom of the trenches and covered over with soil. The lower end of the drain should be left free for the water to run out.

Study your own soil and you will be able to tell when it has too much or too little water; and you can regulate the amount a good deal by cultivating at the right time.

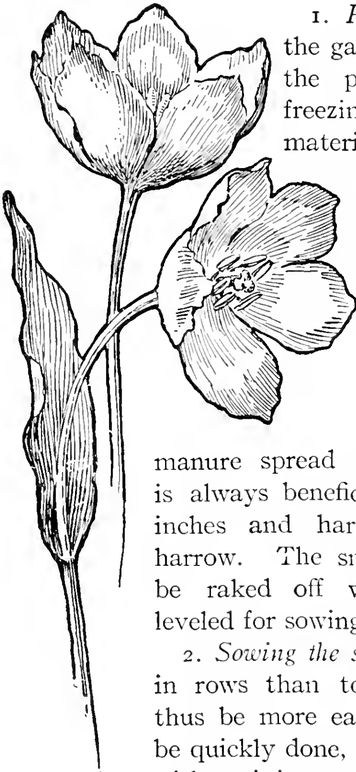
There must be available plant food in the soil. Usually there is food enough present, but often it is in such a form that it will not dissolve in the water and therefore the plants cannot get it. Sometimes manure is mixed with soil. When the manure decays, it forms a gas that helps the soil water to dissolve the plant food more readily. The manure itself furnishes some plant food; it also makes a heavy soil more open or a light soil more compact, in either case regulating the amount of water. Try leaving a small part of your garden without manure and see whether you notice any difference.

Fertilizers are plant foods all ready to dissolve in the soil water. Sometimes it helps the plants to have an increased supply of food at a critical time. You may test and see what your soil needs most by putting a little of each kind, or mixtures of one or more kinds, of fertilizers on separate plots of ground growing the same crop, and watching to see whether the plants grow better on some plots than on others.

While you are growing the plants in your garden you can also be learning how they grow and what part the soil plays in their growth. Study and observe, and you will find out many things for yourselves that it would be hard for you to understand if you read about them. The ability to accurately observe the things around you and to profit by your observations will prove of value all through life.

MAKING A GARDEN

C. E. Hunn



1. *Preparation of the land.*— If the land for the garden can be secured in the fall, much of the preliminary work can be done before freezing weather, having all leveling done, rough material removed, and the ground ploughed or spaded. Fall plowing is recommended since the winter freezing has a beneficial effect on the soil, causing it to crumble and separate into fine particles. It is also possible to work fall-plowed land earlier in the spring than flat-lying land. If spring plowing must be done, it is best to start as early as the ground is fit to work. A good coating of barnyard manure spread evenly over the ground before plowing is always beneficial. Plow to the depth of four to six inches and harrow the soil fine with a spring-tooth harrow. The small stones and the rubbish should then be raked off with the hand rake, and the ground leveled for sowing seeds.

2. *Sowing the seeds.*— It is much better to sow the seed in rows than to sow it broadcast. The seedling can thus be more easily identified, thinning and weeding can be quickly done, and the soil between the rows can be hoed without injury to the seedling plants.

In planting a garden it is best, if possible, to have the rows extend north and south. Each row will thus get its share of sunlight. If the rows are east and west, and one or more rows contain tall plants, there is danger of shading the rows in the rear.

3. *Watering the garden.*— If it is necessary to water the growing plants, it should be done, if possible, late in the afternoon. If the plants are watered in the morning, the sun causes very rapid evaporation, leaving the soil dry, and in heavy soils causing it to bake. Thorough cultivation of the soil or a mulch of either grass or straw will hold the moisture in the soil and lessen the need of water.

4. *Soils.*— It is not often that a heavy clay soil will be found. If no other soil is obtainable, drainage, sand, muck, grass, or coal ashes will be beneficial. Clay soil should never be worked when wet. Gravelly

loam, sandy loam, and even clay loam are easily worked, and are the soils generally found to give good results. See the lesson on soils, page 219.

5. *Starting plants.*— The seeds of all but the more rankly growing plants may be started in the house in March or April, using shallow boxes filled with light soil. A little care is needed to avoid sowing the seeds too early, for if the window conditions are such that the plants grow spindling, they transplant with difficulty. Six weeks before the time to plant out of doors is early enough to sow the seeds in boxes, and even then it is often necessary to transplant into other boxes before the ground is fit to receive the seedlings. For the first year it would be well to have the children grow some one thing indoors, in order to give them a lesson in transplanting. Tomato plants would be good for the first lesson. If flowers are desired, pansies might be started in boxes.

WHAT TO PLANT

C. E. HUNN

A list of garden vegetables, the seed of which may be sown as soon as the ground is fit to work in the spring:

Variety	Time of Sowing	Depth of Sowing		Soil Best
Asparagus	April 2	1	inch	Light Loam
Beets	"	2	"	"
Carrots	"	1	"	"
Chicory	"	1	"	"
Cress	"	1/2	"	"
Endive	"	1	"	"
Kale	"	1	"	"
Kohl-rabi	"	1	"	"
Leek	"	1	"	"
Lettuce	"	1	"	"
Mustard	"	1	"	"
Onion	"	1	"	"
Parsley	"	1/2	"	"
Parsnips	"	1	"	"
Peas	"	2 1/2	"	"
Radish	"	1	"	"
Rutabaga	"	1	"	"
Salsify	"	1	"	"
Sea kale	"	1	"	"
Spinach	"	1	"	"
Turnip	"	1	"	"

A list of garden vegetables, the seed of which should not be sown until the ground is warm and all danger of frost is over:

Variety	Time of Sowing	Depth of Sowing	Soil Best
Beans	May 10	2 inch	Light Loam
Corn	" 10	2 "	"
Okra	" 20	1 "	"
Pumpkin	" 10	2 "	"
Squash	" 10	2 "	"

Annual flowers. The seed to be sown after the danger of frost is over. The best results are obtained if the plants are started in the house in April, and set out after the tenth of May:

Variety	Time of Sowing	Depth of Sowing	Soil Best
Antirrhinum (Snapdragon)	May 5 or after	1 inch	Light Loam
Aster	" "	1 "	"
Celosia (Cockscomb)	" "	½ "	"
Cosmos	" "	1 "	"
Dahlia	" "	1 "	"
Lantana	" "	1 "	"
Myosotis (Forget-me-not)	" "	1 "	"
Ricinus (Castor oil bean)	" "	2 "	"
Salvia (Scarlet sage)	" "	1 "	"
Schizanthus (Butterfly flower)	" "	1 "	"
Mathiola (Stocks)	" "	1 "	"

Annual flowers. Seeds to be sown early:

Variety	Time of Sowing	Depth of Sowing	Soil Best
Adonis (Pheasant's eye)	April or early May	1 inch	Light Loam
Ageratum	" "	½ "	"
Alyssum	" "	½ "	"
Amaranth	" "	1 "	"
Brachycome (Swan river daisy)	" "	½ "	"
Browallia (Amethyst)	" "	1 "	"
Calendula (Pot marigold)	" "	1½ "	"
Calliopsis (Coreopsis)	" "	1 "	"
Aethionema (Candytuft)	" "	½ "	"
Carnation	" "	1 "	"
Centaurea (Bachelor's button)	" "	1 "	"
Chrysanthemum (annual)	" "	1 "	"
Clarkia	" "	1 "	"
Dianthus (China pink)	" "	1 "	"

Variety	Time of Sowing	Depth of Sowing	Soil Best
Euphorbia (Snow-on-a-mountain)	April or early May	1 inch	Light Loam
Gaillardia (Blanket flower)	" "	1 "	"
Godetia	" "	1 "	"
Gypsophila (Baby's breath)	" "	1 "	"
Helichrysum (Everlasting)	" "	1 "	"
Lobelia (Cardinal flower)	" "	½ "	"
Tagetes (Marigold)	" "	1 "	"
Mignonette	" "	½ "	"
Nasturtium	" "	2 "	"
Nicotiana	" "	½ "	"
Nigella (Love-in-a-mist)	" "	1 "	"
Petunia	" "	½ "	"
Phlox D.	" "	1 "	"
Eschscholtzia (California poppy)	" "	½ "	"
Poppy, Shirley	" "	½ "	"
Portulaca	" "	½ "	"
Pyrethrum	" "	1 "	"
Salpiglossis	" "	1 "	"
Scabiosa (Mourning bride)	" "	½ "	"
Lathyrus (Sweet pea)	" "	4 "	"
Verbena	" "	1 "	"
Zinnia	" "	1 "	"

A list of popular perennials. Plants to be grown the previous summer:

Variety	Time of Planting	Depth of Planting	Soil Best
Abutilon (Flowering maple)	May	3 inches	Any well-enriched, well-drained soil. Light loam preferable.
Aquilegia (Columbine)	April	3 "	
Bellis perennis (English daisy)	"	2 "	
Campanula (Canterbury bells)	"	3 "	
Canna	May	4 "	
Delphinium (Larkspur)	April	3 "	
Digitalis (Foxglove)	"	4 "	
Gaillardia (hardy)	May	3 "	
Althaea (Hollyhock)	April	4 "	
Poppy (hardy)	"	3 "	
Rudbeckia (Cone flower)	May	4 "	
Helianthus (Sunflower [hardy])	"	3 "	
Sweet william	"	3 "	
All hardy pinks	"	3 "	

A list of shrubs for garden borders: Almond (flowering), cornus in variety, elder, forsythia, hydrangea, honeysuckle (bush), japan quince, kerria, lilac in variety, mahonia, privet, roses in variety, snowball in variety, spirea in variety, sumac, weigelia, witch-hazel, evergreens, dwarf thuja, retinispora, junipers, norway spruce, dwarf pine.

A list of early vegetables that should be started inside in April, and the plants set out as soon as the ground is fit: Brussels sprouts, cabbage, cauliflower, celery, celeriac.

A list of late vegetables, the seed of which should be started in April and the plants set out after the tenth of May: Cucumber, eggplant, melon, pepper, tomato.

THINNING AND TRANSPLANTING

C. E. Hunn

In order to have a good garden, each plant should have room for its fullest development, and since most of the seeds of garden flowers and vegetables are small it is almost impossible to sow the seeds sparsely enough so that each plant will grow to perfection. Since this is the case, the plants must be "thinned," and either thrown away or transplanted to some other part of the garden. If the thinning is done in cool, cloudy weather, the seedlings may be transplanted with great ease; but if it is done in dry, sunny weather, the seedlings must be shaded after being set out. It is best to thin the plants when they are small, before they have become crowded, but if one wishes to save them for transplanting they may be left until large enough to handle. The following statement will be found helpful to young gardeners in thinning and transplanting:

1. *Flowering plants that should be four inches apart:* Alyssum, ageratum, balsam, candytuft, lobelia, pansy, poppy, portulaca.

2. *Flowering plants that should be six to eight inches apart:* Amaranthus, browallia, carnation, centurea, dianthus, eschscholtzia, gaillardia, mignonette, myosotis, phlox D.

3. *Flowering plants that should be twelve inches apart:* Aquilegia, aster, campanula, calliopsis, colosia, helichrysum, heliotrope, larkspur, marigold, nasturtium, "drop," nigella, petunia, salpiglossis, scabiosa, verbena, zinnia, sweet william.

4. *Flowering plants that should be eighteen to twenty-four inches apart:* Canna, chrysanthemum (annual), cosmos, dahlia, delphinium, digitalis, gypsophila, nicotiana, phlox (hardy), salvia, rudbeckia, schizanthus, tritoma.

5. *Vegetables that should be six inches apart:* Beet, celery, lettuce, parsnip, parsley, spinach, salsify, turnip.

6. *Vegetables that should be twelve inches apart:* Bean, cabbage, cauliflower, eggplant, endive, kohl-rabi, pepper.

7. *Vegetables that may be sown thickly:* Carrot, leek, onion, pea, radish.

8. *Vegetables that should be three to four feet apart each way:* Bean (pole), corn, cucumber, kale, melon, squash.

THE GARDEN MULCH

C. E. HUNN

In many school gardens as well as in many home gardens, the lack of a good supply of water often results in a partial failure of the crop or demands hard work in carrying water. This lack of water may be overcome by the use of some kind of mulch. The mulch serves several purposes: conserving moisture in the soil by preventing evaporation; keeping the surface of the soil loose; protecting the plant roots from injury by frost; and to a certain extent with some materials adding plant food to the soil. The first two considerations are perhaps the most important in the school garden, and even where water may be used in quantity it is often better to mulch the ground around the plants than to use water too freely.

Constant watering will cause heavy soil to become sodden and sour, whereas by the use of two or three inches of mulch the soil will remain loose and sweet. Mulch is also valuable on light, sandy soil where evaporation is rapid. Plants demand moisture around the roots, but do not thrive with their roots standing in water; and where a mulch is used there is a constant supply of moisture rising through the soil which will be held near the surface by the mulch.

The material that can be used as a mulch may be anything supplying shade and lying close to the ground: short grass, straw, hay, coarse manure, leaves, and old boards. Stirring the surface of the soil with a hoe or a rake will produce a "dust mulch" that will be of benefit. (See page 219.)

BUYING SEEDS

FOR the cultivation of a large piece of ground for children's gardens, it would be well to buy the seeds in bulk. Some of the older children will enjoy putting them up in packets and marking them. This will be a good school exercise. The teacher with some of the children might estimate the number of lineal feet to be planted with each kind of seed. If the teacher does not know the quantity needed for this estimate, the seedsman will tell her. If there are but few children in the school or a small piece of ground to be cultivated, the penny packets will be found satisfactory.

All orders must be sent through the teacher.

Post office.................................. *State*..........................

School No.................................. *Grade*..........................

Teacher...

JAMES VICK'S SONS

189 Main Street, East   18–20 Stone Street

Rochester, N. Y.

Please fill our order for the following:

Flower Seeds

........Asters	........Nasturtium { dwarf or climbing
........Alyssum	........Petunia
........Bachelor's Button	........Phlox
........Calliopsis	........Poppy
........Candytuft	........Scabiosa
........Dianthus	........Sweet Peas
........Marigold	........Zinnia
........Mignonette	
........Morning Glory	

Vegetable Seeds

........Beans	........Onions
........Beets	........Radish
........Carrots	........Spinach
........Lettuce	........Sweet Corn

Postage, two cents extra for every 12 packets of flower seed, and three cents extra for every 12 packets of vegetable seeds. Large orders will go cheaper by express, charges to be paid by the purchaser. No order accepted for less than one dozen packets.

PLANTING TREES

THE EDITOR

BOYS and girls in rural districts have the opportunity to give pleasure and profit to themselves and to others by planting trees. Make the most of it. Tell your father that you want to plant and bud an apple tree each year, and ask him to help you to decide on the place for your trees. He will be glad to do this. Girls as well as boys should try.

An apple tree will unfold a story to the watchful boy or girl, which will be as interesting as many stories in books: the effort of the young tree to make a start in life; the first springtime when it shows itself ready to take advantage of the sun and rain; the struggle with the storms; the first blossoms; the first fruit. You will watch the insect enemies and will protect the tree. Some day a robin will sing from its branches. In future years a mother bird may find it a safe and sheltered place for her home. Yes; you will want to plant a tree this year, and bud it when the time comes.

Read the following stanzas. You will then understand what one naturalist felt as he stood in his own orchard.

"For I planted these orchard trees myself
On hillside slopes that belong to me;
Where visions are wide and winds are free
That all the round year might come to my shelf.

And there on my shelves the white winter through,
Pippin and Pearmain, Rambo, and Spy,
Greening and Swaar and Spitzenbergs lie
With memories tense of sun and dew.

They bring the great fields and the fence-rows here,
The ground-bird's nest and the cow-bell's stroke,
The tent-worm's web and the night-fire's smoke,
And smell of the smartweed through all the year.

They bring me the days when the ground was turned,
When the trees were pruned and tilled and sprayed,
When the sprouts were cut and grafts were made,
When fields were cleaned and the brush-wood piles burned."

L. H. Bailey

AN APPLE TREE

C. S. WILSON

How to plant an apple tree.— The apple tree is bought from the nurseryman in the fall or the spring. It should be two years old, and the variety should be Northern Spy. The tree is planted in the spring as soon as the ground can be worked. Dig a round hole large enough to receive the roots of the tree, and deep enough to plant the tree three or four inches deeper than it was in the nursery row. This will cover the bud and crook near the base. When the hole is dug, throw back into the bottom a few shovelfuls of the good surface dirt; then place the tree in the hole. Let one pupil hold the tree straight, while others throw in the soil, at the same time working it between the roots with the fingers. Step on the soil and tramp it down firmly. Fill the hole up level with the surrounding surface.

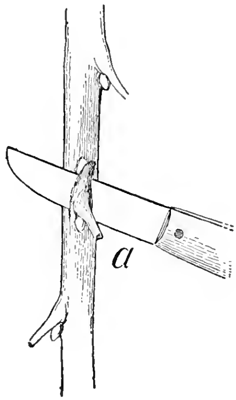


FIG. 1

Budding.— This is such an interesting and important farm operation that every boy and girl should know how to do it. It is so simple, too, that one can learn it in a few minutes. Think of changing the little apple trees in the orchard, or those that come up in the fence row, to any variety of apple you wish! And this is exactly what budding is for. It is to change the variety of a fruit, and this change can be made on branches as small as a lead pencil or as large as the thumb.

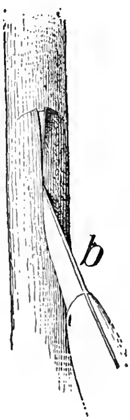


FIG. 2

The nurseryman buds the little trees in the nursery row about two or three inches above the surface of the ground, inserting a single bud in each tree. The fruit-grower top-buds the trees he has set in the orchard the spring before, inserting two or three buds in the main stem of each tree about three feet from the ground. This is what you will do if you have planted a Northern Spy tree in the spring.

Plan to bud the tree in August. At this time the bark peels readily. It would peel in the spring also, but then the flow of sap is so great that the little bud would be drowned or forced out of the bark. Later in the fall than August the bark becomes so dry that it will not peel.

To prepare the tree or stock.— Choose the place for the bud. Make a horizontal cut across the stem just through the bark. This cut should be made with a rolling motion of the knife, and should be crescent-shaped. Then, beginning in the middle of this crescent-shaped cut, draw the knife straight down, making a vertical cut, as in Fig. 2. To loosen the bark, twist the knife sidewise before drawing it out. The stock is now ready for the bud.

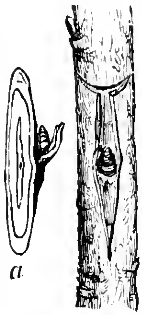


FIG. 3. *a*, *Bud*

The bud stick.— Take the buds from bearing trees of the variety you wish. From the ends of the branches cut twigs that have grown this spring. These are called bud sticks. The leaves are still on them. At the base of each leaf and between the leaf and the branch you will find a little bud. This is the bud you wish to insert into the tree, which has been prepared as above.

To cut the bud.— Cut the leaves off the bud stick about a quarter of an inch above the bud, thus leaving the base of the leaf stalk as a handle for the bud. Also cut off the upper part of the bud stick three or four buds from the end. These end buds are soft and immature, and should not be used. Cut each bud as you use it. Beginning with a sharp knife below the bud, cut upwards just through the bark beneath the bud and above it about half an inch. Be sure to cut through the bark, but be careful not to get much wood beneath the bud. The illustration (Fig. 1) shows how to cut the leaves from the bud stick, and also how to cut the bud.

Inserting the bud.— Push the bud down into the incision made in the stock, using the leaf stalk as a handle. Be sure that the entire bud is shoved into the incision. If a portion of the bark should project above, cut it off. Fig. 3.

Tying.— The bud is now ready for tying. Raffia is the best material to tie with, but if that is not available use ordinary string. Wrap the wound entirely except where the bud is. Begin below the bud to wind the raffia. Wrap it carefully and snugly up to the bud, around the sides, and above the bud beyond the top of the wound. Then tie securely. Fig. 4.

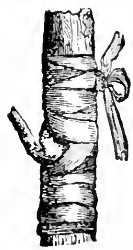


FIG. 4

Later treatment.— Leave the raffia or string about two or three weeks, when the bud will have "stuck." Then remove the raffia. It is the common practice to draw a sharp knife over the strings on the side opposite the bud, completely severing them and allowing them to fall off as they will. The bud will remain dormant during the winter, and will begin to grow in the spring. After the buds have grown one year, choose the strongest branch and cut off all the others. From this branch allow the main branches of the tree to grow.

SUNRISE AND SUNSET COLORS

WILFORD M. WILSON

We have seen the beautiful sunrise and sunset colors many times, and perhaps have wondered what makes the sky so much more brilliant at evening or in the morning than during the middle of the day. Of course we all know that it is the sunlight falling on the clouds which makes them so beautiful at evening, but is not the sunlight brighter and are not the clouds just as beautiful in the middle of the day? It must take something besides sunlight and clouds to make a brilliant sunset. How can we find out what it is?

During the latter part of the year 1883, all of 1884, and a part of 1885, the sunset colors all over the world were remarkably brilliant. They were of such unusual beauty that almost every one spoke of it.

In the Strait of Sunda between Java and Sumatra is a little island called Krakatoa. On this island was a volcano. On August 27 and 28, 1883, there was an eruption of this volcano so violent that it destroyed more than one half of the island and left water a thousand feet deep where the mountain once stood. The ashes and the dust thrown up by the eruption fell for hundreds of miles around. The finer dust reached great heights in the atmosphere, and the winds carried it all around the world. As the dust spread out over the world the sunsets became so remarkably brilliant that almost every one noticed it.

Many times before and since this incident it has been noticed that the sunset colors were much more brilliant after the eruption of volcanoes that threw much dust up into the air, than at other times; but in no case have they been so beautiful or continued so long as after the eruption of Krakatoa. We feel almost certain that the dust in the air has something to do with the sunset colors. Let us see whether we can find out just what happens to sunlight when it shines through air that has a large amount of dust in it.

What colors do you see the most in the sunset sky? Red, orange, and yellow, of course. Did you ever see any blue or violet? Not often, I think. You remember that sunlight has in it the seven rainbow colors, violet, blue, peacock, green, yellow, orange, and red. We sorted them out by letting a little beam of light pass through a piece of glass called a prism. We found that the finest light waves were violet and the coarsest were red, and because the little violet waves were bent more in passing through the prism than were the larger red waves, each fell in a different place on the screen.

Dust also sorts out the colors in sunlight, but not in the same way that a prism does. In the first lesson we said that many ocean harbors had breakwaters, or great walls, to stop the waves as they came in from the ocean, so that ships might have a quiet place to anchor. Suppose that a wave higher and bigger than the breakwater should come in from the ocean. Would the breakwater stop it? Of course it would not. It would roll right over the breakwater on into the harbor, would it not? Would the breakwater stop a little wave — one that was not so high as the breakwater itself? Certainly it would. Now, the little particles of dust in the air are something like breakwaters, because they stop the little violet and blue waves of light that are smaller than the dust particles; but the coarser waves of red and orange, which are bigger than the dust particles, pass right on over them. We do not see any blue or violet in the sunset colors because the little waves of light that make these colors have been stopped by the dust in the air. In the same way that a breakwater will not stop a wave from the ocean that is higher than itself, so the dust in the air will not stop the waves of light that are larger than the dust particles themselves. These larger waves that make the yellow, orange, and red pass on through the dust, and when they fall on the clouds we see them in the gold and crimson colors of the sunset.

But is there not just as much dust in the air in the middle of the day? Then why are the clouds not colored at noon, as well as at morning or evening? I think you can answer this question if you will try. When the sun is overhead, which side of the clouds does the light fall on? Which side do we always see? When the sun is nearly down, which side of the clouds does the light then fall on? There is another reason. Most of the dust in the air is near the earth, probably below the clouds. So when the sun is nearly or quite down, the light passes through a greater thickness of dusty air than when the sun is overhead, and the more dust there is the more the violets and the blues are sorted out, leaving only the yellow and the red to color the evening sky.

NOTE.— Weather maps are now published only at the Ithaca, Buffalo, Binghamton Albany, and New York City Weather Bureau offices.

CORNELL
Rural School Leaflet
[FOR BOYS AND GIRLS]

Published monthly by the New York State College of Agriculture at Cornell University, from September to May, and entered as second-class matter September 30, 1907, at the Post Office at Ithaca, New York, under the Act of Congress of July 16, 1894. L. H. Bailey, Director

ALICE G. McCLOSKEY, Editor

ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

Vol. 5 ITHACA, N. Y., APRIL-MAY, 1912 No. 4

Only a little forest-brook
The farthest hem of silence shook;
When in the hollow shades I heard —
What is it, a spirit or a bird?
Or, strayed from Eden, desolate,
Some Peri calling to her mate,
Whom nevermore her mate would cheer?
" Peri! peri! peer! "

From "The Pewee," by J. T. Trowbridge.

GIRLS IN THE HOME

We are looking for the best possible development of our New York State girls and particularly of the girls living in country districts. A long summer vacation is near. It will afford an opportunity to accomplish some definite piece of work for the improvement of the home and for the comfort of the family. A garden to furnish flowers and vegetables for the table; a room which it shall be your care to keep neat, clean, and attractive; some new curtains for the windows next fall; clean paper coverings for the cupboard shelves; a well-made dish of food. In line with this last suggestion we print the following article on Bread Making. Try the recipe until you are able to obtain each time bread that is *evenly porous*, with a *sweet, nutty flavor*, *thoroughly baked* with a *well-browned crust*, and having *no odor nor taste* of *yeast*.

BREAD MAKING

FLORA ROSE

Suppose you try to plant a yeast garden and make a loaf of bread. For one loaf of bread:

½ pint of water or milk
¼ of a yeast cake, softened in ½ cup of water, or
½ cup of liquid starter
1 teaspoon of salt

If a crumbly crumb is liked, use 1 teaspoon to 1 tablespoon of lard or drippings or butter.

If sweet bread is liked, use 1 teaspoon to 1 tablespoon of sugar.

At first use enough flour to make a batter (about 2 to 2½ cupfuls).

After the batter has become very light add enough flour to make a dough. I cannot tell you how much flour to use at this time, for different kinds of flour vary so much in the amount of water they take up, but do not have the dough either very stiff or very soft. Knowing the characteristics of yeast, you will not have any trouble in understanding the following directions:

Have hands, cloths, and utensils scrupulously clean. If milk is used, boil it up once, add salt, butter, and sugar, and then let it cool until it is about lukewarm. It is better to boil the water used, for it may contain some living things harmful to the yeast. After the liquid has cooled, add the yeast and enough flour to make a batter and then heat it well to put in plenty of oxygen. Cover with a clean cloth and set in a warm place until light. If compressed yeast or "starter" is used, the batter will be light in three or four hours. If dry yeast is used, it will take at least over night for the yeast to get a good start. When the batter is light, add enough flour to make a dough and knead it until it is no longer sticky.

RED-WINGED BLACKBIRD

SUPPLEMENT TO
CORNELL RURAL SCHOOL LEAFLET
VOL. 5, NO. 4, APRIL-MAY, 1912

Then put it back into the same bowl or pan in which the sponge was made and let it rise until it is a little more than double its original bulk. Shape into a loaf, put into a buttered bread pan, and let it rise again until it has about doubled its size. It should feel light and very elastic. Bake at once in a moderately hot oven for 40 to 45 minutes. This will not make a very large loaf of bread, but I hope you are going to learn to make and to like the small loaves of bread, for they are easier to bake through and they have a larger amount of good crust.

A good loaf of bread should be evenly porous; should have a sweet, nutty flavor; should be thoroughly baked; have no odor nor taste of yeast; the crumb should be tender and elastic; the crust should be well browned; it should be so palatable as to encourage the family to make it a prominent feature of the meal.

WHAT I EXPECT OF THE BOY OF FOURTEEN

Arthur D. Dean

(New York State Education Department)

Right at the start I expect him to be a *Boy* — not a cherub, not a little old man, not a sneak. Just plain unadulterated Boy. I expect that he stands well on his feet, looks you in the eye, tells you the truth; that he sleeps when he sleeps, works when he works, plays when he plays; that he swims like a duck, runs like a deer, sees like an eagle; that he plays fair on the field, at the school, in the home; that he likes a dog, delights in woods and fields, believes in comrades; that he admires real men, stands by his heroes, looks up to his mother; that he sees in a violet, a sparrow, a worm, the touch of the hand of God.

Furthermore, I expect that the boy has a father as well as a mother, a few brothers and sisters, a wise teacher or two; that his father remembers that he was once a boy; that his mother tempers her all-abiding love with justice; that his home is more than a pantry and a bed; that his school is more than a recitation period; that his teacher sees something beyond marks; that his church is more than a form.

But my expectations are more than one-sided or two-sided; they are many-sided. I rather suspect that the boy expects a few things himself. He expects that his parents are sturdy, responsible, clean; that fresh air is his in sleep, at play, in school; that he is fed at least as sanely as are horses, cows, and hens; that his desire for activity is turned from devilry into useful knowledge, productive labor, wholesome play; that his parents reverently tell him of the functions and care of his beautiful body; that he is taught obedience and right thinking by example as well as by preachment; that his capacity, interest, and native ability are studied and wisely directed; that the idealism of his adolescence is nurtured as though it were the voice of God. In fact, he expects that every hour out of the twenty-four is a step forward in his educative process, and that the task of educating him is more than a school affair.

There is yet more. Beyond my expectations or his expectations there are *our* expectations. You and I — everybody. He is our boy. He is to be our Michelangelo, our Thomas Edison, our Abraham Lincoln, our First Citizen, our Great Good Man. It is for us to give him his chance to be great, good, and godlike. It is for us to give him a parentage untainted by disease — social, civic, or industrial. It is for us to give him his rightful heritage of playgrounds, of good schools, of clean cities. It is for us to close the door of the corner saloon, the dive, the vulgar show. It is for us to prevent his exploitation in sweatshop, factory, or store.

Our boy cannot run the race with his feet tied. He cannot do it all. He will do his share. We must do ours. Now let's all push and pull together, then we shall find that our boy meets my expectations, his expectations, our expectations.

BIRD STUDY

Boys and girls throughout New York State are now interested in birds. There is not the careless hunting that used to drive away the little singers long ago. Birds are needed because they are useful and because they give us joy. Let us see each year how much we can learn about them and how well we can protect them from their enemies.

If I were to go into your schoolroom and ask you to name all the birds you know, I am sure you would name the blackbird, the crow, the robin, the owl, and a number of the larger birds. There are very few boys and girls, however, who could tell me anything about the group of small birds called warblers. I should like you to try to see some of them during the summer. They are very interesting.

Keep your eyes open, then, for all small birds and have particularly in mind the little redstart, since it is one of the fly-catching warblers that we have for study this year. Remember it is smaller than a sparrow and you will have to look carefully to find it. You may see a bird smaller than a sparrow that does not answer to the description of the redstart on page 237; if so, describe it and we may be able to name it for you.

Before summer comes, try to learn from the description on the next page the colors of the redstart. Read what Thoreau, the great naturalist, says of the little bird. Listen for every delicate bird note all summer and try to find the bird that makes it. If you do not find the redstart you will probably see one of the other warblers.

THE REDSTART

Size: Smaller than a sparrow.

General color: Black above, including the throat, with six orange patches, one in each wing, one on each side of the base of the tail, and one on each side of the breast. Under parts white. The female has the black replaced by green and the orange by yellow.

Nest of redstart

Distinctive features: The black and orange color, together with the small size, will distinguish it.

"*May* 10, 1853.

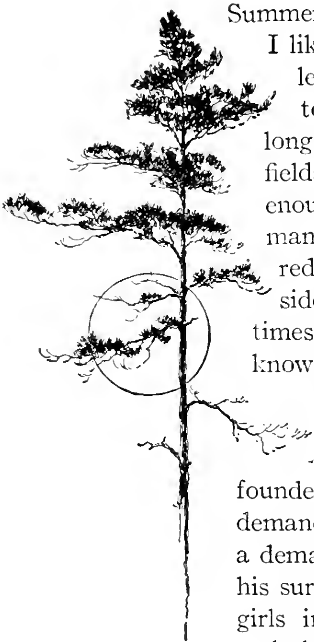
"I hear, and have for a week in the woods, the note of one or more small birds somewhat like a yellow-bird's. What is it? Is it the redstart? I now see one of these. The first I have distinguished. And now I feel pretty certain that my black and yellow warbler of May 1st was this. As I sit, it inquisitively hops nearer and nearer. It is one of the election-birds of rare colors which I can remember, mingled dark and reddish. This reminds me that I supposed much more variety and fertility in nature before I had learned the numbers and names of each order. I find that I had expected such fertility in our Concord woods alone as not even the completest museum of stuffed birds of all the forms and colors from all parts of the world comes up to. The neat and active creeper hops about the trunks, its note like a squeaking twig."

Redstart

Thoreau, Journal

BOYS AND GIRLS

THE EDITOR



Summer is almost here and with it comes vacation. I like to think of the rosy-cheeked girls and freckled-faced boys in the country who will be free to work and play out of doors through the long, long summer days. To help father in the fields or to help mother in the home will give work enough, but there will probably be time to spend many hours with chipmunk or squirrel or gay robin redbreast, or in finding some new wood or wayside plant that you have never seen before. In times of leisure you can add much to your nature knowledge and boys and girls should not neglect this.

The world needs persons who have knowledge of nature because all agriculture is founded on this knowledge. There is always a demand for the successful farmer and there is also a demand for the man in the city who is awake to his surroundings. This is why we want boys and girls in the public schools to study natural forces and objects. If you become farm folk in the future you will then have preparation to become successful farmers. If you go to the city to live you will find that your training in the study of nature will help you in any line of work.

A boy or girl who wants to live well should train the senses. To see, to hear, to feel, to taste, to smell — all are important. As you grow older you will know that many persons have failed to make the most of one or more of these gifts. If any one of the senses is neglected while we are young we can never have the use of its full power. I am going to ask you, therefore, to learn all that you can through sight, sound, touch, taste, and smell. There are hundreds of ways in which you will do this all by yourselves. I am going to suggest some things to think about along this line, that come to me as I write.

SOME THINGS TO SEE

1. The dawn of the new day: what it reveals in the sky, in the fields, in the distant trees, in the life in and about the farm. 2. Sunset time. How many different colors will you see during the spring and summer

evenings? How does one sunset differ from another? Look out into the nights, some starry and some moonlit. 3. Note all the different greens that can be seen in a landscape: the greens of trees; the different crops; a far-away bit of water. Note the touches of rich color that brighten the landscape, all the reds and the yellows. 4. Try to see some bird that is smaller than a sparrow. Many boys and girls never see the very small birds. 5. Look closely to find all the parts of some one flower: a lily of the valley, a tiger lily, a wild rose, or a bluebell. 6. Try to see blossoms on at least one tree. Often young persons do not realize that trees blossom. 7. If you have red poppies growing in your garden, arrange some with ripened wheat and see what beautiful color you will have. 8. Notice the best-kept grounds in your neighborhood, and notice the most attractive house inside and out. 9. Look in villages near, or in your own community, for the most attractive garden. 10. Learn to see at a glance when mother or father needs you. When you truly see this your heart will answer the need.

SOME THINGS TO HEAR

1. Listen to the early morning sounds. Sound gives to some persons as much joy as does sight. 2. Try to distinguish the different bird notes. 3. Listen to the music of the crickets and katydids, and to the sounds of other insects by day and night. 4. Learn to recognize the sounds made by the pines, the rain on the roof, the hail near the close of the summer shower. 5. Listen for the sound of the church bell which may come to you from the village near. 6. Notice how restful and pleasant it is to hear persons speak in low, soft tones. Try to speak in this way when talking to others.

SOME THINGS TO FEEL

1. The warm, sweet winds of spring. 2. The touch of a gentle rain on your face. 3. The cool, soft moss in the deep wood. 4. The joy that all clean things give: cleanliness of person; of clothing; of everything in the house or barn. 5. The confidence of your dog when he puts his nose into your hand. 6. The response of the farm animals to your affection.

SOME THINGS TO TASTE

1. Good bread and butter. Some persons do not know when butter is good and wonder why the butter they make is not in demand. Learn to tell the difference. 2. Girls should find out how the best bread is made. Do not be satisfied until you know that you can make it. 3. Learn to distinguish quality in apples and other fruit; in vegetables. 4. Learn the value of cool, refreshing, pure water.

SOME THINGS TO SMELL

1. The pine woods. The distant buckwheat field. The lilac hedge. Garden flowers at night. 2. A clean barn. 3. Clean rooms at home. Good cooking. 4. Be sure that all unpleasant odors, indoors and out, are removed as soon as possible. Help to keep all parts of the house and farm buildings clean so that you will be able to get the benefit of the agreeable odors.

A CHILD'S LETTER

Covert, N. Y., January 18, 1912

Dear Mr. Tuttle:

We received the Cornell Leaflets some time ago and we were all very glad to get them. We enjoy studying and reading them very much. I am greatly interested in the raising and care of poultry. My father and I have a large flock of pure-bred White Leghorn pullets. They are just beginning to lay now. I enjoy caring for chickens especially when they are laying a good amount of eggs.

You asked if we were planning to have a Corn Day celebration. I am glad to say that we are planning to. We expect to recite pieces and we thought it would be nice to pop corn and if we could we wanted to get some farmer to tell us about the raising and cultivating of corn. We also want to trim our schoolroom and make it look nice.

My father works a large farm. We have a large flock of Brown Leghorn hens, several small pigs, and several head of sheep. We keep four cows and we also have four horses. I enjoy farm work and chores very much. I am glad that I live in the country where I can get black raspberries, blackberries, and strawberries in the summer time when the sun is so hot, but the fruit tastes very good when cold weather comes. There is a large woods on the land that my father works. In the spring I like to go and gather flowers and along in May and June and July there are lots of white and red lilies to gather, also Leopard Tongue; some people call them yellow lilies. I think the squirrel cornflowers are pretty also. I like to study about the different kinds of birds. There are a great many different kinds of birds. There are a great many different kinds to learn about. I liked the story about the junco bird in the last Cornell Leaflets that we received.

Very truly yours,

Grace. B. Dawson,

LETTER TO BOYS AND GIRLS

Dear Girls and Boys:

THIS letter is the last one that I shall write to you this spring. I desire first of all that it shall tell you of the joy I have found in my touch with you. How my heart warms to read the letters that come to me signed, " I am your true friend," or " A girl of the open country," or " A boy who loves the country "! As I read these letters I am more and more sure that you all do love the country and that you realize the opportunity which is yours to live free, wholesome, happy, useful lives.

One of the things I wish to ask of you is that you will not be disappointed if I do not personally answer your letters. If it were possible to follow my desires, each one should receive an answer at once. But I cannot do this, for there are so many of you. However, in each Leaflet there will be a letter that will answer all of yours. In these letters I shall try to tell you those things that perhaps may interest you, and to help you to feel how sincerely I wish for your good fortune and how eager I am for your confidence and friendship. Now let us consider some important things to think about and to work out between now and next fall.

As I write, Farmers' Week here at the college is about to begin. Of course, when you read this letter it will be long past, nevertheless I think you will be interested. You remember that we asked to have some prize corn sent to us for an exhibit, and in January we also asked each school superintendent to have some school in his district send us an exhibit of Nature-Study work. The display is a remarkably fine one and I wish all of you might see it, especially those who contributed something. Perhaps you have guessed that the reason why I have told you about all this is that I want you to begin now to think about two exhibitions for next year — Corn Day in the schools and Farmers' Week at the college. This is the time to make plans to take part in them.

We are considering holding Corn Day in November instead of in January, because November is closer to the corn harvest time. What do you think of this plan? If you want some corn to exhibit, *grow it*. (See page 243.) If you are going to make a collection of plants or leaves or seeds or flowers or twigs for Farmers' Week, be constantly on the lookout for the finest specimens. If you are going to keep chickens or cultivate a home garden this summer, such as was suggested in the last letter, decide to keep a neat, accurate, and complete account of all you do and of your results. A record of this kind is as valuable to exhibit as is corn or a collection.

It tells of real experience and will help others. Whatever you plan to do, resolve to do it with all your might, and to have a piece of work to show that will make your fathers and mothers and friends realize that you have done something worth while: something that has not only been a pleasure to you, but that has helped others.

I want every boy and girl who reads this letter to think of what Mr. Dean has said in this Leaflet that he expects of a boy of fourteen. It applies not only to a boy at this particular age, but to all boys, younger and older; and girls, also, will find things there to think of: things that will help them in many ways.

Now it is time for me to say good-by. It is not good-by for good, because next fall I shall write to you all again, and between now and then many letters will come to me from you, some of which I shall try to answer personally. Let me ask one thing of you. The thing I want to ask is that each boy and girl will take a share of responsibility: responsibility to self, in that good, clean, strong habits are formed; responsibility to others, in that their feelings are considered and their needs supplied, that they may be made comfortable and be helped; responsibility to a task, in that it may be carried to a definite and sure end. This does not mean that I do not want you to play and have fine, happy times. I do. I think something would be wrong with you if you did not do these things. Be natural, free, happy boys and girls, but be clean, respectful, useful boys and girls, too. I hope you will feel that I am very earnest in my desire to be a friend that will stand by and pull with you and for you. I shall watch you growing day by day and month by month, and it will be my joy to see the boys and girls of this State find the fullness of life.

Good-by, and good luck.

Your friend always,

Edward M. Tuttle

You hear that boy laughing? — You think he's all fun;
But the angels laugh, too, at the good he has done;
The children laugh loud as they troop at his call,
And the poor man that knows him laughs loudest of all!

Oliver Wendell Holmes

HOW TO GROW CORN

E. R. Minns

Preparation.— Select some good ears of a variety of corn that is known to produce a large crop of ripe corn in your neighborhood. A few kernels from each ear of seed corn should be tested to make sure that they will sprout vigorously.

The soil on which to grow a prize-winning crop of corn should be chosen from the most fertile part of the farm, if possible. Sod land which grew a crop of clover last year, and which has had a coat of barnyard manure scattered on it during the winter or early spring, is an ideal place to plant corn. It should be carefully plowed early in the spring and harrowed several times before the date for planting arrives, to make the first three inches of soil fine and level.

Planting.— It will not be best to plant corn before the weather is warm enough for boys to go barefooted every day and all day long, for corn needs warmth in the soil and air. We expect such weather as corn needs some time in the month of May or in early June.

Make furrows across the corn plat in its longest direction, if that will not hinder the work of cultivation. Three and one-half feet between furrows will be wide enough. If a furrow marker drawn by horses or pushed by hand can be used, it will save time. Furrows may be made by stretching a stout string between two stakes placed at opposite ends of the plat and drawing a hoe beside it through the soil, so that the corner of the hoe makes the bottom of the furrow. The stakes have to be reset for each furrow.

Plant the corn in hills, five kernels in each hill. Make the hills three and one-half feet apart in the row for large-growing varieties, a less distance apart for small varieties, especially sweet corn and popcorn. Cover each hill with fine mellow soil so that the kernels lie buried about one and one-half inches below the surface. If the soil is rather dry, pat the surface lightly with the back of the hoe blade to bring the soil moisture up around the buried corn kernels and make them sprout faster.

If a hand planter can be found that will drop the five kernels in each hill, it will save time to use it; but one should be careful to see that enough loose soil falls in on the corn to cover it well after the open blades of the planter are withdrawn from the soil.

If a horse-drawn corn planter can be managed by any young corn-grower it will save furrow-making before planting and will leave the rows in better condition for cultivation.

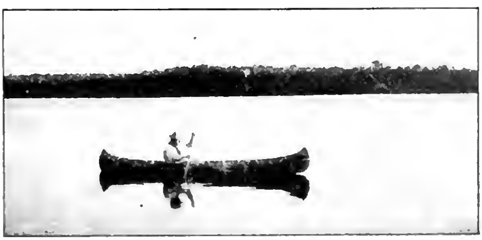
Cultivation.— To kill the sprouting weeds which lie near the surface of the soil, the plat should be harrowed lightly or stirred with a weeder.

About a week after the corn shoots can be plainly seen in the rows it is time to begin using the cultivator. A quiet, steady horse hitched to a single cultivator, or a team and a wheel cultivator with small blades should be used to stir the soil between the rows of corn. Cultivation kills the weeds, airs the soil, and prevents the evaporation of moisture from the deeper soil. Corn is benefited by frequent cultivation, at first moderately deep, then more lightly as the roots spread out through the soil, and when the hot, dry days of summer come, and the corn is tasseling, a small-toothed cultivator that leaves the surface soil fine and nearly level will be most useful. Unless weather conditions interfere, the corn plat should be cultivated four times or more. The soil between the hills in the row needs to be hoed as often as weeds appear. Never hoe nor cultivate the corn plat when the soil is so moist that it feels sticky if squeezed in the hands.

Enemies.— While the corn plant is young one must watch for its enemies. The crows and large blackbirds must be frightened away from the field until the corn is too large for them to pull it up. Sometimes a cutworm can be found lurking near a corn hill and killed before it has cut off all of the stalks.

Thinning.— When the corn plants are about six inches high and danger from birds and insects seems to be past, every hill that has more than three stalks should have the extra ones removed by pulling them out, leaving the three most vigorous ones.

Harvesting.— In September when the lower leaves on the cornstalks begin to die and many of the husks are turning dry, it is time to cut and shock the corn crop if one wishes to save the fodder for feed. About sixty hills of corn may be gathered into a shock and the tops bound together to make the shock stand up. Too large a shock will not cure properly and some of the ears may thus be spoiled. Six weeks of good autumn weather will cure the corn shocks sufficiently for husking. If one does not care for the fodder the ears will be better if left on the standing stalks until the latter are dead and dry and the ears are thoroughly ripened. After husking, corn ears should be stored where air can circulate between them but where rats and mice can not get in.



CORNELL

Rural School Leaflet

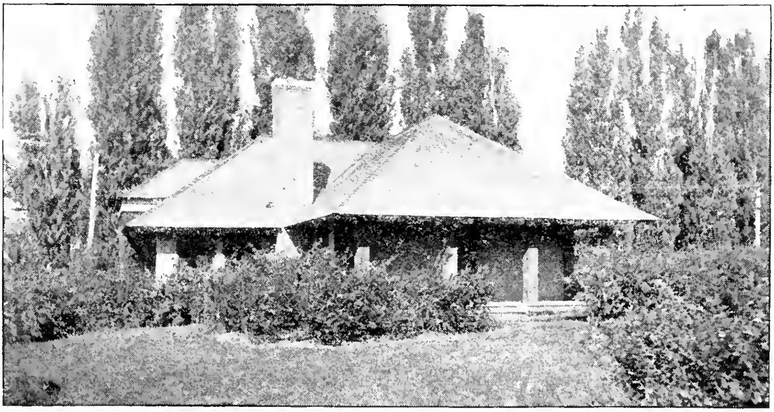
[FOR TEACHERS]

Published monthly by the New York State College of Agriculture at Cornell University, from September to May, and entered as second-class matter September 30, 1907, at the Post Office at Ithaca, New York, under the Act of Congress of July 16, 1894. L. H. Bailey, Director

ALICE G. McCLOSKEY, Editor

ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

Vol. 6 ITHACA, N. Y., SEPTEMBER, 1912 No. 1



SUBJECT MATTER

IN

NATURE-STUDY AND ELEMENTARY AGRICULTURE

FOR 1912-1913

AS OUTLINED IN THE

NEW YORK STATE SYLLABUS

FOR

ELEMENTARY SCHOOLS

ACKNOWLEDGMENTS

We are indebted to Mr. E. F. McDonald, Mr. A. J. Merrell, Mr. C. L. Mosher, and Mr. L. S. Hawkins of the New York State Education Department for helpful suggestions in preparing this leaflet.

The selections from John Burroughs's works are used by permission of and special arrangement with Houghton Mifflin Company, the only authorized publishers of his works.

The poem on page 170 is printed by permission of the Atlantic Monthly.

By permission of the New York State Conservation Commission we are able to publish the frontispiece drawn by Mr. L. A. Fuertes.

Chickadee and Nuthatch

THE POINT OF VIEW*

L. H. BAILEY

A FUNDAMENTAL necessity to successful living is to be in sympathy with the nature-environment in which one is placed. This sympathy is born of good knowledge of the objects and phenomena in the environment. The process of acquiring this knowledge and of arriving at this sympathy is now popularly called nature-study.

The nature-study process and point of view should be a part of the work of all schools, because schools train persons to live. Particularly should it be a part of rural schools, because the nature-environment is the controlling condition for all persons who live on the land. There is no effective living in the open country unless the mind is sensitive to the objects and phenomena of the open country; and no thoroughly good farming is possible without this same knowledge and outlook. Good farmers are good naturalists.

For many years it has been one of the purposes of the College of Agriculture in New York to point the way to this nature-sympathy; and inasmuch as this nature-sympathy is fundamental to all good farming, it was conceived that the first duty of any movement was to lend the effort to the establishing of an intelligent interest in the whole environment — to knowledge of fields and weather, trees, birds, fish, frogs, soils, domestic animals. It would be incorrect to begin first with the specific agricultural phases of the environment, for the agricultural phase (as any other special phase) needs a foundation and a base: it is only one part of a point of view. Moreover, to begin with a discussion of the so-called "useful" or "practical" objects, as many advise, would be to teach falsely, for, as these objects are only part of the environment, to single them out and neglect the other subjects would result in a partial and untrue outlook to nature; in fact, it is just this partial and prejudiced outlook that we need to correct.

In our own work, we have always had in view the agricultural aim or application. We should have been glad if there had been sufficient nature-study sentiment to have enabled us to confine ourselves to the agricultural aim; but this sentiment had to be created or quickened, and we have tried to contribute our part toward accomplishing this result. At first it was impossible to secure much hearing for the agricultural subjects. Year by year such hearing has been more readily given, and the work has been turned in this direction as rapidly as the conditions would admit — for it is the special mission of an agricultural

*Reprinted from the September, 1911, Leaflet.

college to extend the agricultural applications of nature-study. In later years the content of the work has had very direct relation to farm-life questions. The time has now come, we think, when we can devote practically all our energies to this application. It is the purpose of this leaflet to aid the teacher in the rural school to work out the practical daily problem of teaching agricultural subjects.

In doing this, we merely confine ourselves to our more special field. The general nature-study outlook is fundamental, and we shall continue to emphasize it; but we feel that the appreciation of this outlook is now so well established as to allow us to specialize. The Education Department has issued syllabi for agriculture and nature-study; we desire to be useful in applying them to the conditions and needs of country life. Schools here and there are ready for agricultural work: we want to help.

In making these statements we have in mind that the common schools do not teach trades and professions. We do not approach the subject primarily from an occupational point of view, but from the educational and spiritual; that is, the man should know his work and his environment. The mere giving of information about agricultural objects and practices can have very little good result with children. The spirit is worth more than the letter. Some of the hard and dry tracts on farming would only add one more task to the teacher and the pupil if they were introduced into the school, making the new subject in time as distasteful as arithmetic and grammar often are. In this new agricultural work we need to be exceedingly careful that we do not go too far, and that we do not lose our sense of relationships and values. Introducing the word agriculture into the scheme of studies means very little; what is taught, and particularly how it is taught, is of the greatest moment. We hope that no country-life teaching will be so narrow as to put only technical farm subjects before the pupil.

We need also to be careful not to introduce subjects merely because practical grown-up farmers think that the subjects are useful and therefore should be taught. Farming is one thing and teaching is another. What appeals to the man may not appeal to the child. What is most useful to the man may or may not be most useful in training the mind of a pupil in school. The teacher, as well as the farmer, must always be consulted in respect to the content and the method of teaching agricultural subjects. We must always be alert to see that the work has living interest to the pupil, rather than to grown-ups, and to be on guard that it does not become lifeless. Probably the greatest mistake that any teacher makes is in supposing that what is interesting to him is therefore interesting to his pupils.

All agricultural subjects must be taught by the nature-study method which is: to see accurately; to reason correctly from what is seen; to establish a bond of sympathy with the object or phenomenon that is studied. One cannot see accurately unless one has the object itself. If the pupil studies corn, he should have corn in his hands and he should make his own observations and draw his own conclusions; if he studies cows, he should make his observations on cows and not on what some one has said about cows. So far as possible, all nature-study work should be conducted in the open, where the objects are. If specimens are needed, let the pupils collect them. See that observations are made on the crops in the field as well as on the specimens. Nature-study is an outdoor process: the schoolroom should be merely an adjunct to the out-of-doors, rather than the out-of-doors an adjunct to the schoolroom, as it is at present.

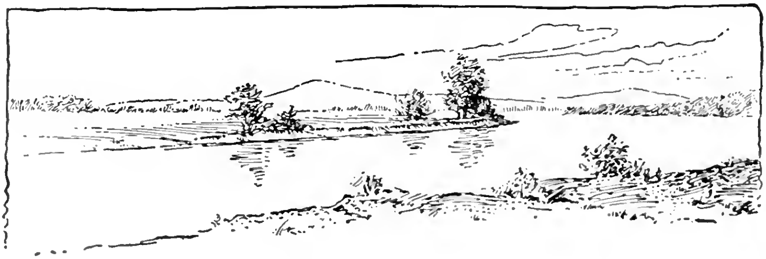
A laboratory of living things is a necessary part of the best nature-study work. It is customary to call this laboratory a school-garden. We need to distinguish three types of school-garden: (1) The ornamented or planted grounds; this should be a part of every school enterprise, for the premises should be attractive to pupils and they should stand as an example in the community. (2) The formal plat-garden, in which a variety of plants is grown and the pupils are taught the usual handicraft; this is the prevailing kind of school-gardening. (3) The problem-garden, in which certain specific questions are to be studied, in much the spirit that problems are studied in the indoor laboratories; these are little known at present, but their number will increase as school work develops in efficiency; in rural districts, for example, such direct problems as the rust of beans, the blight of potatoes, the testing of varieties of oats, the study of species of grasses, the observation of effect of fertilizers, may well be undertaken when conditions are favorable, and it will matter very little whether the area has the ordinary "garden" appearance. In time, ample grounds will be as much a part of a school as the buildings or seats now are. Some of the school-gardening work may be done at the homes of the pupils, and in many cases this is the only kind that is now possible; but the farther removed the laboratory, the less direct the teaching.

To introduce agriculture into any elementary rural school it is first necessary to have a willing teacher. The trustees should be able to settle this point. The second step is to begin to study the commonest and most available object concerning which the teacher has any kind of knowledge. The third step is to begin to connect or organize these observations into a method or system. This simple beginning made, the work ought to grow. It may or may not be necessary to organize a special class in agriculture; the geography, arithmetic, reading, manual training, nature-study, and other work may be modified or re-directed. It is possible to teach the state elementary syllabus in such a way as to give a good agricultural training.

In the high school, the teacher should be well trained in some special line of science; and if he has had a course in a college of agriculture he should be much better adapted to the work. Here the teaching may partake somewhat more of the laboratory method, although it is possible that our insistence on formal laboratory work in both schools and colleges has been carried too far. In the high school, a separate and special class in agriculture would better be organized; and the high school syllabus of the Education Department provides for this.

In all agricultural work in the schools of the State, the College of Agriculture desires to render all the aid it can. Correspondence is invited on the agricultural questions involved. In special cases an officer of the College may be sent to give advice on the technical agricultural phases of the teaching. Considerable literature in the publications of the College is now available and will be sent on application.

In many districts the sentiment for agricultural work in the schools will develop very slowly. Usually, however, there is one person in the community who is alive to the importance of these new questions. If this person has tact and persistence, he ought to be able to get something started. Here is an opportunity for the young farmer to exert influence and to develop leadership. He should not be impatient if results seem to come slowly. The work is new: it is best that it grow slowly and quietly and prove itself as it goes. Through the grange, reading-club, fruit-growers' society, creamery association, or other organization the sentiment may be encouraged and formulated; a teacher may also be secured who is in sympathy with making the school a real expression of the affairs of the community; the school premises may be put in order and made effective; now and then the pupils may be taken to good farms and be given instruction by the farmer himself; good farmers may be called to the schoolhouse now and then to explain how they raise potatoes or produce good milk. A very small start will grow by accretion if the persons who are interested in it do not lose heart, and in five years every one will be astonished at the progress that has been made.



NOTES

The Editor

I. THE RURAL TEACHER

In the State College of Agriculture we believe in the rural school teachers of New York State. The deep interest shown by many of them in the effort to improve country-life conditions has been most encouraging. Some of the best educational work being done in New York State can be found in rural schools. Many men and women are making earnest effort to help boys and girls in the country to a realization of educational opportunities. We consider it a privilege to work with such teachers. We hope they will feel free to make suggestions at any time that will aid the Department of Rural School Education of the State College of Agriculture in more efficiently reaching the boys and girls in country districts.

In the welfare of the country child, rural teachers have a great deal of responsibility. Often a child remains with one teacher for several school years, and in this way the teacher has a better opportunity to help him than many city teachers have who teach but one grade. In many cases, owing to inexperienced parents, or to the fact that parents are having so serious a life struggle that there is but little time to attend to the boys and girls, young persons enter the rural school who need attention aside from their mental development. Although many teachers are fully aware of these essentials, we should like to mention some of them for the benefit of the younger and more inexperienced persons who enter this year into the responsible position of teaching boys and girls. We ask consideration of the following:

Physical condition of the children.— Every teacher should be interested in the physical welfare of the children under his care. Their whole future depends on health. The busy mother does not always notice that a child is breathing through his mouth instead of through his nose; she does not always notice that his teeth need attention; she does not always notice that he is gradually showing less vitality. Effort is being made by the State Board of Health to awaken persons in rural communities to weaknesses in sight and hearing among boys and girls. The movement should meet with hearty cooperation. It is the duty of every teacher who observes physical defects in the pupils in his classroom to do what he can to help them, and to see that parents understand the danger that threatens the young persons.

Presence.— When boys and girls are ready to go out into the world, a large part of their future success depends on personal appearance and manners. By commending boys and girls who come to school clean, with hair neatly combed and finger nails cared for, who walk instead of shamble, who are able to "stand on two feet and look you straight in the eye," the teacher will soon find the more careless children making effort to receive such commendation. Children should be taught some of the essentials of good manners — conduct in school, in the home, in the presence of older persons, at table, and in all public places.

The school grounds.— Everything that a child sees during the day leaves some kind of impress. All constructive work stands for definite gain.

A rural school in Herkimer County

It is a serious thing when children day after day enter unkept school grounds and look upon dilapidated, unclean outhouses. The children could not do a more valuable piece of work than to help improve the school grounds. Everything should be made as neat as possible about the building this fall, and as much enthusiasm as possible created for planting in the spring.

The schoolhouse.—No matter how unclean or unattractive the interior of the school building may be, it should never seem hopelessly so to the rural teacher. Such a condition may be opportunity for him to work with the children to make it livable and attractive. The effort on the part of the children to do this may be suggestive of many improvements that can be made in their homes. Some rural teachers in New York State have called mothers' meetings for the purpose of discussing the improvement of the school building, and they have found the mothers ready to help in making the building a fit place for the children. They have helped to paper the walls, and by means of paint and other inexpensive materials they have demonstrated the satisfactory results that come from labor. If the children take part in cleaning and improving the school building, they will be more interested in keeping it in good condition.

Books.— It is most important that children in the country should have some good literature. Very few children in rural districts have much opportunity for reading, and when these boys and girls go out into the world they soon learn that it is difficult for older persons to become ready readers. The habit of reading should be encouraged in every possible way. The children should have books that appeal to the imagination, such as fairy tales, books of travel and adventure, and the like. They should also have books that relate to the great out-of-doors, such as the works of Burroughs and other naturalists. The older boys and girls should know that there are good books written along the lines of everyday farm practices and interests, and some of these books should be added to the library.

Poetry.— Every human life is enriched by a knowledge of poetry. It keeps the heart young and the spirit attuned to the higher life. It creates a taste for beautiful, deep, holy things. Teachers do not always realize how soon young children cultivate this taste if the teacher shows interest. I have seen rural boys and girls look forward to the hour when they recited together selections from Shelley, Wordsworth, and the others; or poems that have a human interest, such as " Snowbound " and " Horatius at the Bridge." They should be encouraged to commit to memory passages from poems that are worth while.

Out-of-door knowledge.— Every boy and girl, whether in city or country, should be in sympathy with the out-of-door world. There can be no greater contribution to mind and spirit and no greater resource for all future time than the knowledge of natural objects and phenomena. The country child has opportunity in all out-of-door study. This opportunity should be used in every possible way.

Agriculture.— It is most significant that at the present day persons of education and wealth who have had the opportunity to investigate all forms of education for their children are choosing agriculture as fundamental to preparation for life. It provides work with hands and mind in a wholesome, interesting form. To develop a practical agricultural work requires the essentials that make for successful life: *creative power, keen observation, accuracy, perseverance, attention to details, a business sense, an appreciation of the needs of plant and animal life, a love of beauty, a kinship with the out-of-doors.* With a wise teacher, the fundamentals for such development could be given on a half acre of ground connected with the school. There is no other one line of education that offers the all-round growth which comes with farm experiences and practices combined with nature sympathy. Intellect and spirit are awakened.

A rural school in Oneida county

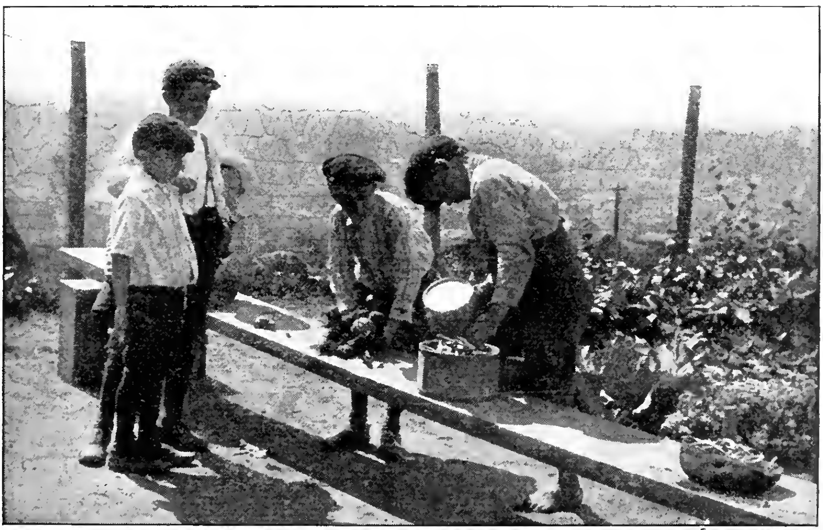
2. THE YEAR'S WORK

The New York State Syllabus.— The work in the public schools of New York State in nature-study and agriculture for the year 1912–1913 includes the following subjects: (1) For special bird study, the **nuthatch** and the **hen;** to be recognized, any two kinds of winter birds and any five of the following: oriole, goldfinch, phœbe, grackle, brown thrasher, meadow lark, cliff swallow, black-and-white warbler, peacock, and eagle. (2) For special animal study, the **cow** and the **cat;** to be recognized, goat, fox, skunk, muskrat, and frog. (3) For special plant study, the **potato;** to be recognized, one of the clovers, one of the grasses, one of the grains, and any six of the following: willow, cherry, daisy, marsh marigold, anemone, trillium, partridge berry, black medick, squash, turnip, pitcher plant. (4) For special insect study, the **potato beetle** and the **lady beetle;** to be recognized, tent caterpillar, honeybee, ant, hornet, spider. (5) For special tree study, the **locust;** to be recognized, two kinds of fruit trees, one conifer, and any four of the following: hemlock, spruce, cherry, quince, horse-chestnut, alder, elm, poplar, tamarack (larch). In this leaflet lessons will be found that will aid teachers in giving instruction in the work as outlined by the State Education Department. The lessons have been prepared in the departments of the State College in which the subjects are taught.

All teachers should read carefully pages 125–127 in the New York State Syllabus before taking up the work in nature-study and agriculture.

During the first six grades in school, the out-of-door study should develop in the child the spirit of the naturalist — an all-round interest in the out-of-doors. If properly taught, at the end of this period the child interested in natural forces and objects will have acquired a spirit of patient inquiry and accuracy in observation. He will begin to realize the kinship of out-of-door objects and the possibilities of interest and resource in them.

Teachers in country schools will find, however, that many of the boys and girls are not interested in nature-study from the viewpoint of the naturalist. The pupils should not be forced into this interest, even if they are in the lower grades, but should be allowed to turn their minds to the more practical side of the subjects. We have found very young children much interested in the commercial side of poultry raising, growing potatoes, and the like. Let us encourage these boys and girls, and, if the teacher will help, they will get the point of view of the naturalist. A field of timothy is as beautiful as a field of violets. Who has not felt his spirit quicken at the sight of a field of oats in the sunlight or in the early



Measuring beans grown in a school garden

evening? Who has failed to see the beauty of pumpkins in the cornfield in the "blue October weather"?

The work for the seventh and eighth grades as outlined in the elementary syllabus has relation to agriculture and may be intensified according to the amount of time and the interest of the teacher and pupils. Each lesson should lay the foundation for fundamental agricultural knowledge which will be introductory to high school and college work in these subjects. We would advise teachers of the seventh and eighth grades to follow the work outlined by the syllabus for these grades, choosing, however, for the most serious study the subject that is of greatest interest in the community; as fruit growing, raising of farm crops, dairying, and the like.

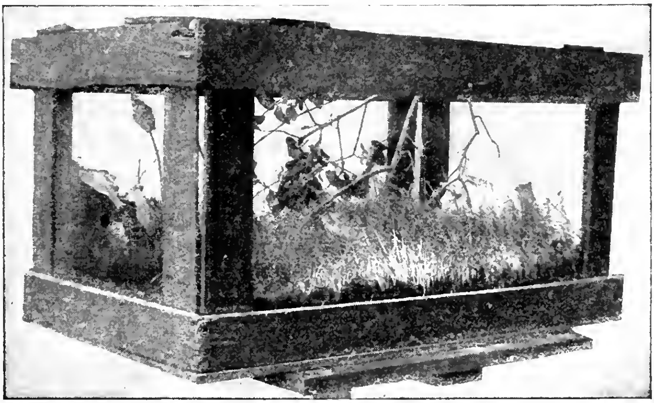
If fruit growing is the special interest in the community, begin in the autumn with discussions of the marketing of apples or other fruit. Have the pupils collect specimens of all varieties to be found in the neighborhood. Have these identified and labeled for a school exhibit. Discuss the most popular variety of fruit in your community and send the pupils on a quest to learn why it is the most popular. Ask a successful fruit grower in the community to give a talk on the subject. During the school year plant a fruit tree. Let the tree planted by each class have significance and stand for a permanent piece of work. Have the children realize, even in a most elementary way, the interrelation and interdependence of outdoor things. The study of soils, for example, in these grades will be most interesting, and will have added value if made in the interest of a tree to be planted. Discuss the advantage of having a home fruit garden. Boys and girls will take an interest in such a garden.

If dairying is the chief interest in the community, choose the subject matter as outlined in the syllabus for which specific material can be found. In country places a visit should be made to a farm, in order that the children may learn the types of cows and begin to think about pure breeds of cattle. A Babcock test machine might be placed in the schoolroom and milk from different farms tested by the pupils. When the test has been successfully made in the schoolroom, it would be valuable to have the class make this test at a grange meeting or a farmers' institute. The matter of balanced rations may be studied, and other subjects of interest on a dairy farm. Special lessons in the interest of dairying were published in the Cornell Rural School Leaflet for September, 1911. Upon request we shall try to supply a copy to teachers who did not receive this publication last year.

To encourage the children in their general out-of-door observations, many teachers have found it helpful to have in the schoolroom a nature-study corner. This is fitted up with a table on which specimens may be kept. Above is a shelf containing reference books. The children may be taught to bring to the schoolroom specimens of plants to be left on this table until the teacher has time to identify them. If the teacher is unable to identify any plant, we shall be glad to have it sent to the University for identification.

A terrarium, which is an enclosed piece of earth on which things may live and grow, has been found very interesting in some of the schoolrooms in New York State. Many kinds of animal life have been housed in terraria. The writer has seen salamanders, toads, snakes, butterflies, caterpillars, beetles, rabbits, hens, guinea pigs, and kittens in terraria in different schools. Children have been allowed to watch the animal life during leisure hours.

Aquaria have not been very successful in most schools, but any teacher can use to advantage battery jars, or even Mason fruit cans, in which aquatic forms of life may be kept for a limited time.



A terrarium

Trips afield.— There should be at least one outdoor trip for the class each year. The boys and girls will long remember the experience, and it matters not whether the way lead along a country roadside, through meadowlands, on the shore of the sea, or in woodland places — some new wonder will be found and some young spirit awakened.

Exhibits.— A most valuable way to arouse the interest of young persons in any new work is to have exhibitions. There is educational value in such work, as the children nearly always make their very best effort in preparing the individual exhibits, and they have opportunity to compare their work with that of other pupils. The small school exhibits are doubtless as valuable as any, and the children should be encouraged to prepare for them. An exhibit of fruit or corn or the eggs and feathers of poultry, or a general nature-study exhibit, will bring about a broader interest than will many formal lessons along agricultural lines. Often schools prepare exhibits for the county fair and some for the state fair. Many send exhibits to the State College for Farmers' Week. Our request for a Farmers' Week exhibit was responded to with so much enthusiasm that we did not have space for all the material received. We hope this year that there will be an exhibit in all of our rural schools held at the schoolhouse, and that the best specimen from each exhibit will be sent to the State College for Farmers' Week. To each school from which we receive an exhibit, we shall send some kind of appreciation, a certificate or a picture. Additional information regarding the time and method of sending exhibits to the College will be published in the children's leaflet for November. This will afford ample time for the preparation of a good piece of work before Farmers' Week in February.

One of the largest exhibits sent to the College of Agriculture during Farmers' Week was from Tompkins county. We have asked Mr. J. D. Bigelow, the superintendent of schools in the district from which it was received, to state briefly his methods of interesting teachers and pupils in the work. His statements are as follows:

" When I received the letter asking for an exhibit of evergreens, cones, twigs of various kinds, weeds, and the like, I wrote to the teachers of six schools then in session. I enclosed the letter and asked to have the collection made.

" Some teachers responded cheerfully with offers to do what they could, but were afraid they would not do very well. Other teachers felt that they already had so much to do that they would not have time to devote to the work. Others felt this work was a great burden. They did not know how to do the mounting and somehow it seemed like a heavy load.

" After a short time, I wrote again and stated how the work of collecting the specimens might be given to pupils, and added that if they would make the collections I would go to their schools and help in mounting them. Of course they all were glad for this help and commenced making the collections. At the time appointed I went to the different schools. On request I took material for mounting the specimens. When I arrived, I found specimens enough collected to keep the pupils busy for a long time. This was true in every school but one, of which I shall speak later. I asked for five or six pupils to do the work. I helped trim the specimens and showed how to mount one or two, and then started the pupils in the work.

" In some instances the specimens were all mounted before the day was over. I then asked how many wanted to go out into the fields or woods for more things to add to the collection. There was always a ready response to this question. I shall long remember the occasion when, one stinging cold day, five sturdy boys and I started over the crusted snow down into the valleys and up the hills for something new to put into the collection for Farmers' Week. The tracks of birds and rabbits, of foxes and hounds, added interest on the happy occasion.

"At one school that I visited with the expectation of having a large quantity of specimens to be mounted, I found that no collection had been made. I called for boys to go out into the fields near and collect what they could. How glad the young boys were to go out in groups, some for one thing, some for another, as they were directed! In half an hour they were back with enough specimens for mounting to keep us busy nearly all day.

"At every school in which an exhibit was made, both teachers and pupils were surprised and delighted with what was done and many were the exclamations of pleasure when they saw how attractive the mounted specimens were.

"*About all that is needed to make such an exhibit, I learned, is to have some one with enthusiasm enough to start the work and encourage it along the way.*"

Leaflets.— There will be but one leaflet issued to teachers this year, the Cornell Rural School Leaflet for September. We hope to issue at least three leaflets for boys and girls, one in November, one in January, and one in March. The leaflet for teachers will be sent to all teachers in New York State, in city or country, who make request for it. The leaflet for boys and girls will be sent to schools in communities of 3,000 inhabitants or less. The children's leaflet is sent only on receipt of children's names. A blank form is sent with the September leaflet for this purpose.

In each issue of the leaflet for boys and girls Mr. Tuttle will publish a letter. The pupils will gain much by answering these letters. We hope that teachers will encourage them to write. To all young persons who write three letters on nature subjects during the year, we shall send a picture.

Letter writing can be made a most interesting form of composition. Life can be given to the exercise if these letters are to be sent to a higher institution of learning. If teachers might read the thousands of letters received at the College, they would realize the value of having their pupils become interested in such a correspondence. Following are three selected for publication. We have hundreds of others as good.

Getzville, N. Y.
March 5, 1912

Dear Mr. Tuttle:

Having permission from our teacher I will now write and thank you for the leaflets I received a short time ago. Perhaps you will be glad to hear that our school is being improved very much. We are about to receive our new desk and library. The color of our schoolhouse is red. We have a large school yard. In the summer the grass is mowed and raked up by the trustees. There are thirty-two trees in the school yard, such as ash, pine, and maple. The school children planted flowers last year on Arbor Day which grew very large. We would like to have a garden for the school, but our school closes so early in the summer. But I am going to have a garden of my own at home. My father is going to prepare the ground and I am going to plant the vegetables. I am going to plant cabbage, onions, radishes, and lettuce, and some flowers. I will write later and let you know how my garden is getting along. Our teacher is very neat. I am going to write you three letters and see if I receive a picture.

Very respectfully yours,
Mamie Heim.

Trumansburg, N. Y.
Jan. 11, 1912

Edward M. Tuttle
Cornell University
Ithaca, N. Y.

My dear Mr. Tuttle:

As I have just been reading your letter to the boys and girls of the country, and as you ask us all to write a letter to you, I am taking this opportunity to do so.

I love the country because it pertains so much to nature, and I also love the birds and animals which live upon this earth.

My work at home is to help care for one hundred hens and the other stock.

Then, too, I help my mother in the house. I bake, wash dishes, make beds, and take many steps for her.

I am the most interested in the raising of, and caring for, sheep and horses.

I have a collie dog who is very intelligent. He will drive sheep, play hide-and-go-seek, ride down hill on a sled, carry wood, pails, and many other things. He will go out to the mail wagon and bring the mail when the mail carrier gives it to him.

Although I enjoy my work on the farm, I also love to play. My favorite games in summer are "drop the handkerchief" and "play ball" and in winter I play "fox and geese."

One of the things which I learned when reading this leaflet was the selection of seed corn. I have become greatly interested in the selecting of other grains to exhibit at the fairs. I also enjoy gathering grasses. Having seen some time ago a bulletin on the breeding of timothy by Professor Webber, I enclose a sample of timothy which I gathered last June. I have been wondering if Mr. Webber has succeeded in breeding timothy larger than this. If so, I should like to know about it.

My father is a breeder of pure-bred sheep, and I love to see the young lambs growing up. I have noticed that the improvement of the flock came from breeding by selection.

As my letter is growing long I fear you will not have time to read the other letters which are probably coming into your office. Thanking you for this interesting leaflet, I am,

Your friend,
Stella N. Weatherby.

White Creek, N. Y.
Feb. 6, 1912

Edward M. Tuttle
College of Agriculture
Ithaca, N. Y.

My dear Mr. Tuttle:

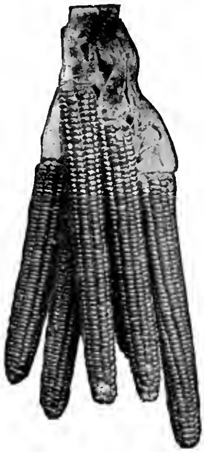
In your letter you asked us to write to you soon, but different things have prevented me from doing so. This afternoon we have devoted to writing a letter to you.

I have received James Vicks' Sons' catalogue and am making out my seed order. I am going to get some white dent corn and many kinds of vegetables for my own garden this year. I have a box of dirt in the cellar already to put in my hotbed this spring. We have a book in our school library which is entitled " Agriculture for Beginners." It is from this book that I learned how to make and take care of a hotbed. I sowed some tomato seeds in a dish in the house. After they were big enough I transplanted them into dried-beef cans. I kept them in a sunny window and watered them well and they grew very fast. I raised all of my other plants in my hotbed. I had about one hundred and fifty tomato plants. Some were the Earliana and some the Stone tomatoes. I had about eight bushels of tomatoes and sold most of them. The rest mother used for pickling and canning. I also had about twenty-five pepper plants, some potatoes, and cucumbers. I sold three bushels of potatoes at a dollar a bushel. I made over five dollars out of my garden last year. I had a large bed of small vegetables, such as radish, lettuce, turnips, and beets. At one side of this bed I had a row of celery and at the other side a bed of strawberries. At first I had only twelve plants given to me and one of them died. The rest grew well and there are several runners on each plant. This spring I will clip the runners and transplant the strawberries in rows where a cultivator can be run through.

I also take a great interest in flowers. Last year my petunias and asters did very well. Every year I try to have a more attractive and well-arranged flower garden. I do not have my flower gardens all over the lawn. You suggested that lawns do not look so well with flower gardens all over them, making it hard to mow. By the time we write our next letters to you we will probably have our hotbeds made and we can tell you all about them

Yours very sincerely,
Frederick L. Masten.

Corn Day.— This year Corn Day will be observed Friday, December 6. The time to begin to prepare for Corn Day is in September. The children should make the selection of corn before it is cut. The teacher could make this experience a most valuable one if he would go out with the boys and girls when they select the corn. Ten ears each of as many varieties as possible should be selected. Place on the blackboard before the children make their selection of corn the following information, prepared by Professor Gilbert:



What constitutes a good ear of corn

1. *Shape of ears.*— A perfect ear of corn should be full and strong in the middle part, indicating a strong constitution. It should retain this size to near the tip and the butt, thus forming as nearly as possible a cylindrical ear.

2. *Butts of ears.*— The rows of kernels should extend well down over the butts of the ears, thus giving an ear of better appearance and containing a higher yield of grain. The shank, or the part of the stalk which is attached to the ear, should not be too large and coarse. Swelled, open, or badly compressed butts, as well as those having kernels of irregular size, are objectionable.

3. *Tips of ears.*— Tips of the ears should be well filled out, indicating a type of corn that will mature easily. The rows of kernels should extend in a regular line to the extreme tip of the ear.

4. *Shape of kernels.*— The shape of the kernels is very important. They should broaden gradually from tip to crown, with edges straight, so that they will touch throughout the full length, and should be wedge-shaped without coming to a point. Kernels of this shape will fit close together and thus insure the highest possible yield of grain that can be grown on the cob. If the kernels have this wedge shape, there will be found no wide spaces between the rows. Such spaces are always objectionable.

5. *Proportion between corn and cob.*— There should be a large proportion of grain as compared with the amount of cob. This will be the case with ears having deep kernels. A large ear does not necessarily indicate a heavy yield of grain, and it is objectionable in that the cob, being large, contains a considerable amount of moisture which, drying out slowly, injures the grain for seed purposes.

6. *Color of grain and cob.*— Good corn should be free from admixture. White corn should have white cobs and yellow corn should have red cobs.

3. THE DISTRICT SUPERINTENDENT

With the new supervision of schools, a great impetus has come to the work in connection with the Rural School Education Department of the State College of Agriculture. While in the past we have had the cooperation of many school commissioners, there has never been such widespread interest as at the present time. The district superintendents are making effort to give the teachers opportunity to become familiar with work relating to country-life interests. They are doing their part in every way to help the teachers in their districts to make use of our publications and any suggestions that we are sending from the College. This is most encouraging and is an essential movement in the interest of a better rural life. The opportunity of the district superintendent for the improvement of rural conditions is limitless. We wish to cooperate with him in every way and will be grateful for suggestions for making our work more suited to the needs of teachers. Whether agriculture and nature-study shall be taught in the public schools of New York State is not for the State College to decide, nor is it our province to say how much time should be given to these subjects. That rests with the State Education Department. Our work is to help place before the rural teachers of New York State accurate subject matter, prepared by persons who are teaching the various subjects in the State College.

There are many ways in which the district superintendents can help to make our work more effective, the most important of which are: (1) *By sending us the names of their teachers as early in the year as possible.* (2) *By urging the teachers to send us the names of the children at the beginning of the year.* (3) *By encouraging the teachers to have the children write letters to the College three or four times during the year.*

With our large correspondence, it is absolutely necessary that we file the names of teachers and pupils who desire the publications. It is quite important that the materials should be mailed to the teachers the first of the year. It is the right of every boy and girl in New York State to know that he is entitled to copies of the Cornell Rural School Leaflet which are prepared for him. The district superintendents can help us to keep our mailing-lists *complete and accurate.* They can help the boys and girls in their districts by encouraging them to take an interest in the out-of-doors and in farm practices.

It would be well for the district superintendents to speak to their teachers about the importance of sending addresses when they make request for the leaflets. Many letters have reached us in which no address was given.

The following report will doubtless be interesting since it shows the distribution of the Cornell Rural School Leaflet for the year 1911–1912:

Copies of the leaflets sent out:

To cities	10,311
To villages	1,303
To training classes	5,460
To teachers in rural schools	30,206
To rural children	228,640
Total	275,920

Range of distribution:

1. In all but one rural county in the State every rural teacher was supplied with the exception of a few whom we were not able to reach. Over 75 per cent of the teachers in the remaining county were supplied. There were probably not over 300 of the 16,363 (1911 Report) teachers in the rural districts of the State unsupplied.

2. All but six of the forty-nine cities and all but one of the forty-one villages of the State received leaflets.

3. All training schools and all but nine of the eighty-nine training classes were supplied.

4. In country districts 94,853 children received at least one leaflet; most of them received all three.

During 1911–1912 many of the district superintendents have held teachers' conferences in connection with farmers' institutes. The conferences have proved particularly valuable at that time, since the services of both agricultural instructors and representatives of the State Education Department were available. Teachers can contribute to the success of such meetings and get much from them by presenting questions and by offering experiences that might prove helpful to others. The district superintendents should encourage teachers to come to such meetings prepared to do their part to make the meetings useful. Any part of the State Syllabus or lessons in the Rural School Leaflet not understood should be brought up for discussion. The teachers can get the best help by presenting specific problems to the instructors.

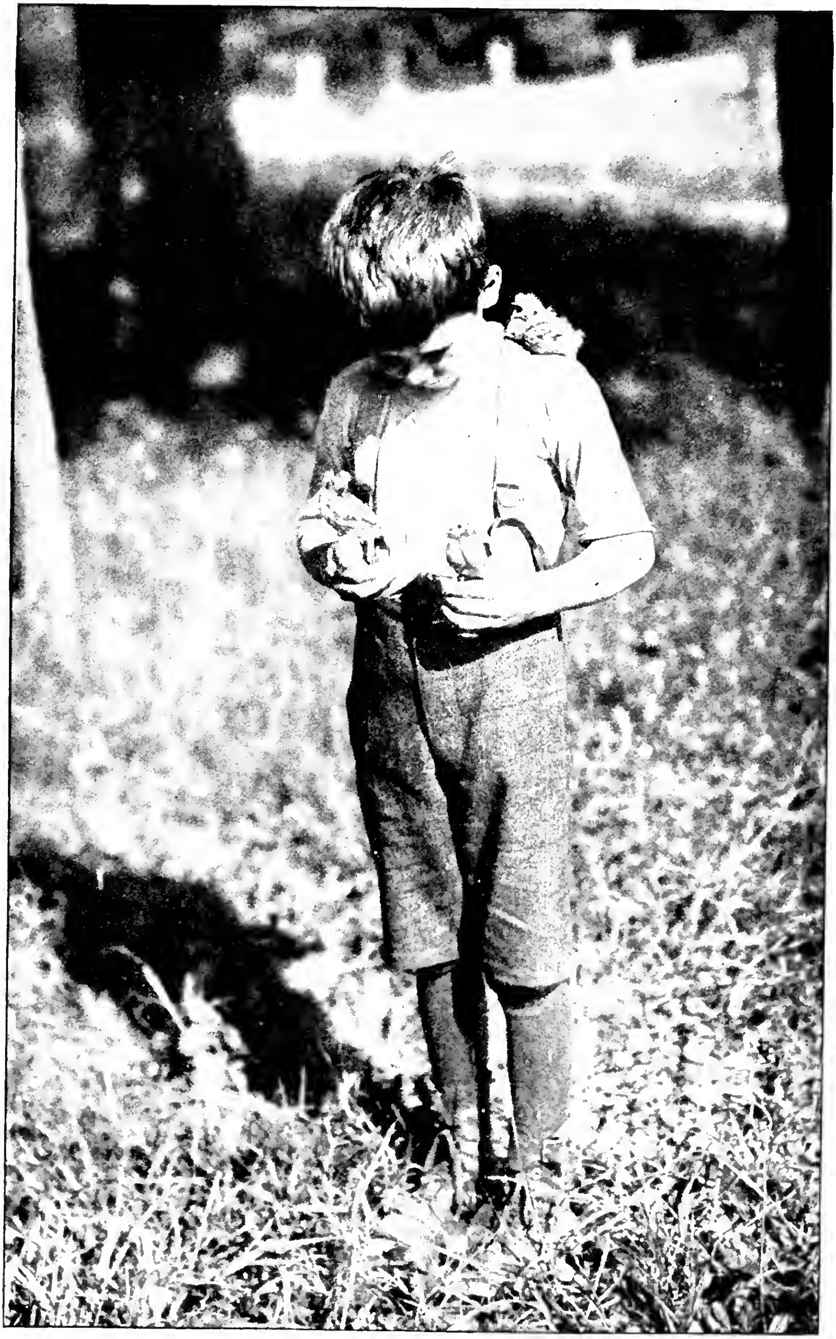
4. THE GRANGER

FROM past experience in our work connected with the public schools of New York State, we find that the opportunity to help country-life education through the State College has been greatly increased by the earnest effort of men and women on the farms. They have encouraged us in our endeavor to reach the boys and girls; they have encouraged the teacher to consider the educational advantage to be gained by instruction that has direct relation to country living; they have discussed rural education at meetings of the grange and, in fact, have kept in touch with the progress of the times in the interest of agricultural education.

We are now ready to ask very concrete help from New York State grangers. Their organization is conducted in a way that makes it possible to be of great social service. There is no more important question before the world to-day than the public school. To all grangers and to the staff of the State College of Agriculture the rural school is of special interest. We must look to education to bring about a more nearly ideal country life.

It is most significant that the educational world to-day is looking to agriculture as a means to the fundamental preparation for life to which all boys and girls have a right. As we have before stated in this leaflet, agriculture provides wholesome, concrete labor which, if combined with the intellectual processes necessary for its success, will make it stand for an all-round development. A child trained through farm practices and experiences the while he gains intelligent sympathy with nature, is receiving valuable education. All children should have such education, but only the children in the country can have the advantage of the practical outdoor experience.

The staff of the State College of Agriculture is deeply interested in the boys and girls in the country districts. Eventually we should like to be in touch with all of them. We are making effort to strengthen every medium by which we may reach the children, so that any message of value to them may be sent promptly. We must not lose the opportunity for a close connection with the grange. We shall ask, therefore, all men and women in New York State who are members of the grange and who are interested in agricultural education to send their names and addresses for our special grange file in the Department of Rural School Education. This will enable us to send communications to them and to keep them in touch with what we are doing in connection with the schools.



The right spirit

BIRD STUDY

THE EDITOR

"A thousand voices whisper it is spring;
Shy flowers start up to greet me on the way,
And homing birds preen their swift wings and sing
The praises of the friendly, lengthening day.

* * * *

"Let me rejoice, now skies are blue and bright,
And the round world pays tribute to the spring;
The birds and I will carol our delight,
And every breeze Love's messages shall bring."

LOUISE CHANDLER MOULTON

The most important factor in bird study is that the teacher should be interested. It then takes but little effort on his part to start the children on a quest for bird knowledge that will be full of joy and growth as long as they live. The subject is one well suited to real live study. The result of spirited work will mean compensation in many ways.

It will not matter whether the quest is started in connection with regular school work or by means of a bird club. In many rural districts the children make their observations of birds on the way to school and report on these observations as a part of the morning exercises. A good reference book is valuable for such an exercise. Chapman's "Bird Life" and Neltje Blanchan's "Bird Neighbors" are used a great deal by teachers in the State. Interest is increased by keeping a bird calendar; by watching the spring migration and reporting on it; by learning pieces of literature relating to birds; by feeding the birds in winter; by building bird houses.

Jim Crow

It will be well for teachers to notice the illustrations on pages 22–25. Spirit is manifested in each one and each tells the story of wise instruction. The children are members of a bird club organized by Mr. Hugh Findlay of the Morrisville School of Agriculture. The boys and girls are not only receiving the valuable training that comes through natural history study, but they are deepening their nature sympathy and laying the foundation for recreation that will become a great resource in future years. Mr. Findlay has the kind of enthusiasm that inspires and that keeps on inspiring until definite results are obtained. *The children do the work.*

Two young proprietors

There are many ways of keeping up the interest in bird study during the winter. Have the children hang suet or beef fat on the branches of the trees, and scatter seeds on the ground. Gradually bring the feeding stations nearer to the house. The chickadees, nuthatches, woodpeckers, and blue jays will visit the suet. The seeds will be appreciated by the tree sparrows, juncos, fox sparrows, and quail.

A shelf placed outside the window has been found very useful in providing a feeding place for birds. It is said that winter birds frequently suffer from thirst. Whenever possible, water should be placed where they can reach it.

Encourage each child to build his own bird house. Teach the importance of having the doorway the right size. It should be just large enough to admit the bird. For the wren and the chickadee the opening should be an inch auger hole, and for the others it should be about one and a half inches. A perch or doorstep should be provided below each door. "It is here," says Director Bailey in "The Birds and I," "that the birds often stop to arrange their toilets; and when the mistress is busy with domestic affairs indoors, the male bird often sits outside and entertains her with the latest neighborhood gossip."

The spring migration is always interesting. Have the children ready to watch it intelligently. Tell them to listen in early spring for the strange sound of "the wild geese honking from out the misty night." The following list of migrating birds is taken from Chapman's "Handbook of the Birds of Eastern North America" and was compiled for use in the vicinity of New York City. The latter dates in the column are about what may be taken for the middle tier of counties. Encourage the children to watch and report.

LIST OF BIRDS COMPRISING THE SPRING MIGRATION

(Until April 20 — Approximate)

Date of arrival	
Feb. 15–Mar. 10	Purple grackle
	Rusty grackle
	Red-winged blackbird
	Robin
	Bluebird
Mar. 10–20	Woodcock
	Phœbe
	Meadow lark
	Cowbird
	Fox sparrow
Mar. 20–31	Wilson's snipe
	Kingfisher
	Mourning dove
	Swamp sparrow
	Field sparrow
Apr. 1–10	Great blue heron
	Purple finch
	Vesper sparrow
	Savanna sparrow
	Chipping sparrow
	Tree swallow
	Myrtle warbler
	American pipit

Date of arrival	
Apr. 1–10	Hermit thrush
Apr. 10–20	Yellow-bellied woodpecker
	Barn swallow
	Yellow palm warbler
	Pine warbler
	Louisiana water thrush
	Ruby-crowned kinglet
Apr. 20–30	Green heron
	Spotted sandpiper
	Whippoorwill
	Chimney swift
	Least flycatcher
	* * * * * *
	Black-and-white warbler
	* * * * * *
	Ovenbird
	House wren
	Brown thrasher
	Catbird
	Wood thrush

Ready for tenants

THE WHITE-BREASTED NUTHATCH*

ANNA BOTSFORD COMSTOCK

"*The busy nuthatch climbs his tree,*
Around the great bole spirally,
Peeping into wrinkles gray,
Under ruffled lichens gay,
Lazily piping one sharp note
From his silver mailéd throat."

MAURICE THOMPSON

"*With more artless inquisitiveness than fear, this lively little acrobat stops his hammering or hatching at your approach, and stretching himself out from the tree until it would seem he must fall off, he peers down at you, head downward, straight into your upturned opera-glass. If there is too much snow on the upper side of a branch watch how he runs along underneath it like a fly, busily tapping the bark, or adroitly breaking the decayed bits with his bill, as he stretches for the spider's eggs, larvæ, etc., hidden there; yet somehow, between mouthfuls, managing to call out his cheery 'quank! quank! hank! hank!'*"

NELTJE BLANCHAN

A voice outside is calling at me; I cannot describe it accurately, but it is making delightful woodsy remarks that make me long to throw aside the pen and go out and wander where the snow is making still softer the carpet of dead leaves on the forest floor. It is not a musical note but it is most enticing and translates into sound the picture of bare-branched trees and the feeling of enchantment that permeates the forest in winter. Neltje Blanchan says the voice reiterates, "hank, hank," others say it is "nay, nay"—but no nasal sound of the human voice and no spelling of the English language adequately represents this call of the white-breasted nuthatch.

On the tree in front of the window I can see the owner of this sylvan voice. It is a little bird blue-gray above, with black head, black and white V-trimmings on the back of its suit, and soft, white breast. It is flitting blithely from tree to tree enjoying the snowstorm and coming often to the suet feast that I have spread for him and his little feathered kin.

We have had exciting times at the suet banquet this morning. The building in which my office is, stands on a high knoll near the forest-covered brink of a deep gorge. Thus my window is opposite the tops of the trees. One of our nature-study staff, a brave and gallant knight, who loves birds and knows that I love to watch them, climbed two of these trees at imminent risk of breaking his neck in order to place this suet just opposite my window. The whole chickadee family, four nuthatches, and Sir Downy Woodpecker and Madam Hairy Woodpecker had been reveling in the feast all the morning when suddenly, one after another, three crows appeared on the scene. My heart sank as I saw them eying the suet with interest. Nearer and nearer they hopped from

*See frontispiece.

branch to branch. I pounded on the window and called out "Go away!" in both the crow and the English language, all in vain. One braver or hungrier than the others, with one defiant eye on me, flapped confidently down and sought to carry the suet off in his beak; to his surprise it was tied on. That seemed suspicious and when we raised the window and leaning far out explained matters, he lifted slowly with a jeering "caw" that said plainly, "I'll call sometime when you are not at home," and he and his companions disappeared up the gorge. The invited guests at the suet table were less disturbed than was I, and I suppose it is rather inconsistent to feed the chickadees and let the crows go hungry. But this suet will last the little birds a month, while it would hardly furnish a breakfast for three crows; and in philanthropic enterprises one is obliged to draw the line somewhere even at the cost of consistency.

Chickadee entering its nest

To return to my nuthatch—who has, by the way, just hammered off a piece of suet and thrust it into a crevice of the bark on the tree bole. Why does he do that? Is it for convenience in eating, or is it an attempt to store up some of his dinner for future need? Anyway, it is bad manners, like carrying off fruit from *table d'hôte*. But he is polite enough in another respect: every time after eating the suet he wipes his beak on his branch napkin with great assiduity, first one side and then the other, almost as if he were sharpening it. The woodpeckers are similarly fastidious in cleaning suet off their beaks.

The loud note of the nuthatch, which seems out of proportion to the size of the bird, is by no means its only note. Yesterday we observed a pair hunting on the branches of an elm over our heads, and they were talking to each other in sweet confidential syllables, "wit, wit, wit," entirely different from the loud note that is meant for the world at large.

The nuthatches and chickadees hunt together all winter. This is no business partnership, but one of congeniality based on similar tastes.

Thus it is that the two birds are often confused. The black throat of the chickadee, however, distinguishes it from the nuthatch at the first glance. Strange to say, the nuthatch has been confused also with the sapsucker and has gained unjust censure thereby. How any one with eyes could confuse these two birds is a mystery, for they resemble each other in no particular nor in general appearance.

Although the nuthatch finds much of its food on trees, Mr. Torrey tells of seeing one awkwardly turning over the fallen leaves for hidden cocoons and other things quite worth his while; and Mr. Baskett tells of having seen these birds catch flies in the air and become quite out of breath at this unusual exercise.

Audubon made some most interesting observations on nuthatches. He says they may sleep hanging with head downward. He also says, of their nesting habits, that " both birds work together, all the time congratulating each other in the tenderest manner. The male, ever conspicuous on such occasions, works some, and carries off the slender chips chiseled by the female. He struts around her, peeps into the hole, cherups at intervals, or hovers about her on the wing. While she is sitting on her eggs, he seldom absents himself many moments; now with a full bill he feeds her, now returns to be assured that her time is pleasantly spent."

The red-breasted nuthatch is sometimes associated with its white-breasted cousin; it is a smaller bird and is essentially a northern species. The nuthatches get their name from their custom of wedging nuts and acorns into bark and then hammering or hatching them open with their strong bill. From every standpoint the nuthatches are most desirable acquaintances, and we cannot spend our time to better advantage than in becoming familiar with their interesting habits.

SUGGESTIONS FOR STUDY

Observations on the appearance of the nuthatch.— 1. What is the general color of the nuthatch above and below?

2. The colors of the top and sides of the head?

3. The color of the throat and breast?

4. Colors of bill, legs, and feet?

5. Color and markings of the wings?

6. Colors and markings of the tail?

7. What are the differences in color between the nuthatch and the chickadee?

8. What is the difference in shape between the bill of the nuthatch and that of the chickadee?

Facts for teachers.— The general color of this bird is bluish gray above, with white breast, and reddish beneath the tail. The top of the head and the neck are glossy black; the sides of the head are white, as is the breast. The bill is blackish and so are the legs and feet. The wing feathers are dark brown edged with pale gray. The upper middle tail feathers are bluish, like the back; the others are dark brown and spotted with white in such a manner that when the tail is spread it has a large white patch on either side. The chickadee is gray in color, while the nuthatch is bluish gray; but the most striking difference is the black bib of the chickadee, which the nuthatch lacks entirely. The bill of the chickadee is short —" a sharply pointed little pick just suited to taking off insect eggs "— while the bill of the nuthatch is long and slender, being as long as, or longer than, the bird's head.

Observations on the habits of the nuthatch.— 1. Is the nuthatch seen most commonly on tree trunks or up in the smaller branches?

2. Does it alight on a tree trunk with head up or down?

3. When climbing a tree does it ascend in a spiral route?

4. When descending a tree does it go head downward? How does it compare in this respect with the downy woodpecker?

5. Does it use its tail as a brace when climbing a tree, as does the downy?

6. How are the nuthatch's toes arranged to enable it to cling to the trunk?

7. What is the note of the nuthatch, and has it more than one note?

8. What is its food and where is it found?

9. How does the nuthatch open an acorn?

10. Of what use is the nuthatch to the farmer and the fruit grower?

Facts for teachers.— The nuthatches and chickadees usually hunt together, the chickadees ordinarily taking the smaller branches and the nuthatches the larger branches and tree trunks. The nuthatch is quite likely to alight head downward on a tree trunk, and it also often climbs the tree in a spiral route; it runs about over the tree so rapidly that it has been called the " tree mouse." Three characteristics distinguish this bird from the woodpeckers: it descends a tree trunk head first; its tail is short and square across the end and is never used as a brace; it has three toes directed forward, and one very long and strong one directed backward.

The common note of the nuthatch may be spelled " ank, ank " or " yak, yak," but these birds have for each other some quite different, and very sweet, little confidential notes. While the nuthatch is fond of acorns and nuts and also the larvæ which are the " worms " in nuts, it is also fond of all kinds of insects and spends much time hunting for those that are hidden in the bark of trees. It is therefore a help to the farmer and the fruit grower by destroying so many injurious insects. It is comical to see a nuthatch take off a bit of suet, wedge it into a crevice in the bark, and then strike it with great force with its beak, apparently forgetting that it is not encased in a shell.

THE ECONOMIC IMPORTANCE OF THE WHITE-BREASTED NUTHATCH

H. D. REED

The white-breasted nuthatch is one of our most industrious gleaners of insects and their eggs and young from the trunks and branches of trees. An individual nuthatch hustling about his work, as frequently upside down as the reverse, is the very embodiment of industry and keen scrutiny. No crack nor cranny is too insignificant to escape inspection. The nuthatch does not dig holes in the trees in search of its food as do the woodpeckers, but rather gets it from the crevices in the rough bark. In such places millions of insects deposit their eggs for safe keeping during the winter months. The bill of the nuthatch is adapted through its shape to slip under the pieces of bark and to the very depths where eggs and, later, larvæ ("worms") are to be found. It is impossible to estimate the millions of injurious insects destroyed by a single nuthatch during a year.

Among the injurious insects devoured by the nuthatch are: beetles, which bore in the bark or wood; scale insects, among which is the oyster-shell bark louse, injurious to apples and pears; cankerworms; and the caterpillars of the gypsy moth. A single stomach of the nuthatch in one instance proved to contain one thousand six hundred and twenty-nine eggs of the fall cankerworm. Granting that half of these eggs would produce females, which in turn would lay a large number of eggs, some idea can be gained of one day's service of this bird to man. There are other insects which would probably become pests were it not that they are held in check by the nuthatch.

During the winter months the nuthatch feeds to a large extent on the seeds of weeds, thus adding to its right to life and protection. There is no doubt that this bird is to be considered the friend and colaborer of the forester, the fruit grower, and the farmer, and in return for its very efficient service it deserves encouragement and protection.

"You call them thieves and pillagers; but know,
They are the winged wardens of your farms,
Who from the cornfields drive the insidious foe,
And from your harvests keep a hundred harms;
Even the blackest of them all, the crow,
Renders good service as your man-at-arms,
Crushing the beetle in his coat-of-mail,
And crying havoc on the slug and snail."

HENRY WADSWORTH LONGFELLOW

BIRDS TO BE RECOGNIZED IN 1912-1913 *

The Editor

Orchard oriole

Orchard oriole.— Size: Smaller than a robin.

General color: The whole head, neck, and tail are black; a broad black band extending from the neck down the back. The rump, sides, breast, and under parts are rich chestnut.

Baltimore oriole.— Size: Larger than an English sparrow; smaller than a robin.

General color: Orange and black.

> "*How falls it, oriole, thou hast come to fly*
> *In tropic splendor through our Northern sky?*
> *At some glad moment was it nature's choice*
> *To dower a scrap of sunset with a voice?*"
>
> EDGAR FAWCETT

* The descriptions of the birds were furnished by Dr. H. D. Reed.

Baltimore oriole

"My oriole, my glance of summer fire,
Is come at last, and ever on the watch,
Twitches the pack-thread I had lightly wound
About the bough to help his housekeeping,—
Twitches and scouts by turns, blessing his luck,
Yet fearing me who laid it in his way,
Nor, more than wiser we in our affairs,
Divines the providence that hides and helps.
Heave, ho! heave, ho! he whistles as the twine
Slackens its hold; once more, now: and a flash
Lightens across the sunlight to the elm
Where his mate dangles at her cup of felt."

JAMES RUSSELL LOWELL

Peacock.— Size: Larger than the domestic hen, the tail much longer than the rest of the body.

General color: Prevailing colors iridescent blues and greens. Broad ends of tail feathers with conspicuous spots margined with gold.

Black-and-white warbler.— Size: Smaller than a sparrow.

General color: Streaked all over with black and white except on the under parts. A decided white streak on the top of the head.

Neltje Blanchan says: "Nine times out of ten this active little warbler is mistaken for the downy woodpecker, not because of his coloring alone, but also on account of his common habit of running up and down the trunks of trees and on the under side of branches, looking for insects, on which all the warblers subsist. But presently the true warbler characteristic of restless flitting about shows itself. A woodpecker would go over a tree with painstaking, systematic care, while the black-and-white warbler, no less intent upon securing its food, hurries off from tree to tree, wherever the most promising *menu* is offered."

"His fine strain reminds me of hair-wire. It is unquestionably the finest bird-song to be heard. Few insect strains will compare with it in this respect, while it has none of the harsh, brassy character of the latter, being very delicate and tender."

JOHN BURROUGHS

Black-and-white warbler

Goldfinch.— Size: Smaller than a sparrow.

General color: Top of head, wings, and tail black; remainder of body bright yellow.

The goldfinch

"Just listen to him some day as he flies away from his nest, singing over to himself in tones of exquisite love and tenderness his sweet bay-bee, bay-ee-bee."

FLORENCE A. MERRIAM

"It is a wee, sad-colored thing,
As shy and secret as a maid,
That, ere in choir the robins sing,
Pipes its own name like one afraid."

JAMES RUSSELL LOWELL

The phœbe

Phœbe.— Size: About that of a sparrow.

General color: The general tone of the body is brown, grayish beneath, the head being much darker.

Distinctive features: It possesses no striking color characteristics. There are no white bars across the wings, which distinguishes it from the pewee. It may always be identified in the field by its habit of wagging the tail when perched.

> "*When buckets shine 'gainst maple trees*
> *And drop by drop the sap doth flow,*
> *When days are warm, but nights do freeze,*
> *And deep in woods lie drifts of snow,*
> *When cattle low and fret in stall,*
> *The morning brings the phœbe's call,*
> *'Phœbe,*
> *Phœbe, phœbe,' a cheery note*
> *While cackling hens make such a rout.*"
>
> JOHN BURROUGHS

Cliff swallow.— Size: About the same as a sparrow.

General color: A white band across the forehead and a rich chestnut patch on the throat. The under parts are whitish. *The tail is not deeply forked like that of the barn swallow.*

> "*Gallant and gay in their doublets gray,*
> *All at a flash like the darting of flame,*
> *Chattering Arabic, African, Indian —*
> *Certain of springtime, the swallows came!*"
>
> EDWIN ARNOLD

The cliff swallow

The brown thrasher

> *" The wise thrush, he sings each song twice over,*
> *Lest you fear he never could recapture*
> *That first fine careless rapture."*
>
> ROBERT BROWNING

Brown thrasher.— Size: About the size of a robin, but with longer tail.

General color: The upper parts, wings, and tail reddish brown. Wing coverts tipped with whitish; under parts white, streaked with black except on throat and middle of belly.

Distinctive features: The brown thrasher flirts his tail much as the catbird does. One can distinguish him from the thrushes similar in color by the two white wing bars and long tail.

> *" The brown thrasher calls half furtively, half archly, from the tree-top back in the bushy pastures: 'Croquet, croquet, hit it, hit it, come to me, come to me, tight it, tight it, you're out, you're out.' "*
>
> JOHN BURROUGHS

> *" Our long-tailed thrush, or thrasher, delights in a high branch of some solitary tree, whence it will pour out its rich and intricate warble for an hour together. This bird is the great American chipper. There is no other bird that I know of that can chip with such emphasis and military precision as this yellow-eyed songster. It is like the click of a giant gunlock."*
>
> JOHN BURROUGHS

Grackle.— Size: Larger than a robin.

General color: Black all over.

Distinctive features: The grackle walks like a crow. The absence of red shoulder patches distinguishes it at once from the red-winged blackbird. At close range it may be distinguished from the rusty blackbird by its larger size, wedge-shaped tail, and yellowish eyes, the eyes of the rusty blackbird being white.

Chapman in " Bird Life " gives some interesting facts about grackles, as follows:

" Grackles are among the few of our land birds who live in flocks all the year. They pass the winter and migrate in larger companies, but when nesting are in smaller bands or colonies. They generally select a pine grove, often choosing one in a cemetery, park, or other locality where they will not be disturbed. This may result in a scarcity of food when the young are born, but, rather than abandon a locality which experience has proved to be safe, they make long journeys in search of food for their nestlings. By watching the old birds one may then easily learn where they live."

The bronzed grackle, or crow blackbird

"Sweet, sweet, sweet! O happy that I am!
(Listen to the meadow-larks, across the fields that sing!)
Sweet, sweet, sweet! O subtle breath of balm,
O winds that blow, O buds that grow, O rapture of the spring!
* * * * * *

"Sweet, sweet sweet! Who prates of care and pain?
Who says that life is sorrowful? O life so glad, so fleet!
Ah! he who lives the noblest life finds life the noblest gain,
The tears of pain a tender rain to make its waters sweet."

INA COOLBRITH

The meadow lark

Meadow lark.—Size: Larger than the robin, but with shorter tail.

General color: Bright yellow breast with a black crescent. The back is streaked; the outer tail feathers, which show when spread, are white.

"What a twang there is about this bird and what vigor! It smacks of the soil. It is the winged embodiment of the spirit of our spring meadows. What emphasis in its 'z-d-t, z-d-t,' and what character in its long piercing note! Its straight, tapering, sharp bill is typical of its voice. . . . 'Spring o' the year! spring o' the year!' it says, with a long-drawn breath, a little plaintive, but not complaining or melancholy."

JOHN BURROUGHS

"Oh meadow lark!
From dawn to dark
Your carol quaint is ringing,
And ne'er did float from thrush's throat
Song sweeter than your simple note,
Of sunny summer singing."

SELECTED

"Up from the marsh a chorus shrill
Of piping frogs swells in the night;
The meadow lark shows flashing quill
As o'er brown fields she takes her flight."

JOHN BURROUGHS

Bald eagle.— Size: Four times as large as a hen.

General color: Head, neck, and tail white. Remainder of body dark brown.

The bald eagle

" He clasps the crag with hooked hands;
Close to the sun in lonely lands,
Ring'd with the azure world, he stands.

" The wrinkled sea beneath him crawls;
He watches from his mountain walls,
And like a thunderbolt he falls."

ALFRED TENNYSON

THE HEN

ANNA BOTSFORD COMSTOCK

KNOWLEDGE of our domestic fowl leads us to believe it is descended from the jungle fowl of Asia, which, although a ground bird, has a powerful flight. Ages of disuse of its wings, however, have robbed our barnyard fowl, to a great extent, of the ability to fly; moreover, the hen has been bred for food until she has attained too great weight to be carried by her wings.

It is the hen's nature to scratch for a living. For this purpose her legs are strong and protected by horny scales, and her flexible toes are armed with horny claws. Her beak is also strong and horny, so that she is able to extract from the earth the insect or seed there hidden. She does not need teeth, since she swallows her food whole and it is ground fine in her gizzard. The hen also uses her beak as a weapon of offense and defense.

The hen can run rapidly. The track she makes shows four toes, one projecting backward and three forward. The long hind toe enables her to retain her hold on the perch when she sleeps; the bending of her legs as she settles down on the perch flexes her toes inward and downward, and thus they grasp the perch mechanically while she rests.

The hen's nostrils are two small holes near the base of the beak. She probably has not a keen sense of smell. Her hearing, however, like that of all birds, is very acute. The ears in some varieties of fowl are mere openings in the head, more or less covered with feathers, though some breeds have ear lobes which seem to be more ornamental than useful. The hen can see well. She is able to make her eyes far-sighted or near-sighted at will, to serve her when scratching for seeds at her feet or when watching for hawks in the sky. Her eyes are at the sides of the head, and she has a habit of reinforcing the judgment of one eye by bringing the other to bear on any object in view. The iris is usually yellow, the pupil black and round. When she winks, it is the lower lid that covers the eye; and when she is dozing a thin film-lid slips over the eye from its inner corner.

Birds are the only creatures clothed in feathers, a covering superior to hair and fur, since it gives them the power of flight. The feathers on different parts of the fowl differ much in size and form. The feathers on the back form a roof; they are closely webbed, overlap like shingles, and have pointed tips. The plumage on the breast is softer, and each breast feather is closely webbed at its tip and fluffy at its base. The fluff, being next to the skin, helps to retain the heat of the body. This fluff, commonly called down, is the only covering of little chicks. The fluff has no quill. When new feathers come, either on the chick or on the hen, they are called pinfeathers, because they are enclosed in a pointed sheath. To make her coat waterproof, the hen possesses on her back, near the tail, an oil gland from which she squeezes the oil with her beak and applies it to her feathers.

The feathers of the wing are wonderfully adapted to their service. The strong shaft of each is slightly curved and has a tightly knit web, which enables it to press down on the air. When a bird starts to fly it beats its wings very rapidly; thus the curving under-surfaces catch the air like an umbrella and lift the bird upward. While the lifted wings are carrying the bird, the tail acts as a rudder, by which the bird may steer itself in any direction. For this purpose the tail feathers have a different shape and texture from those on the wings. They are straight-shafted, with the webs equal on both sides.

The feathers on the barnyard fowl are not only a protection from the rain and cold and of use as organs of flight, but they also make the bird beautiful. The rooster's long curling plumes and handsome collar feathers add much to his beauty, and secure for him the admiration of his flock.

In the early spring the hen begins to lay eggs regularly, one each day, announcing the fact with triumphant cackling. She will make her own nest on the ground if we do not provide her with one in the poultry house. When sitting, she seldom allows her eggs to become cold; she turns them daily by pushing them with her breast and her beak; she leaves the nest for food and drink, usually twice a day. The incubation lasts about twenty-one days.

The chick has on the upper tip of its beak a small, horny tooth with which it breaks through its shell. Soon after birth this tooth disappears. The chick is covered with down when it leaves the egg, and is active, bright-eyed, and alert, ready to follow its mother anywhere in search of food. It is very different in appearance and actions from the young robin, which is blind and naked and is nourished by the food brought by its parents. When the chick is young it sleeps under its mother's wing, but as it grows up it roosts on trees or perches and tucks its head beneath its wings.

The conversation of the barnyard fowls is rather extended. The hen clucks to her chicks and they answer by peeping. When she sees a hawk or any other peril she warns her brood by a peculiar note, which causes every chick to run to cover and remain motionless. When a chick is lost its peep is loud and pitiful; when it cuddles under its mother's wing its note is full of contentment. The hen's spring song is one of the most joyous sounds of nature. Her triumphant cackle over the newly laid egg is quite different from her cackle that results from surprise; when she is very much afraid she squalls; and when grasped by the enemy she utters loud squawks. The rooster crows to assure his flock that all is well and to challenge other roosters. When hens take their dust baths together they seem to gossip with each other. These dust baths are very essential to the good health of fowls kept in close yards. They help to relieve the fowls of vermin and to cleanse their skin, for hens are not water bathers, as are the song birds.

A drinking place

When roosters fight they confront each other with lowered heads, and use their beaks, wings, and leg-spurs as weapons.

THE HEN

Observations by pupils.—

1. Can a hen fly like a robin or swallow? If not, why? Where does the hen find her food? Where does the swallow find its food? Does the hen need to fly like the swallow?

2. What tools has the hen for getting her food?

3. Why are her toes so long and strong? Why have they horny claws at their tips? What covering protects the feet and legs? How are the feet and legs fitted for scratching the soil?

4. After the hen has found the insect or seed by scratching in the earth, with what does she seize it? How is the beak fitted by size, shape, and covering, to secure the food?

5. Has the hen any teeth? How is the food ground fine for digestion? Does she need any teeth? Why is it necessary to feed grit, or small gravel stones, to fowls kept in close yards? Does the hen use her beak for anything else than picking up food?

6. Can a hen run rapidly? Note how the hen uses her wings in running. What sort of track does she make in mud or snow? Make a sketch of the track of a hen. How many toes show in the track? Num-

bering her toes with the hindmost projecting toe as first, how many toes has she?

7. Where does the hen sleep? How does she keep her hold on the perch while sleeping?

8. Can you see the hen's nostrils? Are they large? Describe the surface surrounding them. Do you think that the hen has a keen sense of smell? Why?

9. Has a hen ears? Where are they and how do they look? Have they lobes, and, if so, do you think these lobes are ornamental or an aid to hearing?

10. What is the color of the hen's eyes? What is the shape of the pupil? How does the hen wink? Can you see a little film-lid come out of the corner of the eye and cover it when she is drowsy? Do you think the hen can see far and well? How far off can she see a hawk? Can she see an object with both eyes at once? Why does the hen turn her head first this way and then that, when looking at you? What advantage is it to the hen to have her eyes directed sidewise instead of both focusing in the same direction?

11. How does the covering of birds differ from the covering of animals? Study a feather and learn the shaft or quill, the web, the fluff, the barbs, and the barbules. If you have a microscope, or even a good double lens, examine a wing feather and see the little hooks on the barbules which hold the web together.

12. How are the feathers arranged on the back of a hen? Why? How does the hen look when standing in the rain?

13. How are the feathers arranged on the breast? Compare a feather from the back with a breast feather and note the difference.

14. Are both ends of a breast feather alike, and, if not, what is the difference? Is the fluffy part on the outside or next to the bird's skin? Why? Why is the smooth part of the feather on the outside?

15. When feathers are all fluff what are they called? At what age is a fowl entirely covered with down?

16. What is a pinfeather?

17. How do hens keep their feathers oily so that they will shed water? Where does the hen get the oil? Describe how she oils her feathers and which ones she oils most. Is she likely to oil her feathers just before a rain?

18. When you have an opportunity, look at a fowl all plucked ready for market or oven, and see how the wings of a bird correspond with the front legs of an animal or the arms of a human being.

19. Examine the wing of a hen with the feathers on. How are the feathers arranged to press down on the air? How does a bird lift itself

in the air when it starts to fly? What does the wing press against? Can you press against air? If you carry an umbrella on a windy day, which catches more wind, the upper or the under side? Why? How does the wing of a bird correspond to the umbrella?

20. Examine a wing feather. Are the barbs equally long on each side of the quill? Is the wing feather curved? Is the concave or the convex side uppermost on the wing? Why? Which way does the feather bend most easily?

21. If the bird flies by pressing its wings against the air on the down stroke, why does it not push itself down on the up stroke?

22. Look at a tail feather and see how it differs from a wing feather. Does a hen, when she is flying, keep her tail closed, or open like a fan? Have you ever seen a young robin, with tail not yet grown, try to fly? How did it act? Do you think a bird could sail through the air if it had nothing to steer with? What is the bird's tail used for?

23. Are the feathers of the hen beautiful in color? Which is the more handsome, the hen or the rooster? Note the difference in shape and color of the tail feathers of hen and rooster. Do the graceful, curving plumes in the tail of the rooster help him any in flight? Are they stiff enough to act as a rudder? If they are of no use in flight, nor in keeping him warm, nor in keeping off the rain, then what are these beautiful plumes for? Is the rooster's plumage aside from the tail ornaments more beautiful than the hen's?

24. Name all the ways in which feathers are useful to the hen.

25. Observe the combs and wattles of the rooster and the hen. In which are they the more showy?

THE HABITS OF THE HEN

Observations by pupils.— 1. At what time of year does the hen naturally lay the most eggs? How many does she lay in one day? When would she naturally stop laying? How does she announce to the world that she has laid an egg?

2. How does a hen make her nest if we do not make it for her? How many eggs can she sit on at once? How does she care for her eggs when she is sitting? How often does she come off her nest while sitting? How long does it take her eggs to hatch?

3. How does the chick get out of the eggshell? For what purpose is the little tooth on the tip of the young chick's beak? What becomes of this tooth?

4. What is the difference between the covering of a chick and of a hen? The chick has wings — can it fly? Why not?

5. How does the newly-hatched chick differ in appearance from the young robin? Which is the stronger and more active? Where and how does the young chick get its food? Where and how does the young robin get its food? Where does the chick sleep at night?

6. What noise does the chick make when following the mother hen? When lost? When frightened? When cuddling under the mother's wing?

7. What noises does the hen make when with her brood? When she finds food for them? When she sees a hawk? How do the chickens obey their mother's call?

8. How does a hen drink? Why? Does a pigeon drink in this way? Do other birds?

9. Note how a hen expresses suspicion, fright, terror, and happiness.

10. How do hens fight? How and with what weapons do roosters fight?

11. What is the chief note of the rooster? When does he crow and why? Note other sounds made by a rooster.

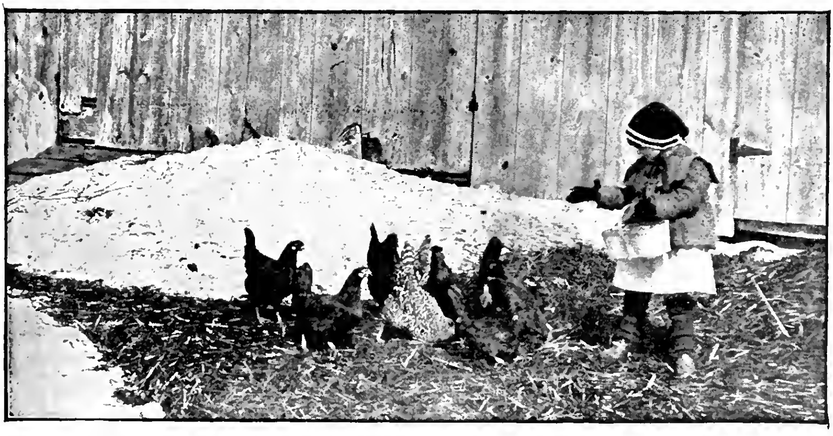
12. Describe how a hen dusts and suns herself. Why does she do this?

The Hen.—"It is good to see Minott's hens pecking and scratching the ground. What never-failing health they suggest! Even the sick hen is so naturally sick — like a green leaf turning to brown. No wonder men love to have hens about them and hear their creaking note. They are even laying eggs from time to time still — the undespairing race."

THOREAU, JOURNAL

"Even the hen has a homely contented carol; and I credit the owl with a desire to fill the night with music. All birds are incipient or would-be songsters in the spring. I find corroborative evidence of this even in the crowing of the cock."

JOHN BURROUGHS



Feeding the chickens

POULTRY LESSONS

I. IMPROVING THE QUALITY OF POULTRY

JAMES E. RICE

We should aim to retain purity of breed and vigor of our stock, and to have high-grade market quality in our poultry and eggs. By so doing, the profits may be greatly increased and the losses reduced because the selling value of the product will be increased. We shall also get more pleasure and satisfaction out of our occupation because we shall take pride in the improvement made. The difference in price between poultry and eggs that are attractive and those that are unattractive is enough to warrant great care in breeding for improved quality.

A flock of miscellaneous colors and types such as is often found on the average farm. Cockerels of this sort are of no value as breeders and are poor ornaments.

Some of the reasons why pure-bred poultry is more desirable than common stock are: 1. Pure-bred fowls lay eggs that are more uniform in size, shape, color, and texture of shell. Uniform eggs sell for a higher price. 2. They are more likely to breed true, that is, the chickens will grow up to be like their parents. 3. They are more uniform in shape and size of body and in color of skin and shanks, therefore more attractive and more profitable when placed on sale. 4. They are more attractive as a flock, because they are similar in appearance. It is worth while to keep poultry that looks well. 5. They furnish a larger income because eggs for hatching and stock for breeding can be sold at prices considerably higher than for market purposes. 6. They are more satisfactory, because, other things being equal, they may be expected to give better results in feeding, hatching, and rearing, due to the fact that

A flock of pure-bred Barred Plymouth Rocks. Note the beauty of a flock like this as compared with a flock of mixed breeds they are more nearly alike as to rate of growth, size, temperament, activity, and the like.

What can we do to improve our poultry?— Any boy or girl who is old enough to take care of chickens can improve the quality of poultry in two ways: first, by keeping only pure-bred stock and by selecting, mating, and taking proper care of them; second, by selecting and using only the right kind of eggs for hatching. Both of these things should be done, but either one alone will be likely to result in sufficient improvement to warrant the effort of doing it. We should keep a pure breed instead of common mongrel fowls. This is within the reach of all. It is neither difficult nor expensive to secure in any neighborhood a few pure-bred fowls or their eggs. With these a small start can be made. Each year more and more pure-bred chickens can be reared to take the place of the common fowls until all the flock are pure-bred.

Find out for yourself, by trying, whether it will pay better to have a pure breed of poultry. Remember, however, that not all pure-bred fowls are good fowls. Whether we have pure-bred or mongrel stock they must be strong, vigorous, and healthy.

II. SELECTING AND KEEPING EGGS FOR HATCHING

James E. Rice

One of the easiest ways to increase the money-earning value of poultry is to improve the quality of their eggs. The best customers usually are willing to pay a higher price for eggs of superior quality. Frequently this difference in price is as high as five to ten cents a dozen. Each hen in a good flock should lay on the average ten to eleven dozen eggs a year. If the eggs are of such quality that they will sell for even two cents more a dozen than ordinary eggs, this would mean a net difference of about twenty-five cents a hen in a year. This extra price is nearly all clear profit, due to the uniformity in size, shape, and color of the eggs.

The eggs that bring the highest price will depend somewhat on the market (see Lesson XI). We must first find out what kind of eggs will bring the highest price and pay the largest profit in our market, and then produce that kind only.

There are several things that we can do which will help to improve the selling quality of the eggs:

1. We should keep a pure breed of poultry that will lay eggs as nearly as possible the right size, shape, and color to meet the requirements of our market. Such fowls cost little, if any, more to keep than fowls that lay an inferior quality of eggs.

2. Only those eggs should be used for hatching that are of best market type as to size, color, and texture. Pure-bred fowls will be likely to lay eggs similar to the eggs from which they were hatched. In other words,

the kind of eggs we select for hatching will determine the kind of eggs that will be laid by the chickens that are hatched from the eggs.

When eggs from the same variety of fowls are compared, the size of an egg apparently determines to a considerable extent the size of the chicken that will hatch from it. Therefore, if we wish to have chickens of good size we must set good-sized eggs. Hence, we see that there are at least two good reasons why all the eggs that are selected for hatching should be full size, perfect in shape, and of the right color and texture.

Eggs for hatching should weigh at least two ounces and should not exceed two and one half ounces each. They should be perfect in shape so that they will pack well in the shipping case, that is, so that they will

Groups of eggs showing the various sizes and shapes that are obtained from almost any flock. All the eggs in the same row were laid by one hen. Note that the eggs laid by one hen have a characteristic shape. Only uniformly shaped eggs should be marked as first class

fill the compartments without danger of breakage from top or side pressure. They should be uniform in color, that is, each egg should be of one color and the right color over its entire surface, and all the eggs should be of the same color. The two colors that are most in demand are pure white and pure brown. There are many degrees of white and of brown in eggs, which will be seen only when the eggs are carefully examined in a good light.

The texture of the eggshell should be smooth, hard, and free from transparent spots when examined with a tester. Eggs having defective shells are not so likely to hatch well or to produce strong chickens.

Eggs for hatching should be kept in a moist, cool place not over 50 to 60°, and for not more than a week or ten days if it can be avoided. They should be turned every day or two, and should be kept covered so as to prevent too rapid evaporation.

Selecting eggs for hatching is interesting and useful work for any boy or girl to do. It will also prove profitable work. How many will do it and do it well?

III. HATCHING THE EGGS

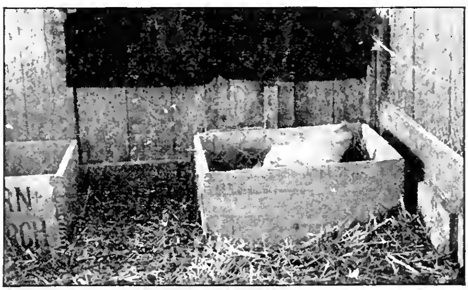
CLARA M. NIXON

Every one who has tried to set and care for a hen so that a good brood of healthy chickens will hatch, knows that it is no slight task. We need education for this as well as for other lines of work. Let us see what we can learn in the following lesson:

The hen.— You will probably have the hen all ready to receive the eggs when they arrive. She should be of moderate size. If too heavy, she may break the eggs; if too small, she can cover a few only. She should be quiet and peaceable, a hen that may be handled without being frightened, and one that is likely to pay strict attention to business.

Do not trust the hen with valuable eggs until you are sure she intends to sit. It will be better to give her two or three other eggs (china eggs will do) and let her sit on these for two or three days. She will probably be more contented on the nest she has chosen for herself, if it be a suitable one.

In case you must change the hen to another place, go quietly after dark, lift her gently, and put her on the nest that has been prepared. Give her two or three eggs, one at a time, and let her place them under her breast as best pleases her. If she clucks contentedly, and snuggles the eggs cozily under her feathers, she will usually sit on this nest. It is best, however, to put a crate or well-ventilated box over the nest. The top should be high enough not to disturb her while sitting, but not high enough to allow her to stand comfortably. If she sits quietly for two or three days, she will probably stay, and you may give her the eggs. Keep the crate over her for a few days longer, allowing her to get off the nest every day for exercise, food, and water, but have her go back in a reasonable time.



Sitting hens should be separated from the rest of the flock and placed in some quiet, cool retreat

The nest.— Have the nest comfortable, clean, and free from lice. It should be large enough for the hen to change her position on the nest and to turn her eggs, but not so large that the eggs will move out of the warm hollow under her breast. First, place some earth in the bottom of the box, then enough bright clean hay to make a good nest; the hen will fix the curve of the nest to suit herself. She feels safer in a somewhat dark, secluded place, and it is best to humor her.

Care of the hen.— The hen has undertaken a very confining task, which will last three weeks. This is a long time. For twenty-one days and nights the patient hen must stay in almost the same position. If you do not think this is tiresome, watch her when she first comes off the nest. She can scarcely stand. The least we can do is to have things as well prepared for her comfort as we can. Plenty of whole grain (corn and wheat are best), clean, fresh water, grit, and a dust bath should be placed where she can reach them, and she should be allowed to exercise every day if she wishes. Be sure to dust a little insect powder into her feathers occasionally. This is a wise precaution, even if you do not find any lice. In case she should break an egg, clean up the nest as well as you can, and wash off the badly smeared eggs in lukewarm water. They will not be likely to hatch if not cleaned.

If the hen seems irritable when the eggs begin to hatch, the oldest chickens may be taken from the nest as soon as they try to get from under the hen, wrapped in a piece of flannel, and kept in a warm place until the others are out. This will keep the hen more quiet, and she will not be likely to kill the younger chickens in the nest, or to leave the nest before the remaining eggs are hatched. If the hen is quiet, it is best not to disturb her while the eggs are hatching. The nest box must be deep enough to prevent the chickens from jumping out.

With careful attention to the instructions given, you should have good success with the eggs.

IV. BROODING AND CARE OF THE CHICKENS

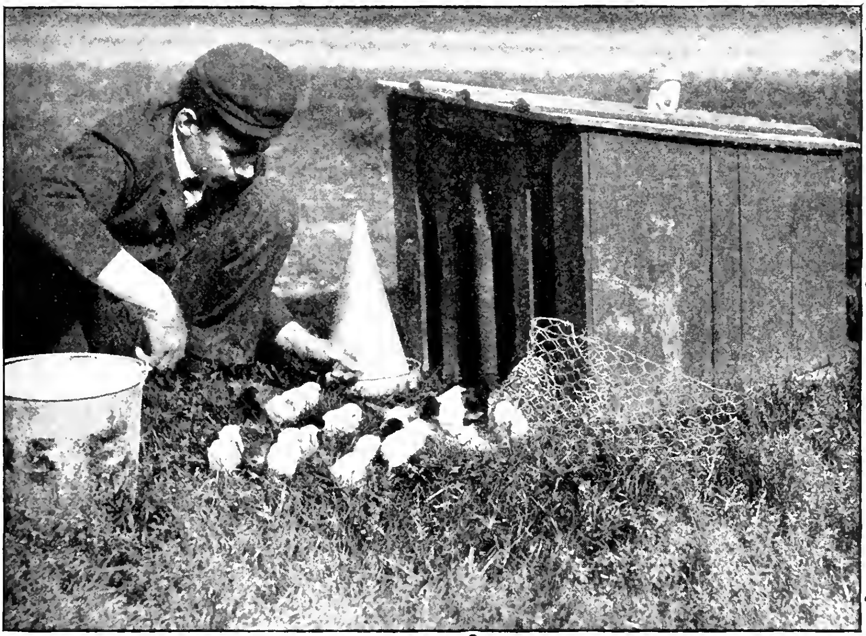
Clara M. Nixon

When the eggs are hatched, as they should be by the end of the twenty-first day, take the hen and chickens from the nest and put them in the coop you have prepared for them.

The coop.— The coop should be large enough so that the hen can move about, and high enough so that she will not strike her head. If it has no floor, set the coop on a platform of boards. This will help to keep out the rats and weasels, as well as to keep the coop dry. The separate floor is more easily cleaned and dried. The coop should be slatted in front, but closed on the other sides; it should have a roof that will keep out the rain. It should face the south and be placed on clean land on which no chickens have recently been reared. This is a precaution against disease. Everything should be clean, thoroughly disinfected with a coat of whitewash, and kept dry. *Dampness is fatal to young chickens.*

During hot weather a shelter against the heat should be arranged on the south side, unless the coop is located in the shade. The coop should be turned over often and the floor set up on edge, so that the sunshine may dry and cleanse every part.

Care of the hen and chickens.— It is better to keep the hen in the coop for a few days, for she will then be likely to return to it. Let the chickens



The first meal. After chicks have been hatched for 24 to 36 hours they will begin to hunt for food. Feed little and often. Provide fine grit and pure water at all times and a clean grass sod for pasturage

run if the weather is fine; they will not go far from the hen. In case the winds are cold, a little yard covered on the sides with coarse muslin instead of chicken wire will give protection. As soon as the chickens can run well, the hen may be allowed her freedom in fine weather, but she should be fed near the coop. In rainy weather it seems best to keep the hen and chickens out of the wet.

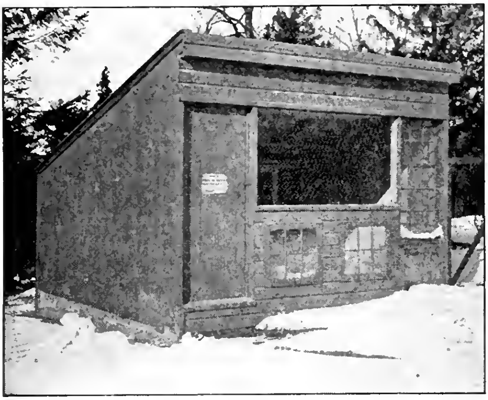
Enemies and disease.— Be sure that the hen and chickens are free from lice. A wise precaution against these pests is to apply a little fresh lard to the hen's body under the wings. An equal quantity of scotch snuff mixed with the lard makes it more effective. A liberal application of kerosene and whitewash to the inside of the coop several days before the hen and chickens are placed in it will be a wise precaution against red mites.

In case of the mysterious disappearance of the chickens, look for cats, rats, crows, hawks, weasels, and other thieves. Crows and hawks catch the chickens in the daytime, when they are roaming about. Rats and weasels often get into the coop at night, and may destroy an entire brood in one visit. Cats are often enemies. Your pet cat may be the one to eat your chickens. Watch her until you know she is to be trusted. The loss from disease will be greatly decreased if the chickens are always well cared for and well fed and if their coops are kept clean.

V. FALL PREPARATIONS FOR WINTER EGGS

JAMES E. RICE

The early fall months should be one of the busiest seasons of the year for the boy or girl who is taking care of poultry. It is a most delightful time to work out of doors. In the North when fall comes we feel the hibernating instinct of squirrels. We enjoy "snugging up" as the days get shorter and the frosts remind us that winter is coming. We know from experience how good it feels at this time to be comfortable. The hens feel the same way. Notice how they seek the shelter of bushes, fences, and buildings. They know full well that this is no time to lay eggs or to rear a brood of chickens. Therefore, what they do is perfectly natural and excusable, from a hen's viewpoint: they stop laying. Hens everywhere do the same; that is why eggs are always high-priced at this season of the year and later. In New York State the season of low egg production is October, November, and December.



A cheap and very satisfactory type of hen house. It is neat and warm and gives opportunity for fresh air for the birds

Did it ever occur to you that hens commence to lay less about the last of June each year, when the days begin to get shorter, and that they naturally begin to lay more about the first of January, when the days lengthen? They apparently know by the amount of daylight and of sunshine when a more favorable or less favorable season is approaching.

Hens lay well only when they are comfortable and happy. The happy, singing hen is the laying hen. That is why great care is necessary in the fall to get fowls into congenial winter quarters early. There are many ways of doing this. One is to provide them with a cheerful, cozy, clean house in which they can be sheltered from the wind, have plenty of sunshine and fresh air, and at the same time have an opportunity to run out of doors. On the snow? Yes! Yes! A hen does not mind cold feet if she can have her own way. In some respects, hens are like human beings. It is not so important for a hen to go out of doors each day the year round, as it is for her to know that she can if she wants to. Hens will not lay well unless they are contented, and freedom helps to make them contented.

There are many things to be considered in making a home for hens. The word *home* instead of *house* is used because many expensive houses are not hen homes; they may look all right but they are too high or too dark or too damp or too dirty. The home of a hen should be low, bright, dry, and clean, and have neat nests in which the birds can hide their eggs. The location should be dry and sheltered and should have good air drainage. Many of the most troublesome poultry diseases are due primarily to improperly located and poorly constructed poultry houses. The walls must be built to provide warmth, dryness, and strength for the house, ease of cleaning and disinfecting, economy in construction, and durability. Interior fixtures should be portable, in order to facilitate fighting the mites. A dust wallow should always be provided.

VI. WINTER QUARTERS FOR THE PULLETS

C. A. Rogers

As the fall advances and the leaves on the trees fall to the ground, it is time to get the season's flock of pullets into cozy, warm quarters where they can spend the winter in comfort. This is a time when the chickens should be given careful attention, for when exposed, the cold nights and occasional snow flurries soon put a stop to their growth and development. It is also a critical time, for under favorable care they should soon begin to lay.

Before putting the pullets into winter quarters, the houses should be thoroughly cleaned and disinfected. New litter should be put in and all signs of disease destroyed

The pen.— Choose, then, a corner of the barn or shed that can be partitioned off into a pen of the desired size; or, better still, build a small house purposely for the pullets. If you have fifteen fowls, build the house eight feet wide and ten feet long. If there are twenty-five fowls, make the house twelve feet wide and twelve feet long. Be sure to build it on a dry place that is protected from the cold winds as much as possible. Have the front face the south in order to get all the warmth of the sun's rays.

Fresh air and sunlight.— These are two very important factors. Both should be provided through windows on the front (south) side. A small window may be made near the top, into which is fitted a cloth curtain frame. During the daytime in pleasant weather this curtain should be removed or swung on hinges or fastened up out of the way, thus letting in the sunshine and fresh air. At night when closed, the muslin cloth keeps the house warmer and still allows abundant circulation of air. In addition to the cloth curtain there should be a glass window with six-by-nine-inch panes for the houses mentioned. For best results this window should be placed one and one half feet above the floor, with the longer dimensions up and down.

Warmth.— Next in importance is the warmth of the pen, on which depends largely the coziness of the quarters. One of the easiest ways to secure this is to line the walls with paper and board up roughly. In addition to this, if the roof is high build a loose ceiling at a height that allows plenty of headroom. Fill the space above with straw.

Dryness.— The straw not only makes the pen warmer, but also keeps it drier. Dryness is equally as important as warmth. With the three walls made tight with paper, the ceiling filled with straw, and a deep litter of straw or hay chaff on the floor, the fowls will be comfortable and contented. Such conditions always add to the number of eggs in the egg basket.

Roosts.— Make the inside arrangements neat and convenient. Small poles or two-by-four sticks of lumber make the best perches. All perches should be on the same level, because fowls seek to roost on the highest if some are higher than others. The scrambling for the higher places often results in injury to some fowls and always causes disturbance. The best height for the perch is about two and one half feet above the floor.

Nests.— By natural instinct hens seek a secluded place in which to lay eggs and this should be provided. They will be likely to lay more eggs when satisfied with their surroundings. An easy way to make such a nest is to fasten a box on the side wall at about the same height as the perches, leaving a small opening at the side of the box toward the back wall through which the hen enters and from which the eggs can be gathered. The nest is very inviting when kept clean and filled with fresh straw or hay.

Freedom.— Fowls should be given their freedom in winter as well as in summer. This is particularly desirable when the house opens into a dry barnyard in which the fowls can roam about and pick up bits of food left by the other animals.

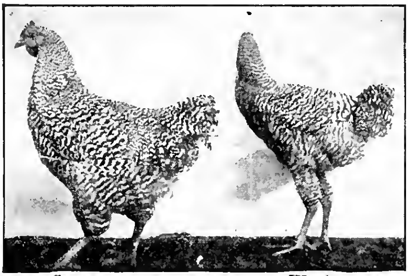
Cleanliness.— The pen *must* be kept clean. The health and comfort of the fowls depends very largely on this. Do not wait until the litter becomes wet and filthy, but change it as soon as it begins to pack. Provide a small box of screened coal ashes or road dust in which the hens can dust. This will help to keep the lice off their bodies. Whitewashing the house will help to keep the lice in check; if necessary, put kerosene on the perches and over the nest boxes, refilling the nests with clean bedding. The whitewashing is very desirable, since it makes the pen lighter and cheerier, and kills most of the vermin.

In the above ways the pullets at a very small cost can be made comfortable for the winter. The one thing above all others which young poultry raisers should remember is: *Provide your fowls with wholesome surroundings and they will make it worth your while to keep them.*

VII. ELIMINATING UNPROFITABLE CHICKENS

James E. Rice

In nearly every flock of chickens or fowls there are good ones and poor ones; in some flocks there are very good ones and very poor ones, and occasionally there are flocks in which there may be found greater extremes than these. Very likely the good ones are profitable and the poor ones are kept at a loss. If we are to make money from our fowls or chickens we must not keep any that are not profitable.


Strong Weak
Cockerels

Every chicken should be looked upon as a living machine for transforming food into chicken meat or eggs. Unless we have a good machine we cannot get good results from the food. In the case of many flocks of chickens a division may be made into three groups: (1) chickens that are growing or laying; (2) chickens that are not growing nor laying; (3) chickens that are losing weight and not laying. All three of these groups are eating valuable food, and if we keep all of them together they will probably eat more than they earn. If we dispose of the third group the others may pay expenses. If we remove the second and third groups, the first group alone should pay a good profit. We shall have one third as much work to do in caring for those that remain, and the chickens will have two thirds more room. Moreover, the flock of good chickens by themselves will look far more attractive, will grow better, lay better, and will be less likely to suffer from disease than they would be if kept with the others.

There are several types of unprofitable chickens that should not be kept:

1. A chicken of any breed or age that shows signs of sickness or weakness. All such should be removed at once and doctored, or killed and burned. Prompt action may prevent further trouble. Delay is almost certain, in the end, to have serious results for the rest of the flock.

2. Old hens that may still be well and strong. Generally it does not pay to keep hens after they are two or three years old unless they are strong and especially valuable for breeding purposes. Fowls should be marked so as to indicate their age.

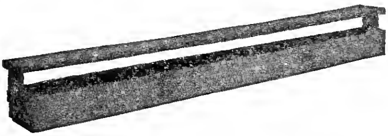
3. Surplus cockerels are unprofitable boarders. It is a common mistake to keep too many males. This is frequently due to a natural desire to avoid killing desirable breeders, and with a hope that if they are retained they may be sold alive for high prices. After they become large enough for market most cockerels do not make enough growth to pay for the food they eat. They also injure themselves or others by fighting. The room they occupy, the food they eat, and the labor they require might better be bestowed on early hatched pullets. They should seldom be allowed to go into winter quarters. They usually fail to grow well in cold weather, and occupy valuable space that should be used by better stock. They are unable to wrestle with larger individuals and generally remain undersized.

Careful grading of all stock as to size, age, breed, vigor, and purpose for which it is kept is one of the most important factors in the successful handling of poultry. This is second in importance only to the elimination of the undesirable members of the flock. This policy should be practiced persistently and continuously from shell to maturity.

VIII. FEEDING THE CHICKENS

CLARA M. NIXON

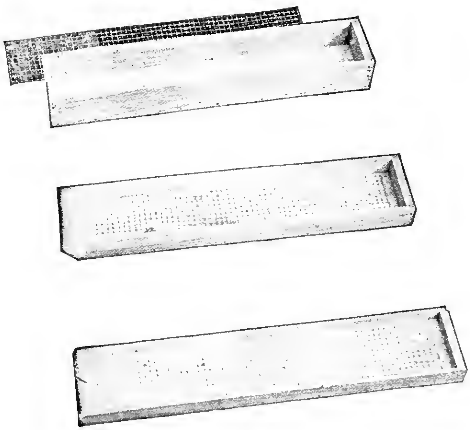
The food.— The egg yolk is enclosed within the body of the chicken just before hatching, and may supply nourishment to the chicken after it leaves the shell. For this reason chickens should not be fed until they are thirty-six hours old. The first meal may be of equal parts of bread crumbs and rolled oats, moistened with some milk or water to make the food crumbly but not wet. Sprinkle over this food a little fine sand or grit, fine charcoal, and some finely shredded clover, lettuce, or chickweed leaves. Mix with the food a little well-burned bone or some bone meal. After the first few days, hard-boiled egg may be added in the proportion of one part of egg to eight or nine parts of the bread and rolled oats. In addition to the moist food, a grain food should be given. A mixture of three pounds cracked wheat, two pounds corn (finely cracked), and one pound pinhead oatmeal, rolled oats, or hulled oats is good. A dry mash may be left before the chickens at all times, but only as much should be given at one time as will be eaten in a day. If any of the mash becomes dirty it should be taken away from the chickens. The mash may consist of four pounds wheat bran, three pounds wheat middlings, three pounds corn meal, three pounds sifted beef scrap, and one half pound bone meal, well mixed together. Beef scrap that is not perfectly good and fresh should never be used.



Troughs for feeding large chickens

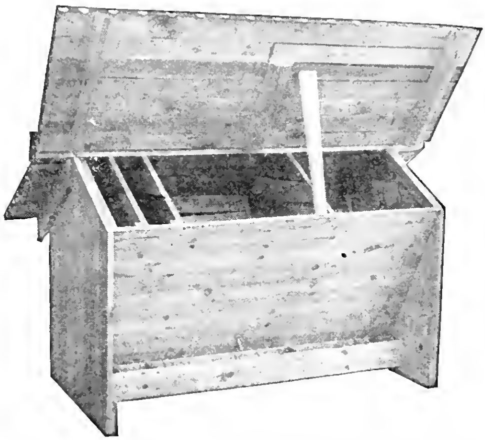
For chickens four weeks old or over, the bran may be reduced to three pounds. Cottage cheese may be given in addition to the other foods, but not in large quantities. It may cause bowel trouble if the chickens get too much at first. *All foods should be sweet and clean, never moldy nor sour.* Make all changes in ration gradually.

The feeding.— Care should be taken to have the hen well supplied with whole grain and large grit. The chickens should be fed often at first, usually five times a day. The moist food may be given in a shallow dish or on a bit of clean board, and should be taken away as soon as all the chickens have had enough. The first few days, they will probably eat but a small amount of grain, and it may be scattered in a shallow dish containing a little dry mash made according to the directions given above. After two or three days, the dry mash by itself may be fed in the dish, and the grain scattered on the ground or floor. Two other meals of the moist food may then be given, the other feedings being of grain. The dry mash may be left where the chickens can get it at any time. After the first week, the bread and rolled oats need not be given, but a little of the mash mixture may be moistened and given instead.



Chick feed-trays of different sizes

As the chickens grow older the number of meals may be less, and the grain of larger size. At four or five weeks of age they will be able to eat whole wheat, hulled oats, and larger cracked corn. Then if they have a large range and the weather is favorable so that they may run about, they need only two meals of grain and one of moist mash a day. They can always come back to the dry mash if they get hungry. Beginning with the first meal green food should be supplied, but the hen will soon teach the chickens to peck tender pieces of clover and the like if she is allowed to range with the brood.



An outdoor hopper for feeding mash, grain, grit, and bone meal

When the chickens are about eight weeks old, the grain and ground food may be fed from a large feed hopper from which they may help themselves at any time. The grain mixture may consist of equal parts of wheat and cracked corn. The chickens should also have free access to cracked bone, fine grit, screened oyster shell, and charcoal.

Give plenty of fresh, clean water in a vessel into which the chickens cannot jump. Ordinarily a water fountain is used for the purpose.

A serviceable water fountain can be made from a pint basin and a tomato can that does not leak. Cut half-inch notches in the edge of the can on opposite sides. Fill the can with water, cover with the inverted basin, then turn the whole thing over, holding basin and can tightly together. The water will run into the basin, but not overflow. If the basin does not become full enough, cut the notches higher.

IX. FEEDING FOR WINTER EGGS

C. A. ROGERS

Does it ever occur to boys and girls that fowls are fond of a variety of food? This is especially so when the weather becomes cold and they are shut up in their pens. Then they are away from the fields where in summer they can nearly gain a living on the bugs, scattered grain and seed, and grass. It is true that they will subsist, even in the winter, on corn and water given them at irregular intervals, but under such care they cannot lay eggs. Notice how much better you feel after eating a meal of wholesome, well-cooked food that you like. Fowls are just as partial, and respond when well fed. There is no one method of feeding that can be applied equally well under all conditions. The method described in the following paragraphs, however, may be followed to advantage under many conditions and may also serve to suggest ways of improving your present practices.

Morning feed.— In the morning the fowls are hungry and ready to work for their breakfast. It is well to let them keep as busy as possible. Work keeps them warm, healthy, and contented. With this in mind, scatter mixed grains in the litter. Be rather sparing of the feed in the morning, so that the fowls will not quickly obtain their fill, but will continue to work and hunt for the grain for the greater part of the forenoon. This grain should be a mixture of all the kinds grown on the farm. They may be mixed in the proportion of three pounds corn, two pounds wheat, and one pound oats, to which may be added, if available, one pound buckwheat and one pound barley. Fresh water should be given to the chickens every day.

Noon feeding.— At the midday meal is the best time to provide those appetizing mixtures so greatly relished by the fowls and so successful in helping to produce eggs. Take the scraps of meat, bread, and vegetables, or oatmeal, from the table, mix them with corn meal, wheat bran, and wheat middlings. Moisten the mass with skimmed milk until it is crumbly. When skimmed milk and table scraps are not to be had, take a pail of cut alfalfa or clover hay and pour boiling water on it, allowing it to steam. Feed when it is still warm. A portion of this steamed alfalfa added to the noon mash gives it a pleasant, appetizing odor. A little salt and pepper can also be added to the mash, in about the same proportion as would be used in your own food. When it is not convenient to make a moist mash, the same ground feeds may be fed dry in a hopper that should be left open during the afternoon. A good mixture for this purpose is: six parts corn meal, six parts wheat middlings, three parts wheat bran, five parts meat scraps, one part oil meal. The best results will be obtained if the hens eat about one third of the ground feed mixture to two thirds whole or cracked grain. At noontime as much green food (beets, cabbage, or lettuce) as the fowls will clean up before the following noon should be given. At this time see that the oyster-shell and grit hoppers are filled. When it is impossible to follow the practice of feeding three times a day, the scraps and green food should be given with the morning feed.

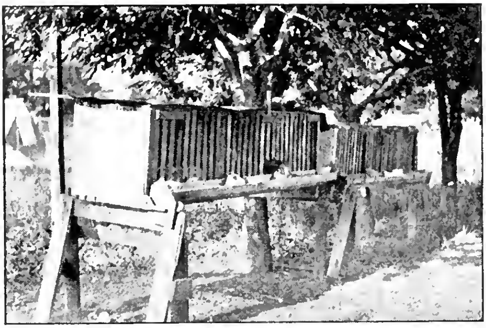
Night feeding.— Fowls go to roost very early, making it necessary for them to eat before sundown. This requires feeding in the latter part of the afternoon, while they can still see to pick up the grain. When given the opportunity, a fowl will go to roost with its crop rounding full of grain, which it gradually digests during the night. This process of digestion warms the body and keeps it more comfortable. An empty crop is a poor bedfellow for the fowl. The same grains can be fed at night as in the morning, but in large quantities so that some will be left over after the fowl's appetite has been entirely satisfied.

X. FATTENING POULTRY

W. G. KRUM

By fattening we do not mean filling a fowl's body with a large deposit of oily fat such as is often found in old hens, but producing large, soft muscles with sufficient fat so that when cooked they will be tender, juicy, and of fine flavor. Not only does this improve their quality for home use, but they will sell in good markets for a much higher price a pound.

The best way to fatten poultry is to restrict exercise by placing them in slatted coops about two feet square, having the bottom slatted or covered with one-half-inch-mesh wire cloth. This will hold four to six fowls or eight to ten young birds.



Shutting birds up in coops or small pens is very satisfactory when fattening them. The coops should be arranged in the shade. By means of troughs, wet mash may be fed three times a day

The fattening coop should be located in a cool, shady place in hot weather and in a comfortable place in cold weather.

The fowls should be thoroughly dusted with lice powder, as fowls infected with lice do not fatten well. Neither do fowls or chickens of low vitality fatten readily.

Poultry should not be fed for twenty-four to thirty-six hours before feeding the fattening ration. The ration should then be fed sparingly at first. Afterward they should be kept eating well by feeding only as much as they will clean up in ten to twenty minutes. If they have more than they can digest for a meal or two they lose their appetite, fail to grow well, and may lose weight.

Feed fowls or mature young stock three times daily for about two weeks, this being as long as they will do well under this heavy feeding.

A good ration consists of three pounds corn meal, three pounds buckwheat middlings, three pounds oat flour, one pound beef scrap, and a little charcoal. These are mixed with sour skimmed milk or buttermilk (the latter preferred) to the consistency of batter, which is then allowed to stand and sour twelve hours before feeding.

Ten pounds of feed usually requires seven to nine quarts of milk. The oat flour may be obtained of manufacturers of oat flakes or oatmeal. Flour middlings may be used in the place of oat flour, although it is not quite so satisfactory a food.

It is usually best, in fattening broilers, to give this ration morning and night only, giving at noon a light feed of cracked corn and wheat.

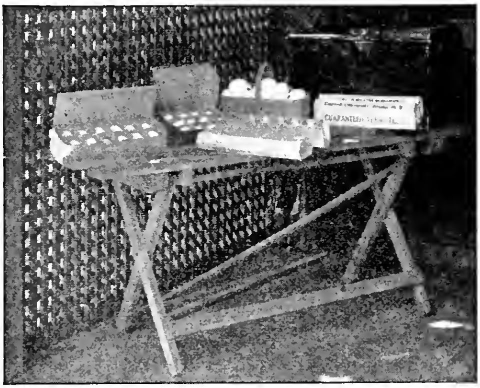
When stock fattened in this way is shipped to market the packages should always be marked " Milk Fed." This will secure the best prices.

XI. GRADING AND PACKING EGGS FOR MARKET

E. W. BENJAMIN

In order to sell eggs most profitably, you should know how to grade and pack them for market.

As soon as the eggs are gathered, sort out all the soiled ones and clean them. If they are only slightly stained, use a cloth moistened in vinegar; if they are badly soiled, use scouring soap or similar substance. Do not soak the eggs in water, as the liquid will pass into the interior of the egg carrying undesirable flavors. Washed eggs will not keep so well as clean, unwashed eggs, therefore it is better to keep the washed ones for home consumption and use them while they are fresh.



First-class eggs may be enclosed in neat cartons and delivered to private customers. Prices well above market quotations are often obtained for this grade of eggs

The market eggs should be kept in a cool place and sold at intervals of not more than one week. These eggs should be carefully sorted and packed. To grade the eggs, make two groups according to size. The first group should contain eggs each weighing two ounces or more, that is, one and one half pounds or more per dozen. The second group should contain eggs weighing less than two ounces each. The grading will be easier if you weigh a few eggs of two ounces each and use them as samples. Practice will enable you to select the eggs of various grades without weighing them.

From each group of eggs take out those having approximately the same color (either uniform white or uniform brown), and a uniform shape and size. After all the eggs of small size, poor color, and abnormal shape have been taken out, you will have two grades of first-class market eggs for which you should be able to secure higher prices than the ordinary market will pay. Egg dealers in New York City have been known to pay ten cents more a dozen for the large eggs than for medium-size eggs of the same color. They have also paid five to fifteen cents more a dozen for the uniformly white eggs than for mixed colors of the same size. The eggs that go into the cull grade may be sold for nearly market prices.

The best grade of eggs that you are producing for the wholesale trade should be packed in an ordinary thirty-dozen case if express shipments are to be made. You may be able to have some private customers in the city who look to you for their regular egg supply. This class of trade is not difficult to secure if your eggs are of superior quality. The same grade should be sold each time to the same customer, so that he will become educated to appreciate superior grades in eggs. Consumers are usually glad to pay a premium for eggs of reliable quality. A little care and interest on your part will give you a profitable business all your own, which will afford some of the best profits and pleasures of farm life.

Remember the following: (1) Breed and grade your fowls so that they will lay eggs that are uniform in size, shape, and color, and of the quality that will best suit your customer; (2) gather the eggs daily; (3) carefully clean all soiled eggs; (4) sort the eggs into at least two grades; (5) neatly pack the firsts in cartons, or other attractive packages, which will command a considerable increase in price; (6) furnish your customer each time with a uniform grade of eggs; (7) up-to-date knowledge combined with attention to details, absolute honesty, and good business methods will bring success.

Cleaning eggs is a good occupation for the children. Soiled eggs should never be offered to a customer

ANIMAL STUDY

THE EDITOR

CATS

Not often so friendly

Although the special study of animals for this year includes the cat, we shall not give any lesson on this subject. Most of the necessary information relating to cats is known to teachers and pupils. It would seem that time might be much better spent in giving instruction that relates to other forms of animal life.

It is very essential, however, that the point of view of some of our best students of natural history should be considered in regard to the large number of cats that are allowed freedom throughout the country. At night they wander in all kinds of places and then go back into the homes in which they are the companions of children. Many persons who make pets of cats feel that there are too many and that the freedom allowed them is serious to the public.

We have asked permission of Professor C. H. Hodge to publish his opinion on this question and we hope that teachers and parents will give it some consideration. However much any individual may care for a cat, he will doubtless be open-minded enough to help in working out a problem that is of deep interest at the present time. It will be well for teachers to read over the following extract to the older boys and girls and to discuss the subject with them. This will give opportunity to consider the question of humane treatment of animal life whenever it is necessary to take measures to prevent animals from becoming a public nuisance. Professor Hodge presents his opinion as follows: "Unlike dogs, cats readily return to a wild, or semi-wild life, and thus become a menace to much of the valuable and interesting nature life of the country, game birds and animals, and even to poultry. They breed in great numbers in cities, where their lives are, for the most part, a prolonged misery both to themselves and the community. Their cries at night are the most disagreeable sounds we have in nature. The various smells that mark the places they infest are utterly nauseating and intolerable.

"Cats are the worst enemies of our common birds. Mr. Forbush estimates that on the average a cat kills fifty song birds a year, and he has known of a single cat destroying six bird's-nests in a day. In most States the legislature has deemed it wise to pass laws imposing fines upon those who kill birds. It is obviously absurd to fine a man for killing one bird and at the same time allow him to keep a cat that kills fifty. In some cities in Europe, where every effort is being made to protect the birds, cats are considered public nuisances if allowed to run at large. People who wish to have cats must confine them within their own premises, both by day and night, because numerous cat traps are continually set for strays. While not inaugurating a crusade against cats as pets, the lessons in nature study may exert some influence toward inducing children to observe what cats do and possibly to keep other pets so far as possible. Special attention should be directed toward preventing cats from killing birds; abundant feeding, keeping in at night during nesting time, and possibly training, may prove effective in some cases. Bells worn about the neck, as sometimes advocated, may save now and then an old bird, but not the newly hatched nestlings or young birds that are not yet wary or strong enough to fly."

COWS

The cow was given for special study last year, but it has such an important place in the world that it is again recommended by the State Education Department for study in the rural schools this year. In the Cornell Rural School Leaflet for September, 1911, a series of articles was given relating to dairy interests. We are reprinting a few of the lessons that will probably be most important for the use of teachers this year. The other lessons can be obtained by any teacher to whom the September leaflet of last year was not sent. The list of lessons that we have not reprinted is as follows: "Why Milk Sours," "A Lesson in Milking," "Clean Milk," "The Constituents of Milk," "The Babcock Test for Butter-Fat in Milk," "Milk Records," and "Cottage Cheese Making."

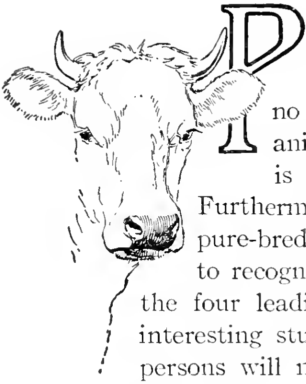
In the following lessons we have given more material for the study of cows than any teacher will take up in the classroom during the year. The teacher should, however, have more knowledge of the subject than is presented to the boys and girls, and from the material given he will be able to select the lessons that will have the most live interest for his school. The work will find a more active response in the dairy sections of the State.

In presenting the lessons on dairying, a visit should be made to a dairy farm, if possible. For this trip the teacher should prepare the pupils by a classroom lesson on the things to be observed. Try to have the farmer give a talk on his personal experience in dairying.

LESSONS ON THE COW

I. THE COLORS OF COWS

E. S. Savage



PURE-bred cows constitute only about 1.5 per cent of the cows raised in New York State. This number should be increased, for it costs no more to keep pure-bred animals than grade animals; and the profit from pure-bred animals is likely to be larger than that from grades. Furthermore, it is a great satisfaction to own a fine, pure-bred herd of cows. Let us teach boys and girls to recognize the four leading dairy breeds of cattle and the four leading beef breeds. The lessons will give some interesting study in color and in markings, and the young persons will make a beginning on observation of cattle in the neighborhood.

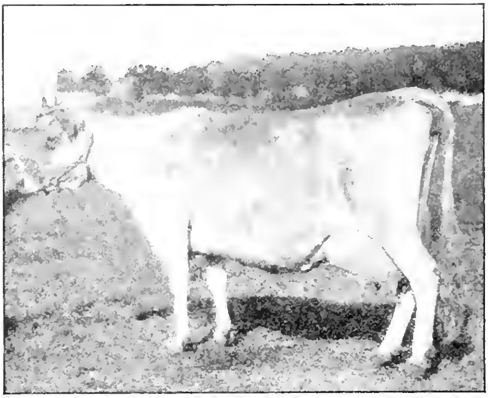
The four great dairy breeds in New York State, in order of numbers of cows, are the Holstein-Friesian, called simply Holstein, the Jersey, the Guernsey, and the Ayrshire. The color of the pure-bred animals in each of these breeds is always the same within rather narrow limits. A pure-bred Jersey would never be mistaken for a Holstein or an Ayrshire, and very rarely indeed would she be mistaken for a Guernsey by any one with any real knowledge of the breeds.

This color characteristic is the one, perhaps, which is most surely transmitted from father and mother to offspring among pure-bred animals. Among grade animals, the color, in most cases, will be that of the breed of which the grade animal carries the most blood.

We may first discuss the color of each of the separate dairy breeds, and then of the leading beef breeds. One way to become familiar with the different breeds of cattle is to see, as often as possible, copies of farm papers that give considerable attention to live-stock production.

The dairy breeds

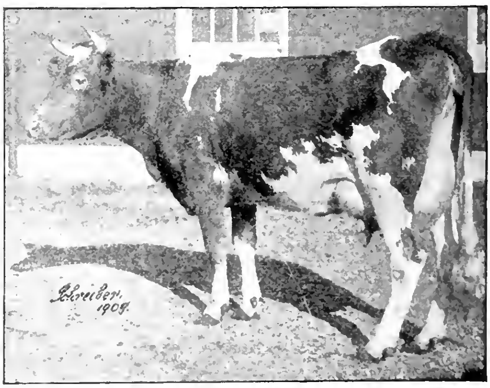
The Jersey.— The color of the Jersey, in general, is solid fawn, varying through all the shades from light to dark, and becoming almost black in some cases. White is allowable and occurs in patches with sharply defined outlines in the general fawn color of the body. Jersey cows showing white are comparatively few in number. The photograph of the Jersey shown is that of a very light fawn-colored cow. Jerseys usually have a black nose, a black tongue, and a black switch, but these points are not required for eligibility to registration. The hair along the back and under the abdomen, and that immediately surrounding the muzzle and the eyes, is usually lighter than on other parts of the body. The skin should be a rich yellow.



A Jersey cow

The Guernsey.— The Guernsey cow is generally larger than the Jersey and perhaps a little coarser. The color is yellowish, brownish, or reddish fawn. This is wholly unlike the fawn of the Jersey, and is not likely to be mistaken after a few individuals of each of the breeds have been seen. The reddish fawn prevails. White markings are more common with Guernseys than with Jerseys. White occurs most often on the limbs and the under part of the body. The muzzle of the Guernsey is buff or flesh-colored, and is surrounded by a circle of light hair. The eyes are surrounded by the same kind of marking.

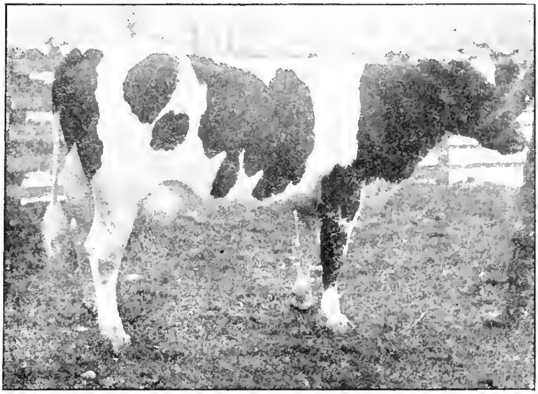
The Guernsey is noted for the rich, yellow color of the skin and of the secretions coming from the skin. There is supposed to be a relationship between this rich skin-color and the bright, rich yellow of Guernsey butter and cream.



A Guernsey cow

The Holstein-Friesian.— The color of this breed is black and white. There is no variation in shade, the only variation among individuals being in the amount of each color. At various times in the history of the breed, more white has been popular than at other times. For example, at present a Holstein bull calf having more than 50 per cent white will bring a larger price than an equally good animal having less white.

The Ayrshire.— The Ayrshire cow is red and white, although occasionally a brown and white animal may appear. In such cases, the brown always has a reddish tinge. As with Holsteins, a large proportion of white is popular. The color markings in the Ayrshire are not so regular as the black and white of the Holstein. Often a white Ayrshire cow will be flecked with red instead of being marked in large patches or in any regular way.

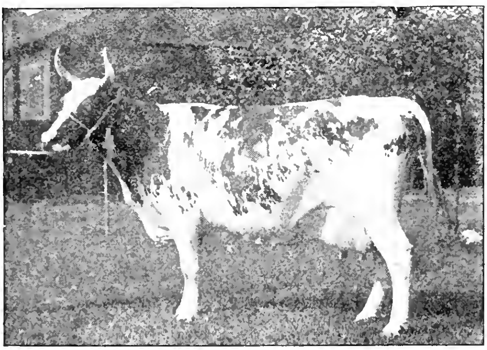


A Holstein cow

The best way to learn the different characteristics in color is to see animals of each breed. It is suggested to teachers that the children be encouraged to tell what kinds of cows they have at home and to describe the colors. Visits to good dairy herds in the vicinity of the school will increase the interest in the subject and give the children first-hand study of animal life.

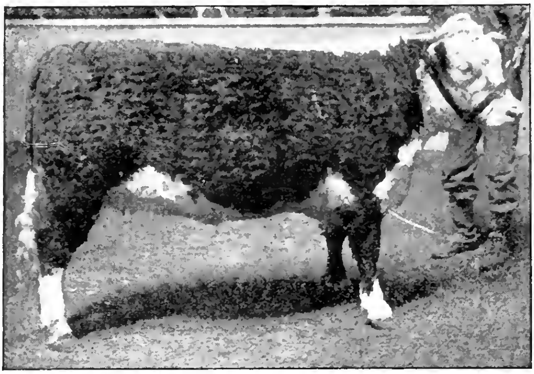
The beef breeds

There are comparatively few of the four great beef breeds — Shorthorn, Hereford, Galloway, and Aberdeen-Angus — in New York State, as this is primarily a dairy State. At one time Shorthorn cattle were in demand in New York, however, and in 1873 the highest price ever paid for a cow, $40,000, was paid for *8th Duchess of Geneva*, a Shorthorn. Beef cattle have given way to dairy cattle, and we do not find large herds of beef animals except in one or two places. The influence of the Shorthorn blood has been left in our grade and scrub herds, however, and we find many animals resembling Shorthorns. The grades of the other beef breeds are not nearly so numerous.



An Ayrshire cow

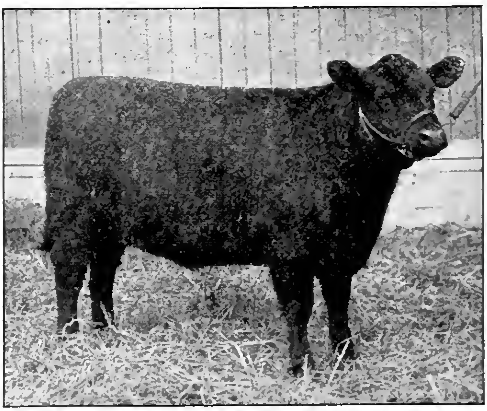
The Shorthorn.— The colors found among Shorthorn cattle are red and white in great diversity of proportions. We have wholly red animals and wholly white animals. Then there is found in large numbers the roan, a mixture of the red and white with the colors grading imperceptibly into each other through a mixture of the red and white hairs. In some cases, the colors are distinct and the outlines of the patches of red are clearly defined. The picture shown on page 71, in the lesson on "The Beef Type and the Dairy Type," is that of a roan Shorthorn cow with some parts of the body graded into clear white and other parts a clear red.



A Hereford cow

The Hereford.— The characteristic color marking of the Hereford cow is her white face, white line on the back, white underline, white markings on the legs, and white switch. There is no definite extent prescribed for these colors, but the face is always clear white and the outlines of the other white markings are distinct. The body is a solid dark red. The Hereford heifer shown in the above illustration well represents this breed.

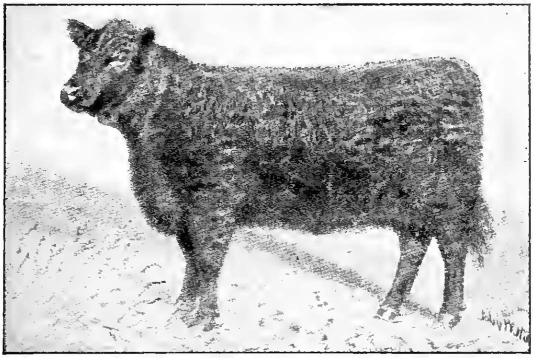
The Aberdeen-Angus.— The Aberdeen-Angus cow is solid black, and is distinguished from the Galloway by having shorter and straight hair. The Angus cow is polled; that is, from birth she has no horns.



An Angus cow

The Galloway.— The Galloway cow is also solid black, with the best coat of hair of any of the breeds of cattle. The hair is rather long and wavy. The hide of the Galloway is especially prized for robes and fur coats. This is a polled breed, also.

The cows of the different breeds cannot always be distinguished by color alone. Other characteristics, which have not been mentioned, may need to be considered; but the color will enable us to determine the breed in the great majority of cases.



A Galloway cow

II. THE BEEF TYPE AND THE DAIRY TYPE

H. H. WING

Cattle are kept for two main purposes: for the production of milk and for the production of beef. These two purposes make quite different demands on the vital energies of the animal. For this reason, by selection through many generations of those animals, on the one hand, that are best developed for meat production, and of those, on the other hand, that give the largest amount of milk, there have arisen two types more or less distinct in form and certain other characters, one known as the " beef form " or type, and the other known as the " milk form " or type.

It must not be supposed that these two types are entirely distinct or separate, for the cows of the beef type always give some milk, and animals of the dairy type will furnish beef of reasonably good quality when properly fattened. Then, too, while the types may be readily recognized in the best-developed individuals of either, there are a great many animals of intermediate form that it would be difficult to assign to either type, since the two types tend to merge into each other by very gradual gradations.

The chief differences in form that distinguish the beef and dairy types are:

1. In outline of body, especially as viewed from the side.

2. In depth and smoothness of flesh.
3. In size of udder and external blood vessels connected therewith.

In the beef form, the outline of the body approaches the rectangular. The general contour of the top and bottom lines is straight and parallel, and the general dimensions of the body approximate those of a brick; that is, length twice the depth, and depth twice the thickness.

In the dairy type the general outline of the body is "wedge-shaped from before backward"; that is, the general contour of the top and bottom lines diverges from the front toward the rear. This is brought about

The dairy type

by a relatively large development of the hind quarters and sometimes by relatively low and thin shoulders. The height of the animal at the hips is one half to one and one half inches greater than at the shoulders. The wedge-shaped appearance is increased by a large and pendulous abdomen and by a large and well-developed udder.

In the best beef animal, even when not fully fattened, the whole body is thickly and smoothly covered with flesh (muscle) so that the angles of the bones are nowhere prominent. This is seen particularly over the upper part of the ribs immediately back of the shoulder, on the loins, in the thighs, and on the shoulder. The neck is short and blends smoothly into the shoulder and the whole body has a rounded appearance.

In the dairy animal, the lack of muscular development gives rise to a spare, angular appearance. The angles and joints of the bones are prominent, particularly in the pelvis and the spinous processes. This does not mean that the animal is poor or emaciated, for there may be abundant fat, as indicated by a soft, pliable skin, and by rolls of fat in the fold of the skin in the flanks, and still the animal may present this spare appearance.

In the dairy type, the udder is, of course, much larger and fuller than in the beef type, and the so-called "milk veins" stand out prominently on the abdomen, extending well forward to the chest. In the beef type, not only is the udder small and comparatively insignificant, but the exterior veins leading from it are small and more or less embedded in the surrounding muscular and fatty tissue.

The beef type

III. A STUDY OF COWS

E. S. SAVAGE

Young folks in the State of New York should become more familiar with the animals of the farm. They should be taught to love farm animals; for cows can be loved and petted as well as dogs and horses, and a child's friendliness will be as fully appreciated by cows as by other animals.

Children in the schools can be taught to study animals at home and to report their observations at school. The teacher of a rural school should visit the homes of the children as much as possible and observe the animal life with the children. In this way parents will become more interested in the school work. In the hope of giving some suggestions to teachers, the writer has prepared the following topics and questions concerning the cow:

1. *The origin of cows.*
   a. What two rather distinct types of cows are there?
   b. In what countries are they found?
   c. From what countries have the cows in the United States come?

2. *The parts of the cow's body.*
   a. Where is the milk produced?
   b. What do the milk veins carry?
   c. Where are the withers?
   d. What is the " wedge shape " in the dairy cow?
   e. How does a cow kick as compared with a horse?

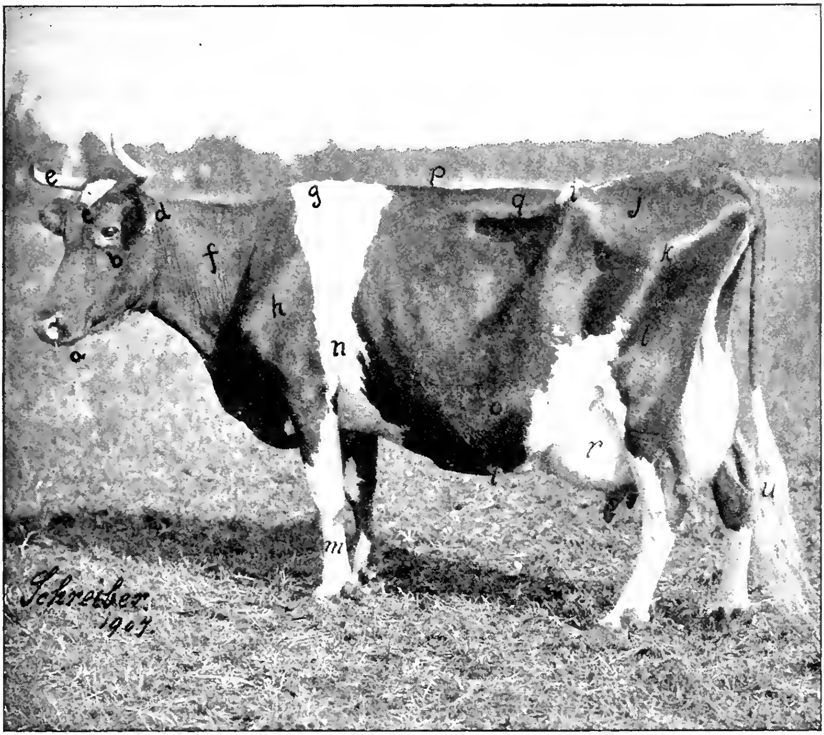
3. *The teeth.*
   a. How many teeth has a cow? How many molars? How many incisors? On which jaw do the incisors grow?
   b. How does a cow bite?
   c. What other farm animal bites like the cow?

4. *Telling the age by the teeth.*
   a. How many incisors has the calf when he is born? When does the calf get all his " milk " incisors?
   b. When does the middle pair of permanent incisors appear? The next pair? The next pair? The outside pair?

5. *The digestion.*
   a. How many compartments has the stomach of a cow?
   b. What other farm animal has the same number of compartments in its stomach?
   c. How many times does the cow chew its food?
   d. Which is the true stomach?
   e. For what purpose are the first three stomachs?

6. *Food of the cow.*
   a. What foods are adapted to the needs of the cow?
   b. Why does a cow need succulent food at all seasons of the year?

c. For convenience in studying the feeding of a cow, into what groups of nutrients do we divide her food?
d. Can we divide the body of the cow into the same groups of materials?
e. What is the interrelation of these materials in the food and in the body?
f. How do we compute a ration?
g. What is the nutritive ratio?



The parts of a cow: a, muzzle; b, eye; c, forehead; d, ear; e, horn; f, neck; g, withers; h, shoulder; i, hip; j, rump; k, thurl; l, thigh; m, leg; n, chest; o, abdomen; p, back; q, loin; r, udder; s, teats; t, milk vein; u, switch

7. *Breeds of cows.*
   a. What are the four principal dairy breeds in America?
   b. What are the four principal beef breeds in America?
   c. In order of richness of milk, how do the dairy breeds stand?
   d. In order of prominence and favor in the United States, how do the beef breeds stand?
   e. Which is New York, a dairy or a beef-producing State?

Answers to questions on cows

1. Prehistoric animals related to our cattle were domesticated by the Swiss Lake Dwellers. These cattle existed in rather large numbers down to historic times and were the ancestors of our domestic breeds of the present day. The two kinds of domestic cattle that exist to-day are our own cattle as we know them as separate breeds in Europe and America, and the humped zebus of the eastern countries of the globe. The humped zebu was domesticated in Egypt 2,000 years before the Christian Era.

The cattle of the United States have come chiefly from England, Scotland, the Channel Islands (the islands of Jersey and Guernsey in the English Channel), and Holland. The beef breeds and all the dairy breeds except the Holstein-Friesian originated in England, Scotland, and the Channel Islands. The Holstein-Friesian cattle came from Holland. The man who may be called the father of all modern breeding and improvement of cattle was Robert Bakewell, who lived in England from 1725 to 1795.

2. The parts of the body of the cow are shown in the illustration on the preceding page and require no further explanation. The udder and the milk veins make up the mammary organs of the cow. The milk veins do not carry milk. They drain the blood from the udder. The fresh blood from which the milk is manufactured is supplied to the udder from the heart through arteries and is drained away through milk veins. The larger the milk veins, the larger the amount of blood probably flowing through the udder and the larger the milk production of the cow.

The wedge shape and the dairy shape are explained in the article in this leaflet on "The Beef Type and the Dairy Type," by H. H. Wing, page 69.

The body of the cow is so made up that she can reach much farther forward when she kicks than can the horse. This enables her to protect her udder to a greater extent. A horse usually kicks straight out with both feet to protect himself.

3. A cow has thirty-two permanent teeth: twenty-four molars, twelve on each side, six above and six below, and eight incisors. The incisors are all on the lower jaw. The place of the incisors on the upper jaw is taken by a hard pad of cartilage against which the lower chisel-like teeth strike when the animal crops the herbage in the pasture. The arrangement of the teeth of the sheep is the same as that of the cow. Sheep and cows can crop the grass closer to the ground than can horses.

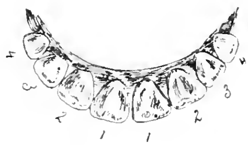
4. A calf, when born, has two pairs of incisors. The other two pairs appear during the first month. When a calf is 18 months old he loses the middle pair of "milk" incisors and grows a permanent pair. The next pair, one on each side, are replaced at 27 months of age, the third pair at 36 months, and the fourth or outside pair at 45 months. The

time of the appearance of these incisors varies within rather narrow limits, so that we are able to tell the age of young cattle fairly accurately. A calf also has a temporary set of molars which are later replaced with permanent ones; but they are not considered in estimating the age of the animal.

5. The stomach of the cow and of the sheep has four compartments. The first three help in the storage and mechanical manipulation of the food. The fourth is the true stomach of these animals, in which that part of the digestion takes place which we ordinarily think of as taking place in a stomach.

A cow chews her food twice. The first compartment of her stomach is large and enables her to eat a large amount of food without stopping to masticate it thoroughly. This food is stored temporarily in the first compartment of her stomach. Later, at leisure, she can lie in the shade and re-chew all her food. After the second chewing, the food is swallowed and passes along to the true stomach and on into the intestines in the regular course of digestion.

6. Coarse foods are adapted to the requirements of the cow. A cow can consume large quantities of such coarse foods as hay, cornstalks, and the like. Under modern conditions when cows are yielding large quantities of milk a large quantity of grain also is fed. The grain is made up of the ground cereals or the ground by-products from the manufacture of certain human foods.



Age of cattle told by permanent incisors. The middle pair, marked 1, appear at 18 months of age; the pair marked 2 appear at 27 months; the pair marked 3, at 36 months; the outer pair, marked 4, appear at 45 months

Succulent foods are peculiarly adapted to the needs of the dairy cow. The best food is, of course, the natural food of the cow, which is green pasture grass. At all times of the year when pasture is not available, some succulent food, such as corn silage or roots, should be given. The cow will respond in every way to special care, such as providing a variety in her ration, with some succulent food when possible.

For convenience in studying in detail the feeding of a cow, we divide her food into five great groups according to composition: water, ash, protein, carbohydrate, and fat. Her food is almost entirely of vegetable origin and the plants or the produce of plants that she eats are made up entirely of these groups of materials. The *water* in the plant is the same as any pure water with which we are familiar. It serves the plant in two important ways: by filling out the cells and thus helping in the support of the plant, and by transporting the food from the roots, or from wherever it is made, to those cells that need food. The *ash* of the plant is the mineral matter. The *protein* is the nitrogenous part of the plant tissue. The *carbohydrates* include the sugars and starches and like materials. The *fat* is the oil of the plant. All agricultural books use these terms, therefore the teacher should have the children familiar with them.

It is not easy to give common examples of the ash or of the protein of plants. These groups are intimately associated with the life of the plant and are present in all parts of it.

The plant may use any one or all three of the groups, protein, carbohydrates, and fat, as its form in which to store reserve food. Mainly, however, the common form in which reserve food is stored is in the form of carbohydrates, of which starch is the most common example.

The body of a cow is built up from the food that she eats. It is composed of the elements that also make up the plant body. These elements form numerous compounds, which may be grouped into the same five groups into which we separated the plant body or the food of the cow: water, ash, protein, carbohydrate, and fat. The chemical formula for an animal fat may not be the same as for the particular vegetable fat that was in her food; and this will hold true also for proteins and carbohydrates. In the animal body there are few compounds that are carbohydrate in nature. The plant, as noted above, stores its surplus food mainly as carbohydrate, with some protein and fat. The animal, on the other hand, stores its excess food material as fat. The proportion of protein in the animal body as a whole is large because the lean meat of the muscle tissue is nearly pure protein. A good example of animal protein is the albumen of an egg; another is the casein, or curd, of the milk. We have no common animal carbohydrate. Lard and tallow are common forms of animal fat.

What data we have go to show that in order to form the protein of the body the animal must have protein in the food. Any excess of protein in the food that is not needed to form body protein will be broken up. A part of the protein carrying the nitrogen will be excreted and the remainder will be used as carbohydrate material. The protein of the body can have no source except in the protein of the food. The carbohydrate material in the body can have as its source, protein, carbohydrates, or fat in the food. The fat in the body may be manufactured from the protein, carbohydrates, or fat. Therefore, to summarize, there must be a sufficient amount of protein in the food to keep up the necessary protein of the body, but the fat or carbohydrates of the body may be derived from any one of the groups (protein, carbohydrates, or fat) in the food.

The animal uses the water that it drinks and that it derives from its food to keep up the supply in the body, much in the same way that the plant uses its water to help support the body by keeping the cells distended, and as a transportation agent. The ash (mineral matter) taken into the body forms the bones and furnishes the mineral matter that is present in all the tissues. The protein makes up the muscle tissues of the body and any nitrogenous matter in the other tissues. The carbohydrates are used to furnish the energy for the muscles. Any excess of carbohydrates may be transformed into fat and stored as reserve material. Fats in the body are used to give energy to the cells, or they may be stored as body fat.

A cow or other animal has three uses for the food it takes into its body: (1) to furnish energy for the mechanical work of the body; (2) to repair any loss of material in the make-up of the body itself; (3) to store as fat any food material in excess of these needs. Fat and carbohydrates and excess protein over the protein requirements of the body, are used for energy and fat production. Some protein and ash are used for the repair work and for the new material added to the body in the case of the growing animal.

A ration is the amount of food that is fed to an animal in twenty-four hours for the above needs. The needs as to digestible protein, digestible carbohydrates, and digestible fat for our animals have been carefully calculated. Estimating the amount of food to meet these needs is called computing a balanced ration.

It has been found that there is a certain relation between the necessary amount of protein and of carbohydrates and fat in a ration. This relation has been called the nutritive ratio. The ratio is expressed between one pound of digestible protein and the necessary number of pounds of digestible carbohydrates and digestible fat. When the first term of the ratio is expressed as one, the second term is found by multiplying the fat by $2\frac{1}{4}$, adding to it the carbohydrates, and dividing this amount by the protein. The digestible fat is multiplied by $2\frac{1}{4}$ because fat is considered to yield to the body $2\frac{1}{4}$ times as much energy as carbohydrates.

For dairy cows, it has been found that a nutritive ratio between 1:5 and 1:6 seems to give the best results in milk flow.

To conclude: When we wish to compute a ration for a dairy cow weighing about 1,000 pounds, we try to furnish suitable food in sufficient quantity to yield about twenty-four pounds of dry matter, in which the relation of the protein to the carbohydrates plus $2\frac{1}{4}$ times the fat is as 1:5 or 1:6.

7. The breeds of cows are mentioned in some detail in the article in this number of the leaflet on the colors of cows. In order of richness of milk, the dairy breeds rank as follows: Guernsey, Jersey, Ayrshire, and Holstein. The milk of the Guernsey and the Jersey tests 5 per cent to 6 per cent of butter fat. The products of the Guernsey are a golden yellow; the products of the Jersey a somewhat lighter yellow, or cream color. The milk of the Ayrshire will average about 4 per cent of butter fat, while the Holstein gives milk testing on the average about 3.5 per cent butter fat.

The Shorthorn probably is held in higher favor in the United States than the other beef breeds, with the Hereford second; the Aberdeen-Angus stands third and the Galloway fourth.

New York is primarily a dairy State. Very little beef is raised in this State except, perhaps, in the western part. Most of the beef consumed is imported into the State from the great western markets.

To introduce the study of the cow successfully, the teacher should use every opportunity to become acquainted with the details of dairy work. There are excellent opportunities to use the dairy problems in the arithmetic and bookkeeping classes. Children who become interested in the business side of dairy farming will be a help and inspiration to their parents and will interest the parents in the school in a spirit of cooperation with the boys and girls and the teacher.

IV. FARM BUTTER MAKING

C. A. PUBLOW

No article of food is more appreciated at the table than good butter, yet no part of the meal is more difficult to procure. It is true that many farmers have taken advantage of the high prices offered for butter of finest quality, and are making a determined effort to provide conditions and utensils with which they may manufacture better butter; but the great majority of farmers in New York State do not make a uniform quality of good butter.

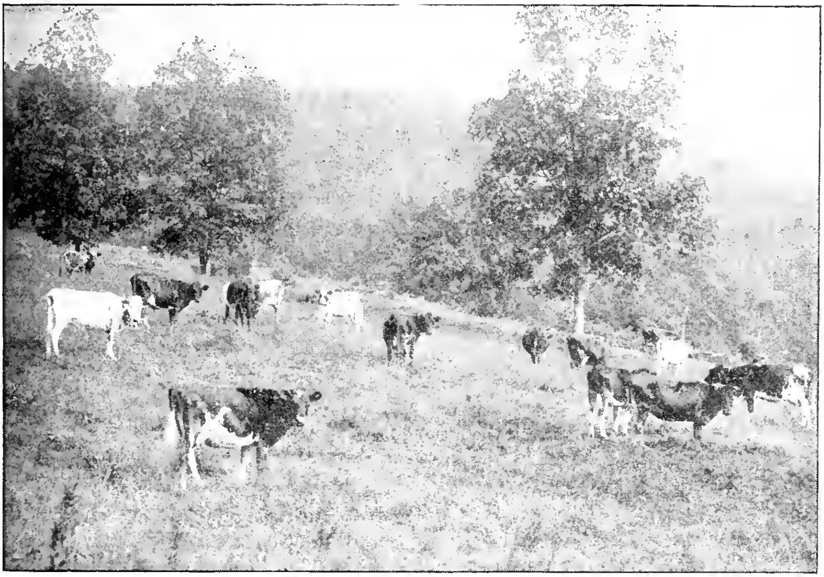
This is a serious problem for the dairy farmer to meet. Millions of dollars are being lost annually because dairy butter is of poor quality. One can readily appreciate this by reading the market reports. From these we learn that creamery-made butter sells for several cents per pound more than dairy-made butter. Surely this should not be, when the creameryman manufactures butter from cream from many herds, cared for under varied conditions more or less unsanitary, while the private dairyman has only the cream from one herd to care for, and should therefore have much better control over conditions that influence the quality of butter.

The most common causes of bad butter are as follows:

1. Unclean milk or cream.
2. Keeping cream too long or at too high temperature before churning.
3. Keeping cream in cellars or storerooms where strong-smelling vegetables or foods are kept.
4. Improper washing of butter to remove the buttermilk.
5. The use of too much salt.

When cream is saved for several days before churning, it must be kept very cold or the butter will be strong or rancid in flavor. It is much better to churn at least every two days; even though the quantity is small, if mild, fine flavor is desired in the butter.

There is a great opportunity for the farmer of New York State to obtain high prices for his butter if the quality is right. In order to have it right, everything surrounding the manufacturing process must be absolutely clean. The cream must be well cared for, and the butter must be put up neatly and be attractive. When this is done, the consumer will have less difficulty in securing good, reliable butter for table use, and the producer will find a more ready sale.



In the pasture

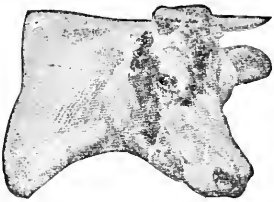
"I wonder that Wilson Flagg did not include the cow among his 'Picturesque Animals,' for that is where she belongs. She has not the classic beauty of the horse, but in picture-making qualities she is far ahead of him. Her shaggy, loose-jointed body; her irregular, sketchy outlines, like those of the landscape,— the hollows and ridges, the slopes and prominences; her tossing horns, her bushy tail, her swinging gait, her tranquil, ruminating habits,— all tend to make her an object upon which the artist eye loves to dwell. The artists are forever putting her into pictures, too. In rural landscape scenes she is an important feature. Behold her grazing in the pastures and on the hillsides, or along banks of streams, or ruminating under wide-spreading trees, or standing belly-deep in the creek or pond, or lying upon the smooth places in the quiet summer afternoon, the day's grazing done, and waiting to be summoned home to be milked; and again in the twilight lying upon the level summit of the hill or where the sward is thickest and softest; or in winter a herd of them filing along toward the spring to drink, or being 'foddered' from the stack in the field upon the new snow,— surely the cow is a picturesque animal, and all her goings and comings are pleasant to behold."

JOHN BURROUGHS

FOOD

LAYTON S. HAWKINS

(State Education Department)



We all know that food is necessary for the life of plants and animals. Plants make their own food from the materials that they get from the air and the soil. Animals cannot do this, but must use the food manufactured by plants. Some animals obtain this food directly from the plants, others from animals that have in turn lived on plants. Thus we see that all food really comes from the same source.

(1) Name all the animals that you know use only plants for food; all that use only animals; all that use some of each.

(2) Name two common domestic animals that now use both vegetable and meat food, but whose ancestors were exclusively flesh eaters.

All foods are a mixture or combination of several substances, called nutrients. These nutrients are three in number: (1) proteins, or proteids; (2) carbohydrates; (3) fats, or oils. In addition to these nutrients nearly all foods contain some mineral matter, as salt, lime, and the like. You will remember Professor Rice told you last year that nearly nine tenths of the white of the egg is protein.* Carbohydrate is a term applied to starches and sugars. Starch in nearly pure form is found in the potato and in cornstarch. Unfortunately for our understanding of all these nutrients, they are not always found in so separate a form as is the protein in the egg or the starch in the potato. In some cases they are combined in such a way that only the chemist can separate them.

Our diet or the ration of a cow means the total amount of food eaten in twenty-four hours. A balanced diet or ration is one in which the proper proportion of the above nutrients is maintained. (A well-balanced diet contains 10 to 15 per cent of the nutrients as protein, 25 to 40 per cent as fat, 40 to 60 per cent as carbohydrates. A well-balanced ration contains 12 to 20 per cent as protein, 3 to 5 per cent as fat, 80 to 90 per cent as carbohydrates [see page 75].) Many of our common foods are also fed to animals. Look up tables that show the relative amount of the various nutrients in our common foods.†

Protein foods build up the muscular tissues. They form new tissues in young, growing, and developing animals and replace the torn-down and

* Rural School Leaflet, September, 1911, page 139.
† In almost any physiology.

worn-out tissues in the adult. Carbohydrates furnish energy that is usually soon expended in the form of motion. Fats furnish energy mostly in the form of heat. These are not absolute uses, but are the chief uses. Mineral matter builds bones and performs other functions. Water acts as a cleansing and transporting agent. Water also acts as a diluting agent which prevents too great concentration of nutrient.

When more carbohydrate is eaten than is immediately used by the work of the body, the extra amount is stored as fat. This fat is used up in a time of need. Too much fat reduces the power of the muscles. Too much carbohydrate in proportion to the protein fed to a cow tends to produce fat instead of milk.

The most important constituent of living matter is protein. One great difference between proteins and carbohydrates is that proteins contain an element called nitrogen and carbohydrates do not. A diet or ration containing no protein could not maintain life, as the tissues would gradually waste away and death from starvation would be the result. Fats and carbohydrates alone would not be sufficient to keep an animal alive. Thus we find that whatever else is considered in the balancing of a diet or ration, the question of including protein of some kind in proper amounts must receive attention.

Most of the food received into the body is in solid form. Before this food can be taken up by the blood and distributed to the various parts of the body, it must be dissolved and so changed that the cells of the body can use it. The process of so changing the food is called digestion. The mouth, stomach, and intestines are the places where these changes are made. Proper cooking of food assists in this work.

(1) Compare the digestive process of the cow with your own. (See page 75.)

(2) In what parts of the digestive system are the various nutrients acted upon?

After the food is digested it is taken into the blood (some directly and some through the lymphatic system) and carried to all parts of the body. The various cells feed on this prepared food. They grow and develop. The blood also brings oxygen to these cells. The oxygen acts on the cells to free their energy in the form of heat or motion, much as the oxygen of the air acts on the coal or wood in the stove to free the energy of the wood cells in the form of heat. The blood then carries away the waste material. This waste material corresponds in a way to the gases that go up the chimney and the ashes that are removed from the stove.

This process of building up and tearing down is constantly going on in all living things. Life is directly dependent on the keeping up of this work.

ANIMALS TO BE RECOGNIZED IN 1912–1913

A. H. WRIGHT

The Goat.— The goat is closely related to the sheep, its horns rising from the forehead and curving backward, but not forming a spiral as do those of the ram. It is covered with hair of varying length, and the male has a beard. The legs are strong, though not large, and are fitted for leaping and running. The tail is short, like that of the deer. Our Rocky Mountain goat is not really a goat, but belongs to the antelope group. It is twice the size of any true goat and is white, with long, shaggy hair.

The goat plays a prominent part in family life in Europe and Asia, but in America there are relatively few of these animals. They are raised more extensively in the South and West. In this State there are perhaps not more than 2,000.

There are many kinds of goats, chief among which are the Milch, the Angora, and the Cashmere. The Swiss farmers have a very high type of Milch goat, which is a source of considerable revenue to them. In the winter these goats are kept in shelters and fed, but in the early spring they are sent to grazing grounds. They browse over great stretches of land. When properly cared for and kept clean, their milk is excellent and very nutritious. The butter is inferior, but many particularly choice cheeses are made from their milk. There are almost none of these animals in America, although there is no reason why the raising of goats should not prove a profitable industry.

The Angora goats first came from Angora, a city in Asia Minor 200 miles southeast of Constantinople. Their fleece is long, silky, and curly. Most of the mohair for mohair, alpaca, and camel's-hair goods is produced by these goats. Their skins are rather delicate, being used mostly as rugs or robes or for trimmings. Morocco leather also is made from their skins. Many flocks of these goats are raised in this country. Besides their intrinsic worth, they are especially helpful in clearing out underbrush, being very fond of leaves and twigs as food.

The Cashmere goats are raised mostly in Tibet. Their wool is long, silky, and straight. It is from this wool that the famous Cashmere shawls are made. It takes the wool from ten goats and the work of several persons for a year to produce one of the shawls.

The common goat is of the "mongrel" type; it will live anywhere and on very little food. The milk is good, but small in quantity. It is a question whether this goat could be raised with profit on a commercial scale.

The Fox.— The common fox of this State is the red fox, although the gray fox occurs to a slight extent in the southeastern part. The predominant color of our common species is reddish, as the name implies; feet and ears are blackish; tip of tail, white. The ears are about three inches long. Three distinct color variations of the red fox are found, together with many intermediate forms. The cross-fox is like the red, but with a dark cross on the back of the neck. The silver fox is entirely silver-gray. The black fox is blackish.

In character the fox is bold to the point of recklessness, and very wild. He seems to scheme and lay plots to outwit an enemy and is very quick to learn to avoid danger. He apparently loves hunting, enjoying the excitement of the chase even though he does not catch anything. His sense of hearing is so keen that he depends largely on it in this sport. Reynard's weakness for poultry is a source of much trouble to farmers. He often carries away his booty with its neck between his teeth and the bird swung across his shoulder.

These shrewd animals have established runways that seldom pass between houses less than one half mile apart, but that always cross streams over the bridges. The footprints of a fox show four toe pads of equal size, with distinct marks of the claws in front of them — differing from the cat, whose claws are concealed; the prints differ also in that the hind foot does not fall in the footprint of the forefoot as does that of the cat. Unlike the dog, the toes seldom drag, the feet are set in a straight line, and the tail occasionally brushes the snow.

Foxes live in dens, which are usually abandoned woodchuck burrows in a sandy hillside, enlarged to suit the new occupant. The male seldom enters the den save to carry food to the cubs. He prefers to sleep on a flat rock or ledge in the open, occasionally choosing a hollow tree trunk.

The bark of the fox is thin, querulous, and husky, with an occasional long wild screech included, the latter being heard in the spring when there are young to be protected.

The gray fox is a wholly distinct species. He is smaller and of different build, dull yellowish gray, and usually lacks the white tip on the tail. He is distinctly a creature of the forest, preferring to live in hollow logs or tree trunks, subsisting on the small creatures of the forest and at times on the fruits found there.

The Skunk.— This animal is about two feet long. His typical marking is his covering of long black hair, with a white patch on the back of the neck from which two stripes extend down the back and along the sides of the very large and bushy tail. There is a thin white stripe down the forehead. Some animals have much less white than others, and some have the two white stripes uniting to form a broad band down the back.

The skunk prefers to live in clearings and pastures near houses, under one of the farm buildings or in some dry hole not far distant.

He travels mostly at night and so is seen only at dawn or early evening. He catches quantities of mice and insects, thus doing the farmer much more service than the loss that results from stealing a few eggs and chickens. He also delights in salamanders, frogs, and the eggs of birds that nest on or near the ground.

The characteristic most closely associated with this animal is beyond doubt his " odoriferous gun." This comes from a fluid secreted by large glands just under the tail, with ducts ending in papillæ that can be protruded and directed as the owner desires. Although armed with so wonderful and effective a weapon, the skunk is very conservative in its use, employing it only in defense and then giving fair warning by his actions and by raising his tail. With provocation, the spray can be thrown ten feet. At night it is slightly luminous. It is perhaps because of the effectiveness of this weapon that skunks have abandoned the agile ways of their brothers, the weasels and the minks, and have become fat, lazy, and slow in their movements. These characteristics are certainly seen in their tracks. In general, the track consists of a double line of footprints, which are about the size of those of the domestic cat and about half as far apart. The toe nails, however, form conspicuous and characteristic marks. When the animals hurry, the footsteps are often in groups of threes or oblique rows of fours. Skunks hibernate only in the severest months of the winter, coming out whenever the temperature allows, regardless of the amount of snow on the ground.

The young are born about the end of April or the first of May, four to six, or even ten, in a litter. They are about the size of a mouse, naked, and with their eyes and ears closed. They stay with the parents through the first winter even though full grown, so that eight or ten skunks of one family are frequently found in one den. Each goes out for himself in the early springtime. Young skunks are easily tamed, making very attractive and interesting pets. They are easily caught in a trap or by digging out a den.

The flesh of the skunk is commonly eaten by Indians and trappers and is said to be white and of delicate flavor.

"Sir Mephitis Mephitica, or, in plain English, the skunk, has waked up from his six weeks' nap, and come out into society again. He is a nocturnal traveler, very bold and impudent, coming quite up to the barn and outbuildings, and sometimes taking up his quarters for the season under the haymow. There is no such word as hurry in his dictionary, as you may see by his path upon the snow. He has a very sneaking, insinuating way, and goes creeping about the fields and woods, never once in a perceptible degree altering his gait; and, if a fence crosses his course, steers for a break or opening to avoid climbing. He is too indolent even to dig his own hole, but appropriates that of a woodchuck, or hunts out a crevice in the rocks, from which he extends his ramblings in all directions, preferring damp, thawy weather. He has very little discretion or cunning and holds a trap in utter contempt, stepping into it as soon as beside it, relying implicitly for defense against all forms of danger upon the unsavory punishment he is capable of inflicting."

JOHN BURROUGHS

The Muskrat.— The muskrat is two feet long, its color a rich dark brown above, grayish below, with the sides and belly tinged with rust color. The body is thickset, the legs short, the tail scaly, nearly naked, and flattened laterally. The fur is thick with woolly underfur. The skins supply a very good quality of fur.

Muskrats live in water and on its banks, except in the early fall when they may wander several miles from their accustomed habitat. They are excellent swimmers and divers. They build elaborate homes and seldom travel more than 200 yards from them. In their travels the tail trail makes their tracks conspicuous. The footprints are arranged in a zigzag line, with the toes quite distinct. When the animals are alarmed, the footprints are in a pattern something like those of the rabbit.

The homes of muskrats are of two kinds, huts and burrows. The huts are used in winter, the burrows at all times. The entrance to the burrow is below the water level and from this a path leads upward to the den, some distance inland and often very near the surface. Several galleries may lead away from this chamber and there may be several passages leading to it. It is by the caving in of these burrows that the damage is done to fields, dams, and levees. The muskrat hut is started in the water, where a small " haycock " of vegetation and mud is piled up. The top is well out of water and contains an air chamber, from which one or more pathways lead downward. This dome is built largely of plant stems and roots that the animal will eat in winter. During the winter the muskrats are very active, swimming around, coming to the edge where there is air space to breathe, or, when the ice is close to water, merely rising to the surface, exhaling their bubble of air against the ice and then taking it again refreshed by contact with the freezing water. Throughout the year they live largely on marsh grasses and aquatic plants, but occasionally they eat fish and water mussels also.

Although these animals are so diligently hunted and trapped, their number is maintained because they are so prolific. Five to nine young are born at a time, and they are said to raise three litters a season, the young maturing very rapidly.

The mink and the great horned owl are the worst natural enemies of the muskrat.

" In the fall of 1878 I observed that the muskrats built unusually high and massive nests. The builders worked only at night, and I could see each day that the work had visibly advanced. The houses were placed a little to one side of the main channel, and were constructed entirely of a species of coarse wild grass that grew all about. So far as I could see, from first to last they were solid masses of grass, as if the interior cavity or nest was to be excavated afterward, as doubtless it was. As they emerged from the pond they gradually assumed the shape of a miniature mountain, very bold and steep on the south side, and running down to a long gentle grade to the surface of the water on the north. One could see that the little architect hauled all his material up this easy slope, and thrust it out boldly around the other side. Every mouthful was distinctly defined."

JOHN BURROUGHS

The Frog.— The kinds of frogs of New York State are five in number, smooth and moist of skin, and have no disks on their fingers or toes.

The most abundant form is the *leopard frog*, whose upper parts may vary from bronze to bright green, with irregular scattered spots. Its under parts are white. It comes out of hibernation the last of March or the first of April. Almost immediately it migrates to swampy localities, where the eggs are laid in flattened, submerged, jelly masses (3,500 to 4,500 eggs in a mass). These hatch in ten to twenty days, and ninety days after the eggs are laid — that is, in the middle of July — the tadpoles lose their tails, assume legs, and change to the adult form.

The *pickerel frog* resembles the bronze-colored leopard frog, except that the spots are square and the under parts of the legs and belly are orange yellow. It appears in the spring about the middle of April. The eggs are deposited in globular submerged masses (2,000 to 3,000 eggs in a mass). The individual eggs have a decided yellow color. The tadpoles transform during the last days of July, about ninety to one hundred days after the eggs are laid.

The *wood frog* is the smallest of the five. In color it is either light or reddish brown above, with a darker brown streak or mask on either side of the head. Underneath it is a glistening white. It appears in early spring — the last of March or first of April — immediately begins to lay globular submerged masses of eggs (2,000 to 3,000 eggs in a mass), and hastens away to the woods again. The eggs hatch in twelve to twenty-four days. The tadpoles transform about ninety days after the eggs are laid.

The *green frog* is slightly larger than the leopard frog. The forward upper parts are bright green, the posterior region brown or olive. The ear plate, or tympanum, is as large as the eye — in the male, larger. The under parts are white, with some marblings; in the male the throat is yellow. The green frog appears in the middle of April and begins spawning in the last of May. The spawning may extend into August. The egg mass (3,500 to 4,500 eggs) is laid among vegetation and is one flat, continuous film, less than one foot in diameter, on the surface of the water. The eggs hatch in four days. In July of the next year the tadpoles change to adults.

The *bullfrog* is much larger than the green frog, but has not the two ridges down its back. It appears from hibernation about the middle of May. The eggs are laid from June 1 to August. They are deposited in a frothy film which floats on the water among brush or near the roots of upturned stumps. The film is over a foot in diameter. The tadpoles live as such for two years before they change in July to the adult form.

"*I know of no other animal capable of giving forth so much sound in proportion to its size as a frog.*"

JOHN BURROUGHS

INSECT STUDY

THE EDITOR

THE study of economic entomology is important in all farm communities. The interest is increased when the relation of insect life to plant and animal life is taught.

A good piece of work for the year would be to have the children try to find out which is the most injurious insect in the neighborhood. In connection with language work, encourage them to write letters to the State College of Agriculture, to the Experiment Station at Geneva, and to the Department of Agriculture at Washington, in order to get all information possible regarding the insect they are studying.

The work on insects given in the New York State Syllabus is in three groups: For special study, the *potato beetle* and the *lady beetle*. For recognition, the *tent caterpillar*, *honeybee*, *ant*, *hornet*, and *spider*. (Lessons on the honeybee, ant, and hornet were given last year, and a copy of the September leaflet for 1911 will be sent to any teacher who did not receive one.) The third group includes one biting and one sucking insect, for which we have selected the *cabbage butterfly* and the *plant louse*. The latter is valuable for study this year, since the lady beetle is the insect given for special work and it destroys many aphids, or plant lice. This will give the teacher an opportunity to discuss a beneficial insect and an injurious insect at the same time.

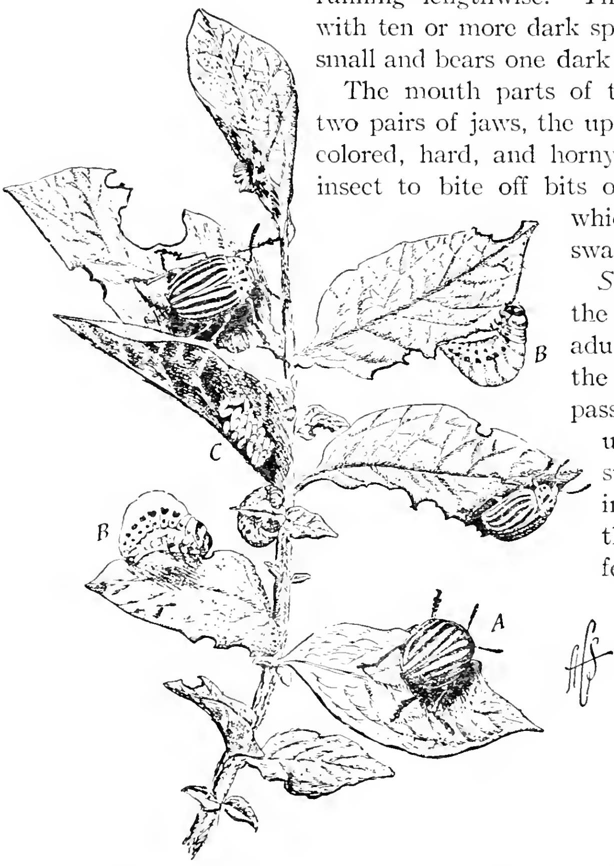
THE COLORADO POTATO BEETLE

GLENN W. HERRICK

The writer recalls the early days of the "potato bug" in New York State and the tedious method of knocking it off the vines into pans of kerosene. Its advent as a pest on potatoes caused a good deal of consternation and as much discussion as has the San José scale insect on fruit trees. This beetle migrated from its original home in Colorado, where it lived on a wild plant of the potato family, and gradually worked its way eastward from field to field of potatoes until, in 1872, it had reached New York. Now it is probably the most familiar insect pest on the average farm. It is no longer seriously dreaded, although it still has to be fought. It not only destroys the vines and lessens the yield of tubers, but actually affects the quality of the potatoes. Where these beetles are abundant on the vines the potatoes are likely to be watery and of poor quality.

Appearance of the beetle.— The adult insect is called a beetle because it has two hard, horny wing covers that close over and hide the true thin wings, the chief organs of flight. The beetle is a robust insect nearly half an inch long, and has a ground color of ocherous yellow, almost reddish yellow at times. Each wing cover is ornamented with five black lines running lengthwise. The thorax is marked with ten or more dark spots, while the head is small and bears one dark three-cornered spot.

The mouth parts of the beetle consist of two pairs of jaws, the upper pair being dark-colored, hard, and horny. These enable the insect to bite off bits of leaves and stems, which it chews and swallows.



Potato stalk with beetle at work: a, beetle; b, grub, or "slug"; c, eggs

Story of its life.— In the fall of the year the adult beetles burrow into the ground, where they pass the winter. They usually go below the surface eight or ten inches, but sometimes they are found several feet underground.

Occasionally individuals hide away beneath piles of rubbish. In the spring the beetles work their way out of the ground very early and during warm days make long flights, so that they are well distributed over the fields and ready for the potato plants as soon as they push through the soil. After feeding a few days, the mother beetles begin to deposit their orange-colored eggs in clusters on the leaves. The eggs hatch in a week or ten days, depending on the temperature, and the young grubs begin at once to eat the leaves. The grubs have soft, red bodies, with two rows of dark spots along each side. They also have biting mouth-parts and are always apparently very hungry. They eat most of the time, grow very fast, and become full-grown in two to three weeks. When mature they go to the ground and burrow beneath the surface, where each one makes a snug cell in which it soon changes to a pupa. The pupa remains in its cell for two weeks or longer and then transforms into the adult beetle. These beetles come out of the ground and lay eggs for another generation, which usually is the last one.

Natural enemies.— Most of us have no idea how often we are aided in our fight against insect pests by our friends the birds, toads, ladybird beetles, flies, wasp-like parasites, and other helpers in the struggle. The enemies of the Colorado potato beetle are many and we are certainly indebted to all of them for the eggs, grubs, and beetles that they destroy.

Perhaps the most efficient enemies of the potato beetles are the ladybird beetles. At least eight different kinds of ladybirds attack and destroy the potato beetle in some of its stages. We should become acquainted with these ladybirds so that we may protect them if possible, and certainly not destroy them. Both the adult ladybirds and their larvæ feed on the eggs and grubs of the potato beetle and destroy great numbers of them.

There are also several kinds of rather large, dark-colored beetles, known as ground beetles, which prey on the potato beetle and its grubs.

A certain fly, called a tachina fly, lays its eggs on the grubs. The eggs hatch and the maggots bore through the skin of the grub and live inside its body, finally killing it. It is said that the tachina flies are sometimes so abundant in fields of potatoes that their buzzing sounds like a swarm of bees. These flies must aid us greatly by killing many of the potato beetle grubs.

Toads and snakes devour many of the potato beetles and help greatly in the fight. Birds, too, join in the good work, especially the rose-breasted grosbeak and the bobwhite, or quail. Robins, crows, nighthawks, cuckoos, and other birds also destroy potato beetles.

Methods of control.— Since both the beetles and the grubs have biting mouth-parts, they are best destroyed by spraying the potatoes with an arsenical poison. The substance most commonly used is paris green, a very strong poison, and one that is likely to burn the leaves unless quicklime is added to it. It should be used at the rate of 1 pound to 100 gallons of water, with two or three pounds of good quicklime carefully slaked and added to the water.

Potatoes are subject to the disease known as blight, and most potato growers spray their plants with a fungicide known as bordeaux mixture to control this disease. It is not necessary, however, to make separate sprayings for the blight and for the potato beetle, since by combining the paris green with the bordeaux mixture, 1 pound to 100 gallons, both objects may be accomplished. In this case, because the bordeaux mixture is largely composed of lime, it will not be necessary to add more of this material.

Some potato growers prefer to apply the paris green dry by mixing it thoroughly with 10 to 20 parts dry flour or fine air-slaked lime. Others actually dust the pure poison on the plants in the early morning while the dew is on the leaves. The dust is best applied by means of a powder gun or "dust-spray" machine. In case the pure paris green is used, only a small amount of it should be dusted on the plants because it is likely to burn and kill the leaves.

The first spraying should be made as soon as the eggs begin to hatch and the young grubs are seen on the plants. In severe cases two applications, a week or ten days apart, may be necessary.

Arsenate of lead is also a much-used poison for biting insects and is often applied to control the potato beetle. It sticks to the plants much better than does paris green, but, since it is a weak poison, more of it has to be used. The best results will be obtained by using it at the rate of 5 or 6 pounds to 100 gallons of water or of bordeaux mixture.

OBSERVATIONS FOR PUPILS

What color are the potato beetles? How many black lines are there along the back of each one? Examine the mouth of a beetle and see whether the hard, black biting jaws can be found. How many are there? How many wings does each beetle seem to have? What is the difference between these wings? The top ones are called wing covers and are probably not true wings. Watch the beetles flying and see which wings are used for flight.

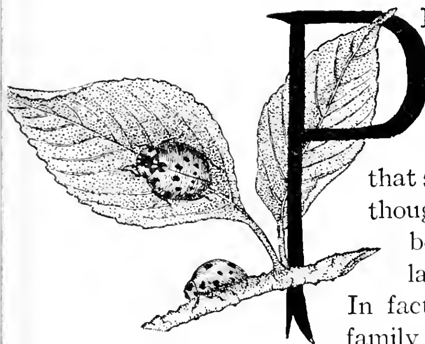
Where are the eggs mostly laid? How many eggs in one bunch? What color are the eggs? Find out, if possible, how long it is from the time the eggs are laid until they hatch. Beetles may be kept on plants grown in the house. A lantern globe should be placed over the plant and a piece of muslin tied over the top.

Describe the grubs, or "slugs" as they are often called. What color are they? Do they have any markings on their bodies? What kind of mouth parts do they have? How do they injure the plants?

Take one of the beetles in the hand and squeeze it slightly. Does it give out a fluid? What color is the fluid? Does it have an odor? Is the odor pleasant? The liquid issues from the hind edge of the thorax and the front parts of the wing covers. It is probably distasteful to birds and may aid in protecting the beetles from their enemies. The grubs eject a similar fluid.

THE LADY BEETLES

ANNA BOTSFORD COMSTOCK



PERSONS who do not know about the small brothers of the fields have an idea that all insects are injurious to our human interests. This, however, is a very unjust view; there are many insects that spend their whole lives doing us favors, even though we show no gratitude. Some of these beneficial insects belong to the family of ladybirds, as these small beetles are called. In fact, all except one or two members of this family are very friendly indeed to the gardener, the fruit grower, and the farmer; for instead of feeding on plants, they feed on the plant lice and the scale insects that infest plants.

The ladybirds, or ladybugs, are small beetles that look like pills of various sizes cut in half with legs attached to the flat side. Some species are brownish red with black spots; some are black with reddish or yellowish spots. Throughout the land, whenever a country child sees one of these ladybird beetles, he addresses it thus:

> " Ladybird, Ladybird, fly away home,
> Your house is on fire, your children are burning."

But Ladybird is not at all frightened at this piece of news, because she does not know where her children are, and I am afraid she would not know one of them if she met it. She performed her last duty to her family when she laid a cluster of yellow eggs on the underside of a leaf of some plant infested with plant lice or scale insects; and from every one of these eggs hatched a little creature that is very different in appearance from its mother. It is a long, rather flat, velvety creature, covered with warts and short spines and black or brownish black in color, ornamented perhaps with some bright-colored spots. It moves around briskly on six stiff little legs, one pair to each of the three segments of the body next to the head. The first thing this little creature does is to hunt for a stupid plant louse or scale insect and promptly seize it with strong jaws and chew it with great gusto, not leaving even a leg to tell the tale. A great many of these insects must share a like fate before the larva ladybird grows enough so that its skin is too tight for comfort. When this occurs the old skin is shed and a new skin takes its place, giving the greedy youngster plenty of room, so that it starts on a new crusade against the plant lice and then repeats the process. At last, when it is perhaps half an inch long, some day it hangs itself up and sheds its old spiny skin and changes into a queer little spotted pupa. Here it hangs, still and helpless, for some days, and then the pupa skin bursts, and out comes a little hemispherical ladybird which may soon be ready to lay more eggs. Or, if too late in the season for this, she may seek a cozy nook in which to pass the winter. We often find her in the curtains about our windows and we should be very careful not to harm her; instead, we should cherish her and let her out when spring comes, so that she can go on helping us. The help the ladybirds give us is all the more valuable because both plant lice and scale insects have mouth parts in the form of a sucking tube, which is pushed down into the stem of the plant, thus reaching the sap and sucking it up, injuring the plant. Spraying the plants does not inconvenience these insects at all, because they never get a taste of the poison applied to the outside of the plant.

Larva, pupa, and adult of a species of ladybird

If we look at a ladybird carefully we can see that she has attached to her head a pair of short, club-like antennæ. Behind the head is the thorax covered with a shield, which is broader toward the rear and is ornamented in various patterns. The head and thorax together occupy scarcely a quarter of the length of the insect, the remainder consisting of the half-globular body encased in polished wing-covers. Below these wing covers is a long pair of dark wings, which are folded crosswise when at rest.

The ladybird is a good flyer as well as a rapid runner. One of the greatest achievements of economic entomologists was the introduction on the Pacific Coast of a ladybird from Australia, called the Vedalia, which preys on the cottony-cushion scale insect, a species of insect introduced from Australia also and very injurious to orange and lemon trees. Within a few years the introduced ladybirds had completely exterminated this pest.

LESSON FOR THE PUPILS

Method.— The ladybird beetles are very common in the autumn and may then be brought to the schoolroom and passed around in phials for the children to observe. As many species as possible should be collected. The ladybird larvæ may be found on almost any plant infested with plant lice. A plant with the insects on it may be brought into the schoolroom and studied.

Observations for the pupils.—1. How large is the ladybird? What is its shape?

2. Describe the colors of your ladybird. How many kinds have you seen?

3. Can you see the ladybird's head and antennæ? Can you see, back of the head, the thorax covered with a shield? How is this ornamented?

4. What are the colors of the wing covers? How many spots are there on them? Describe the position of the wing covers when the ladybird is flying. Where does the ladybird keep her true wings when at rest? Describe the wings.

5. Note the legs and feet and describe them. To what part of the body are the legs attached? Is the ladybird a good runner?

6. Describe how a ladybird plays possum when disturbed? Of what use is this to the insect?

7. Describe a young ladybird. Does it look like its mother? What is its shape? Is it polished like its mother, or is it warty and velvety?

8. How does it act when eating? Can you see how it uses its jaws when eating? Describe its legs. Is there a claw at the end of each foot?

9. Describe the action of the ladybird larvæ in attacking and eating plant lice or scale insects.

10. Describe how a ladybird larva grows by shedding its skin.

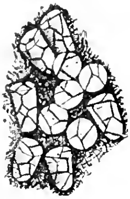
11. Feed the larva by placing it on fresh plants covered with plant lice, and note its growth. What happens when it changes into a pupa? How does it look when in the pupa state? What happens when the pupa skin bursts?

12. Where do the ladybirds spend the winter? Why should we take good care of them?

THE APPLE-TREE TENT-CATERPILLAR

ANNA BOTSFORD COMSTOCK

The moth of the tent caterpillar is a canny mother and does her best to protect her eggs from their enemies and from the vicissitudes of winter. This is an especially wise proceeding on her part, for she lays her eggs in the summer, and there they must stay safe and sound until the coming spring. She selects some apple twig and on it she lays her beautiful white eggs, each shaped like a thimble; she arranges them in a mass that encircles the twig, and weaves around them a net of dark, firm cement that holds them fast in place. Then she covers the whole mass with a waterproof varnish, which protects the eggs from dampness and at the same time makes the egg mass look like a swollen bit of the twig, so as to deceive hungry birds. In fact, few birds, except the chickadees, find these eggs. This busy midget makes it his business to carefully examine twigs in his search for insect eggs, and so he has discovered this mother-moth's egg basket.



Eggs (enlarged)

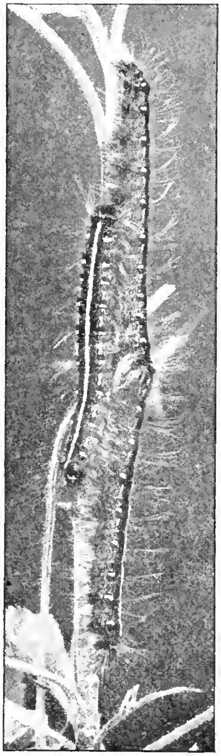
From these eggs hatch tiny caterpillars with large heads. The first thing they do is to have breakfast from apple buds or new leaves; then they climb down the twig, the whole family together, to the nearest fork of the branch that offers a convenient support for their home, and there they begin to spin their web, or tent. The silk gland is within the body of the caterpillar, but it has its opening near the lower lip, so that the caterpillars seem to spin silk from their mouths; the spiders, on the contrary, have their spinnerets on the rear end of the body. The web of the tent caterpillar is at first a little triangular affair, consisting of irregular sheets of silk between which the tiny caterpillars can be protected from the rain, just as cozily as we are in our tents when we are out camping. There they stay during the nights and on dark and stormy days; only on pleasant days do the caterpillars go out to get their food, which consists of the leaves.

And wherever he goes each little caterpillar spins a thread of silk so that he has no trouble in finding his way back home. Each caterpillar grows for a time until his stiff, horny skin is too tight for comfort. He then retires into the web and sheds the old skin, and afterward goes back to his business of eating in a new elastic skin that gives him plenty of room; but this, too, hardens and in turn must be shed, for this is the way all young insects grow. Each time the new skin may be a little different in color from the old one.

Egg mass

The tent caterpillars are social insects and always live together in peace and harmony. As they grow they enlarge their tent until it is sometimes two feet or more in length. Finally, when fully grown the whole band scatters and each for himself finds a place in which to pass the pupa state. At this time any one who is unprejudiced must admit that the tent caterpillars have beautiful colors. They are velvety brown, spotted with purple and yellow, and have a most ornamental fringe of "whiskers" along each side of the body. They have six true legs, one pair to each of the three segments of the body behind the head. Each of these legs has a sharp, shining claw at the tip. These true legs are used often for holding the leaf in place while the caterpillar eats; meanwhile, he holds himself to the branch by four pairs of fleshy legs with hooks on them, which extend down from the sixth, seventh, eighth, and ninth segments, counting from the head. And, lest he fall off, he has on the last segment of the body a clasping foot, called the prop leg. On each side of each segment, except the first, there may be seen a breathing pore, or spiracle, through which air is drawn into the insect's body to purify the blood.

Our fully grown, uneasy caterpillar finally finds snug quarters on the underside of some board or stone, and there it spins a thick cocoon, shaped like a slender jug without a handle. The silk of the cocoon is white and with it is mixed a yellowish white powder. Once within the cocoon the caterpillar sheds its skin, and it now appears as an oblong, smooth object, very little like a caterpillar in shape. This is its pupa state, and during this time it develops within itself its wings and various other adult organs. In about three weeks the pupa skin bursts open and the insect crawls from the cocoon, a pretty moth with dull yellowish or reddish brown wings and with two whitish stripes across each front wing. The adult moths usually appear the last of June or the first of July and soon afterward the mother moth lays her eggs.



Apple-tree tent-caterpillars

There are several ways of protecting our orchards from the ravages of this caterpillar. A common way is by destroying the webs with a torch. It is necessary to apply the torch on dark or stormy days, so that the little inmates may be destroyed with their tent. But nowadays we trust to spraying. We must spray as soon as the apples are out of blossom for the codling moth and the apple scab, and this spray settling on the leaves usually kills the apple tent-caterpillars very early in their career.

LESSON FOR THE PUPILS

Method.— This is one of the most valuable and interesting lessons for the spring term. The pupils should search for the egg masses during the winter or early spring, while the boughs are bare. The picture will show them what to look for. These egg masses may be brought to the school and left out of doors so they will not hatch too early. In April bring in twigs from apple or pear trees, place them in water, and place the twigs with the eggs among them. After the worms hatch, fresh apple leaves should be given them. If they seem inclined to wander, confine them in a box made of mosquito netting tacked to a frame. Meanwhile the pupils should hunt the orchards for those beginning nests. If one is found near by it should be studied and the caterpillars allowed to develop naturally so that the pupils may become thoroughly familiar with their habits and methods of growth.

Cocoons of the apple-tree tent-caterpillar

Observations for the pupils.—1. Why do we not readily see the eggs of the tent caterpillar? Of what use is this protective covering to the insects?

2. Describe the egg mass and where it is found. Is it varnished outside? Of what use is this? Remove some of the varnish and examine the eggs. How do they look? How are they made fast to the twig?

3. What hatches from the eggs? How many caterpillars come from one egg mass? Describe one of the little caterpillars.

4. What do the little caterpillars begin very soon to do? What sort of a place do they select for making their silken tent? From what part of the body do they spin their silk? How does this differ from the method of the spider? Describe how the tent is enlarged.

5. Observe closely, and if possible describe, how a caterpillar sheds its skin. Why does it do this? Is the new skin likely to be of different colors and markings from the old? Note this carefully.

6. Observe in some orchard at what time of day and during what sort of weather the caterpillars remain in their tent. Of what use is this knowledge to us?

7. At what time of day and under what conditions of weather do the caterpillars go out of the tent to feed? Describe how they destroy the leaves. How does this injure the tree?

Moth of the apple-tree tent-caterpillar

8. Do the caterpillars all live together while they are growing up? Do they still remain together after they are fully grown? Describe a caterpillar that is fully grown,

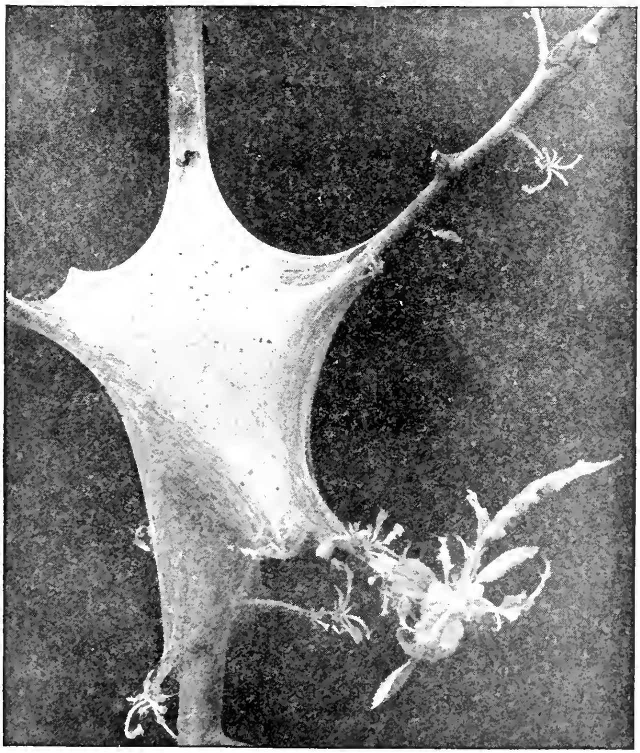
giving the number of its segments, its colors, and markings, the number of its legs, and the appearance of the breathing pores.

9. Why does the fully grown caterpillar leave the tree and crawl down to find a place to hide? What does it do in its hiding place?

10. Describe the cocoon. Where was it spun? Cut open a cocoon and describe the pupa. What happens to the insect during its pupa state? Collect all the cocoons you can find and put them in a box, so that you can secure the moths when they issue. Describe one of these moths.

11. How can we protect our orchards from these caterpillars? How do the chickadees help us in this work?

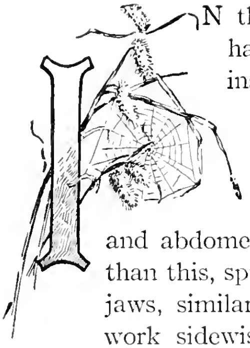
12. Are these tent caterpillars more common some years than others? Did you notice many of their white tents the past summer? Watch for them next spring and see whether they are common again. On what kinds of trees and shrubs do you find these tents? Are there more on wild cherry than on any other plant?



Tent of the apple-tree tent-caterpillar

SPIDERS

ANNA BOTSFORD COMSTOCK



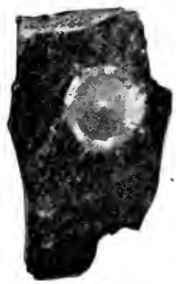
IN the opinion of some persons who are not in the habit of counting what they see, the spider is an insect. This is quite as absurd as calling a rabbit a bird; for any one not blind can see that the spider has eight legs and the insect only six, and that the spider has only two parts to its body, while the insect has three — the head, thorax, and abdomen; the spider has its head and thorax joined. More than this, spiders never have wings. Spiders have two pairs of jaws, similar to the jaws of insects, and in most cases they work sidewise instead of up and down as do our jaws. The first pair of jaws is called the mandibles and the second pair, the maxillæ. Each of the inner jaws, or maxillæ, bears a large feeler, called the palpus. In some spiders these palpi are long, resembling legs, while in the males the tip of the palpus is knob-like in form.

The eyes of spiders are not like the large compound eyes of insects. They are single, each shining like a little gem, and are usually four in number; however, there may be but two, or there may be six.

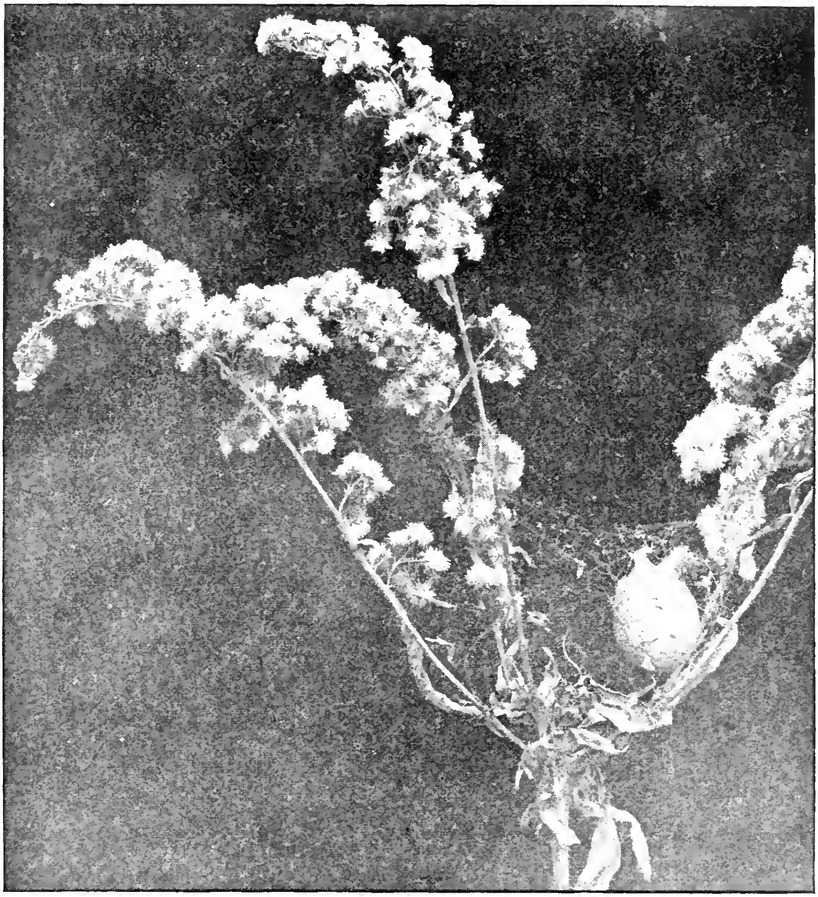
The most interesting of the spider's organs are its spinnerets. These are tiny organs at the tip of the rear end of the body, and on each spinneret are many tiny tubes, sometimes as many as two hundred and fifty, each tube capable of spinning a strand of silk. The silken thread of the spider is indeed most delicate, and yet each single thread is made up of several strands.

The spider's silk is of various kinds and is used for various purposes, as follows:

1. The silk is used to make a protecting sac for the eggs. These sacs vary greatly in appearance. One is jug-shaped and as large as a marble, and is suspended by silk in the top of weeds; this is the sac of the large yellow-and-black spider that makes its orb web in the bushes in fields. Some spiders make globular egg sacs and hang them on lines of strong silk in bushes; others build soft, yellow, downy sacs under stones or boards or in other protected places; while a very common spider of our fields, which does not make a web at all, spins a shining egg sac attached to stones. This sac is flat, circular, and silvery in color and is not so large as a ten-cent piece. In all spiders' egg-sacs there are placed many eggs, and in the case of some observed



Egg sac of a common spider found on stones in fields the stronger spiderlings within the sac devour their weaker brothers and sisters — a fate which the latter seem to take calmly, as if it were a perfectly natural proceeding. Thus, from a nest containing originally 500, perhaps not more than 40 or 50 spiders will emerge .



Egg sac of a large orb weaver

2. Spiders use silk as a means of getting about in the air. If we disturb a spider's web the spider will drop to the ground, extending as it goes a line that keeps it from falling; and as soon as all is well, it climbs back up its rope ladder and returns to the net. But if a spider wishes to make a bridge from one point to another, it spins a thread that floats away on the breeze; the thread is sticky and as soon as it touches something

it sticks fast, and the spider pulls in the slack, making the line tight, fastens it, and thus has a bridge along which it can pass at will.

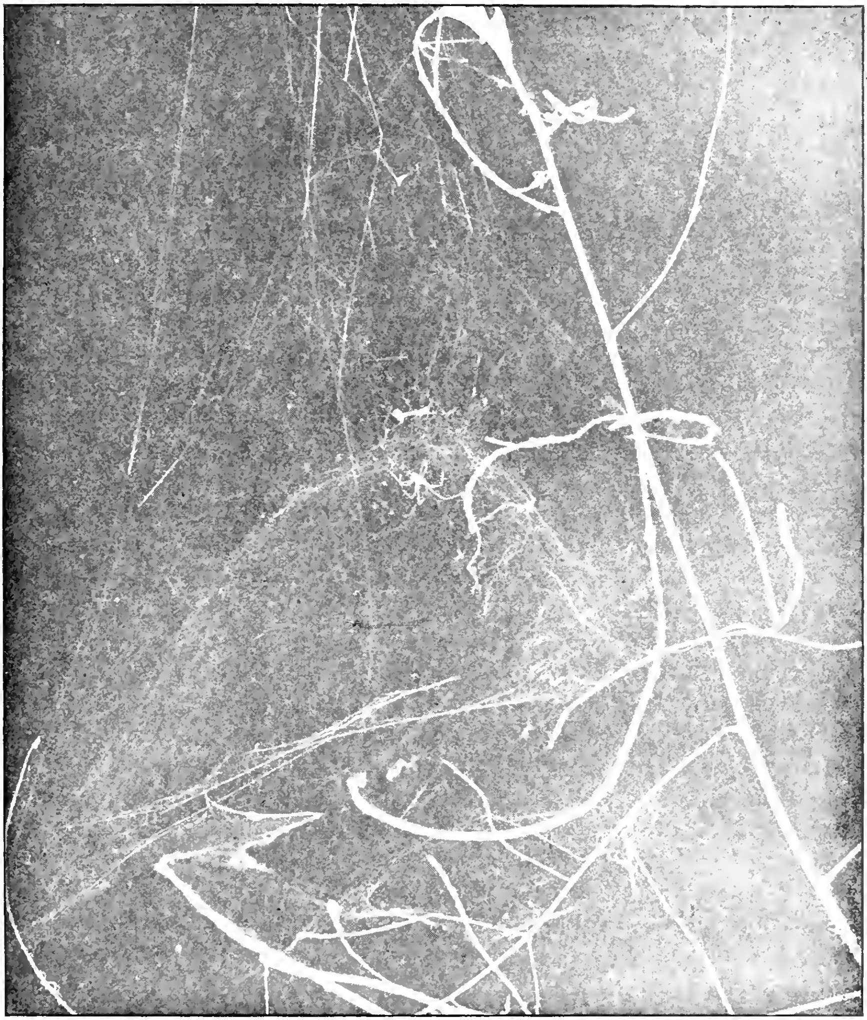
But the young spiders have a more wonderful way of traveling than this: After one of these little creatures is large enough to get about, it climbs to some elevated place, such as the tip of a grass blade, lifts the end of its body, with the spinnerets high in the air, and spins out a thread which the breeze catches and carries upward. When the thread is long enough

Web of the grass spider

to support the tiny spiderling, it lets go its hold and sails off attached to its silken balloon. Thus we see young spiders are scattered far and wide, as are dandelion seeds or milkweed seeds, carried by silken balloons; but the spider's balloon is likely to be just one long thread. Often these threads become attached to grass and weeds, and thus on autumn mornings, when the spiderlings are ballooning, the fields may be seen covered with these threads of silk.

3. Some spiders use silk to line their nests and to make tubes, within which they live. In this way the trap door spider lines its burrow with silk and carefully lines the hinges of its trapdoor with the same useful material.

4. Many spiders use silk to make snares in which they catch the creatures on which they feed. These snares occur in many forms. A few are as follows: the cobwebs in the corners of rooms near the ceilings, each



Filmy dome

consisting of a sheet of silk supported by many threads; the grass spider weaves a sheet of silk out on the grass and constructs a little tube at one side, in which it hides; another spider builds a filmy dome, a very delicate sheet of silk shaped like a half-bowl inverted, which it supports by lines attached to shrubs and bushes; but the most wonderful of all these snares are the orb webs, the most perfect structures made by living creatures, except by the hand of man. Each species constructs its own kind of orb web, but the general plan is similar. The spider first constructs the framework of the supporting lines; the outer part of this framework is irregular and holds the web in place, but the central part is very regular, being constructed like a wheel with many lines radiating from the center. All of the threads of the framework are dry and will not adhere to anything that touches them, nor will they stretch. But after the wheel framework is constructed, the spider places on the radiating lines a spiral thread, which is sticky and elastic so that it will adhere to and entangle any insect touching it. Many of the orb weavers spin a zigzag ribbon across the center of their webs to make them stronger. Some species reside at the center of the web, while others have a retreat near the edge of the web. But, in either case, the resting spider has in its claws one or more lines connected with the web, and through them receives warning when an insect is entrapped and jars the net. One of the most interesting observations to be made in the field is to watch a spider construct an orb web. This may be seen easily in the morning or late in the afternoon on summer days.

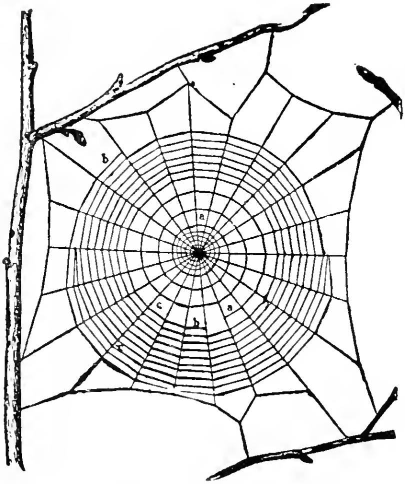


Diagram of an orb web

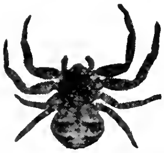
THE KINDS OF SPIDERS MOST COMMONLY SEEN

The web weavers.— These have been described just above and there are a large number of species that construct the snares. These include the cobweb weavers, in the corners of ceilings or cellars; the funnel-web weavers, which spin their sheets of web on the grass; the curled-thread weavers, which spin irregular webs over weeds and flowers, especially the goldenrod and wild plants; and the orb-web weavers.

The garden spider; an orb weaver. The black-and-gold spider that makes the egg sac shown suspended in the goldenrod

The crab spiders.— These spin no webs, but lie in wait for their prey. They are crab-like in appearance and move backward as readily as forward.

They live chiefly on plants and fences; some of the species conceal themselves in flowers, where they lie in wait for the visiting insects. These spiders are colored like the flower in which they hide; they are yellow when in the goldenrod, and white when in the white trillium.



A crab spider

A jumping spider

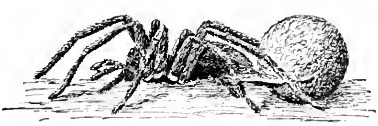
The running spiders.— These are large, dark-colored, hairy spiders often found under stones and logs or boards. They run very swiftly and thus overcome and capture their prey. They spin no webs, but the mother spider makes a very beautiful globular sac in which she places her eggs, and she often carries this egg sac with her, attaching it to herself by means of her spinnerets.

The jumping spiders.— These spiders are of medium size. They make no webs, but spin nests in which they hide in the winter or when laying eggs. They have short, stout legs, are often gray and black, but sometimes have bright colors. They are remarkable for their powers of jumping. They move sidewise or backward with great ease and can jump a long distance. One of these jumping spiders, " dressed in a suit of pepper and salt," we often find on a windowpane, and if you put the point of a lead pencil within an inch of his face, you are likely to see a remarkably high jump. He regards the moving pencil as a fly and it is his business on the windowpane to catch flies by jumping and seizing them, as a cat jumps after a mouse.

Much has been said about the bloodthirstiness of the spider; but spiders, like the rest of us, are obliged to eat in order to live, and their ways of securing their prey are no crueler than our methods of procuring chicken or lamb for our tables. To one who has watched the spiders carefully it would seem that, after all, their chief characteristic is patience. They spin their webs and then sit and wait until some unwary insect is entangled, and whole days may elapse before a meal is thus obtained.

LESSON FOR THE PUPILS

Method.— Talk with the pupils about the different kinds of spiders and ask them to observe their webs. It is not desirable that the children handle the spiders or collect them, although none of the spiders in New York State are dangerous to handle. All of them when they bite — which they never do unless they are forced to in self-defense — leave some venom in the wound which might occasion some pain, but usually not so



A running spider carrying her egg sac

much as that inflicted by a bee sting. However, it is not necessary to handle these creatures in order to study them. In nature-study we are more interested in what they do than in how they look.

Observations for the pupils.—

1. How many different kinds of spider webs can you find? Study a cobweb in the corner of the room. Is the web a sheet of silk, or is it a mass of crisscrossed tangled threads? What is the purpose of this web? Where does the spider hide? Describe how it acts if a fly falls into the web.

2. Examine one of the funnel webs out on the grass. What is its general shape? Is it made of a sheet of silk? Is there a tube leading off at one side? What is in this tube? Is there a back door to this tube? Of what use is this?

3. Study an orb web. With a pencil touch the lines of the framework. Do they stick fast to the pencil point? Touch the spiral threads. Do they stick fast? What is the use of this sticky, elastic thread? Is there a zigzag ribbon of silk at the center of the web? What is this for? Where does the owner of the web stay? How does it know that an insect is caught in its web? If possible, describe how a spider spins the orb web.

4. In the autumn look carefully in the low bushes or in the tops of weeds or among the dead branches of young hemlocks for the filmy dome web. Why is it called a filmy dome? How large is the dome? How is it suspended? Where does the spider rest within it?

5. How do little spiders go traveling? Describe the spider's balloon.

6. Note the spider hidden in the goldenrod or trillium or milkweed. Is it the color of the flower? How does this help it to get its prey? Does this spider spin a web?

7. Lift up boards and stones. Do you see large, hairy spiders under these? Do these spiders spin a web? How do they catch their prey?

8. Note on the bark of trees or on fences or on the windowpane, gray and black, rather chunky, spiders. Place the tip of a pencil in front of one of these about an inch away and move it toward the spider. What will the spider do? Why does it do this? How does it get its prey?

9. Collect all of the spiders' egg sacs that you can find and study how these are made. Where are they placed and how protected?

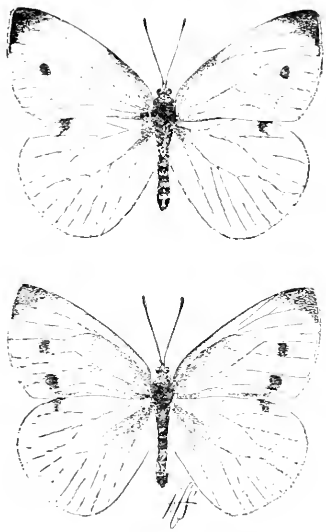
Editor's Note.— We have included the study of the spider in the regular insect work since it is so included in the State Syllabus, doubtless for the purpose of calling attention to the common error of calling the spider an insect. It will be well for teachers to emphasize this fact and the points of difference between spiders and insects given on page 98.

THE IMPORTED CABBAGE BUTTERFLY

(The larva has biting mouth-parts)

Glenn W. Herrick

The common green cabbage worm is one of the serious pests of cabbages in this country. It is the caterpillar of the white butterfly so often seen fluttering about in numbers over a field of these vegetables. This butterfly is an Old World insect and was probably imported among shipments of cabbages sent from Europe. It was first noticed in Canada in 1860 and by 1865 it had reached the State of Maine. From thence it has spread over the whole United States and has become a much more serious pest than our own native cabbage butterfly.



The imported cabbage butterfly; male above, female below

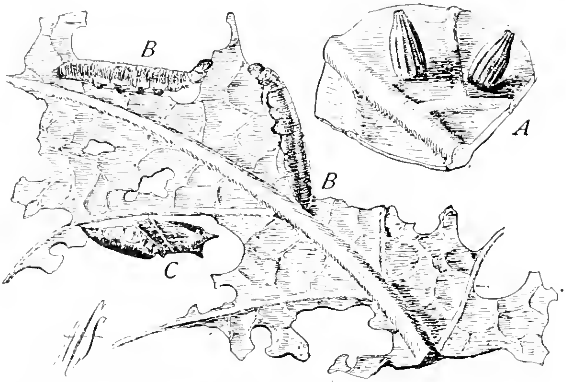
This cabbage pest furnishes a good example of one way in which we are in constant danger of getting new insect enemies. Moreover, it shows how well a new pest brought from another country may thrive under the new conditions found here.

Appearance of the insect.— The parent butterfly has two pairs of large, strong, white wings. Each of the front wings has a black patch in the outer corner; those of the mother butterfly bear two black spots in addition, while those of the father insect bear but one black spot. The undersides of the wings are sulfur or straw color. The body of the butterfly is long and slender, and dark in color. Two long, slender feelers or antennæ project from the head. Each antenna ends in a swollen knob.

On the lower side of the head of the butterfly is a long, slender, thread-like projection coiled up like a tiny watch spring. This is the sucking tube of the mouth. When uncoiled it is half an inch in length.

The caterpillar is velvety green in color and about one and one fourth inches in length when full grown. There is a faint yellow stripe down the middle of the back and a row of yellow spots along each side of the body. The caterpillar eats out holes in the leaves of the cabbages and where abundant practically devours the leaves.

Story of its life.— The butterflies appear early in the spring and the mother insect begins to fly about among the cabbages. She flits here and there, resting for a moment now and then on a cabbage leaf. If we examine the place carefully where she has rested, we shall find a long, small, pale yellow egg stuck to the leaf. In about one week the egg hatches and the tiny green "worm" appears. The caterpillars eat ravenously and grow very fast. They riddle the outer leaves of the plant and many of them crawl down among the tender leaves of the head itself. Here they feed and cause much injury by soiling the tender white leaves. In about two weeks they become full-grown and then change to pupæ. The pupa forms a chrysalis, which may vary in color depending somewhat on the color of the object to which it is attached. The chrysalid is attached by a small band of silk around the middle and by a small mass of silk at the pointed or posterior end. The chrysalids may be found attached to the undersides of cabbage leaves, boards, or palings of a fence near by, or to other convenient objects. During the summer the chrysalid stage lasts one to two weeks. At the end of this time the chrysalid breaks open on the back near the larger end and the butterfly gradually works its way out. After the butterfly has drawn out all of its legs and is entirely free from the shell of the chrysalis, it rests quietly while its wings gradually expand and dry and then it flies away.



Parts of cabbage leaf with eggs at A, caterpillars at B, and chrysalis at C

The whole life cycle, from the laying of the egg to the appearance of the butterfly, is passed in twenty-two days to five weeks. In New York the cabbage butterfly finds time during the summer season for at least three broods. Farther south, where the summers are longer, there must be four or five generations each season.

The winter is passed in the chrysalid stage. The last chrysalids formed in the fall, instead of bursting open and giving forth a butterfly, remain unchanged until warm weather of the following spring.

Natural enemies.— The green caterpillars are subject to the attacks of certain tiny, wasp-like, parasitic insects that kill many of them and aid greatly in controlling this cabbage pest. Very often one of the dead green caterpillars is found attached to a cabbage leaf and partially covered by many small, white objects, usually considered eggs by those who do not know. As a matter of fact, these are the cocoons of the tiny parasites that have lived within the body of the caterpillar and killed it. When the parasites are full-grown they leave the caterpillar and spin their small white cocoons on the outside, from which the small, dark-colored, wasp-like parasites emerge in a few days ready to parasitize other " cabbage worms." Whenever a lot of these white cocoons are seen about a green caterpillar they should not be destroyed, but should be allowed to remain undisturbed so that the parasites may emerge to work on other " worms."

Methods of control.— This cabbage pest is best controlled by spraying the plants with one of the arsenicals, paris green or arsenate of lead. There is no danger in spraying cabbages with a poison up to the time they are half-grown, and even later. A cabbage is only a gigantic bud and grows from the inside outward as does any other bud. The outside leaves never fold up about the head, hence there is little danger of enclosing the poison within the cabbage.

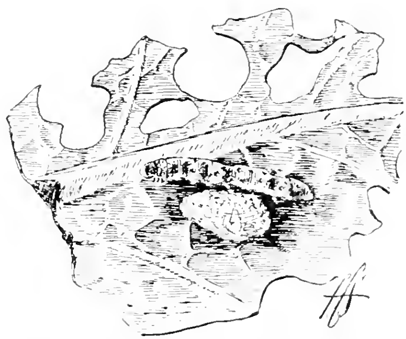
If paris green is used it should be applied at the rate of 1 pound to 150 gallons of water, or sifted on dry, in the latter case being thoroughly mixed with flour at the rate of 1 pound to 25 pounds of flour. This should be applied in the morning while the dew is yet on the cabbage leaves.

Arsenate of lead may be applied at the rate of 2½ pounds to 50 gallons of water.

The first applications of poison should be made when the " worms " first appear, while the cabbages are young. Other applications should follow as needed.

OBSERVATIONS FOR PUPILS

Watch the butterflies in the garden and describe their manner of flying. Do they soar like a bird and do they fly long distances at a time? When one alights on a cabbage leaf see, if possible, what she does. See whether a tiny egg can be found sticking to the leaf.



A dead cabbage " worm " with a cluster of the cocoons of the parasite that killed it

Where on the cabbages are the green caterpillars found? How do they injure the leaves? What kind of mouth parts do the " worms " have? What color are they? Do the bodies have any colored lines or spots? How can the caterpillars be killed?

Find some of the chrysalids. How are they attached to the leaf or board? Describe their color and shape. Draw one of the chrysalids. Watch one of them and see how the butterfly gets out of the case.

How many wings has the butterfly? What is the ground color of the wings above and below, and what and where are the markings?

How many antennæ has the butterfly? What is the shape and length of each one? Draw one of the antennæ. Find the tiny watch spring on the underside of the head. Uncoil it by passing a pin through the center of the coil and straighten it out. How long is it? This tube constitutes the mouth parts of the butterfly and it forms a sucking tube. With it, the butterfly can suck up nectar from flowers.

THE CABBAGE LOUSE AND OTHER APHIDS

(Sucking insects)

GLENN W. HERRICK

The cabbage aphis, commonly known as the "cabbage louse," came to us from Europe. It was probably brought across the sea on cabbages imported for food. Now it is widely distributed all over the United States and is a most serious pest on cabbages. Moreover, it also feeds on turnips, cauliflower, brussels sprouts, kohl-rabi, and other plants of the mustard family.

FIG. 1.—*Eggs of cabbage aphis*

The life history.— If, late in the fall, we were to examine carefully leaves of cabbages that had been infested with this aphis, we should almost surely find some of the dark brown eggs of this little pest (Fig. 1). Sometimes the eggs are laid in great numbers on leaves, both on the upper and under sides. In the fall of 1910 we found as many as 342 on the underside of a single cabbage leaf. The eggs seem to have a thick, heavy covering and they remain on the old cabbage leaves throughout the winter, exposed to all the vicissitudes of a winter season. In the spring the eggs hatch and the young lice find a living for a time, at least, by sucking the juices from the tender leaves of the sprouts sent out by the old stump (Fig. 2). In about two weeks another generation of aphids is borne alive by the mother aphids and in the course of two more weeks a third generation appears. This rate of increase continues during the whole summer season; for generation after generation is produced as long as the food supply lasts and the weather is favorable. By taking this cabbage aphis into the warm greenhouse during the winter we have bred as many as thirty generations in one year. In Fig. 3 is shown a mother aphis with a small brood of young ones on a cabbage leaf. The mother aphis is just starting the colony, but it will increase until perhaps the whole leaf is covered with aphids so closely packed together that one could not put a finger on the leaf without touching several of them.

FIG. 2.—*Sprouts on a cabbage stump in spring*

Finally, late in the autumn, the true shining black eggs (Fig. 1) are again laid on the leaves, thus completing a very interesting life history.

One interesting phase of the life of these aphids, and also of other species of plant lice, is the sudden appearance of individuals with wings. The first generation of lice hatched from the eggs on the cabbage sprouts in the spring are all without wings. Indeed, the individuals of the second generation are wingless, so far as has been observed; but in the third and following generations there appear many individuals that possess wings. This is really a very remarkable thing, and scientists have been wondering and guessing for many years as to why these winged lice appear and what causes them to appear. Certain it is, that these winged aphids fly away to other cabbages or other food plants and there start new colonies. Per-

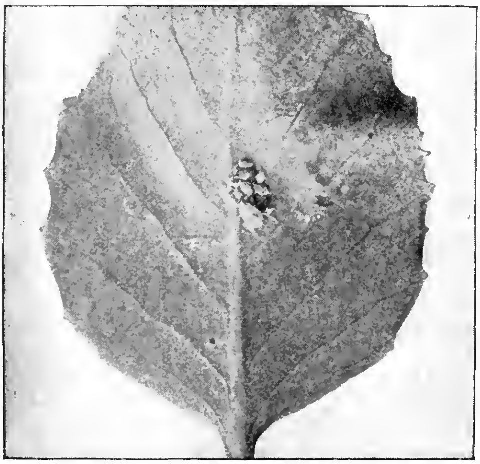


FIG. 3.—*Mother aphis with colony of young aphids*

haps the winged lice are produced for the purpose of spreading the aphids and of finding new, fresh food so that the race will not die and be lost altogether. Observations seem to show that whenever a plant becomes very much crowded or begins to wither and die so that the lice have difficulty in obtaining food, individuals with wings are promptly produced, although all of the lice on the plant up to that time were absolutely wingless and incapable of flight. The winged ones, of course, can fly to other fresh plants, start new colonies, and thus preserve the species although the wingless ones left behind on the old plant all perish from starvation.

Injury to the plant.— The cabbage aphis, like all other aphids, has a tiny beak, or proboscis, with which it pierces the leaves of the cabbage and through which the juices of the plant are sucked into the mouth of the insect. It is this constant drain on the plant caused by thousands of tiny beaks sucking out the juices, that produces the injury. The leaves remain small, become deformed and rolled up, and finally wither and perhaps die. The whole plant remains stunted, fails to head, and so becomes worthless. Often, as a result of the injury, the plants are attacked with the bacteria of decay and actually rot in the field. We have known whole fields of cabbages destroyed by this pest, and large portions of other fields rendered worthless for market.

OTHER APHIDS

There are many kinds, or species, of aphids and they occur on many different plants. During some seasons, apple trees are badly infested with plant lice that curl the leaves, stunt the new growth of the branches, and cause small, knotty apples. The shining dark brown eggs of these aphids are laid on the twigs and branches in the fall, where they may be found at any time before the first of April. In the spring these eggs hatch and the young green lice may be found all over the swelling buds.

Currant bushes, rose bushes, peach trees, cherry trees, elm trees, and other plants are often badly infested with aphids. Most of these aphids are green in color, but some, like those on the cherry, are black, while others are grayish or sometimes covered with a downy, cottony material.

THE FRIENDS AND ENEMIES OF APHIDS

Plant lice have the rather peculiar and interesting habit of secreting a sweet liquid commonly known as honeydew. Often the flagstones in sidewalks are wet beneath elm and maple trees from the drops of honeydew that have fallen down from aphids on the leaves. Ants are very fond of this honeydew and carry it away to their nests for food. It is seldom that one finds lice on a plant without finding them attended by many ants in quest of the honeydew. The ants obtain the sweet material in an interesting way, and the whole process can be seen by patient, careful watching. An individual ant walks up to an aphid and strokes the latter with its antennæ, or "feelers," to which the aphid responds by giving out a drop of the honeydew. This action may be repeated with three or four of the aphids until the ant has all that it desires, when it hurries down the stem of the plant and away to its nest with its load of sweet provender. In return for these supplies of delectable food, the ants protect the aphids from their enemies and sometimes actually build coverings, or "sheds," over the aphids. More remarkable still, sometimes the ants carry the eggs of the aphids into their nests in the fall and care for them most solicitously through the winter until they hatch in the spring; then the ants take the young aphids and carry them out tenderly, placing them on favorite food plants where they can thrive and produce honeydew again.

FIG. 4.—*Syrphus fly, enlarged and natural size*

On the other hand, aphids have their enemies as well as their friends, and their enemies are legion. One of the worst enemies of aphids, and at the same time one of the most effective forces in keeping plant lice under control, is the ladybird beetle. At least eight different kinds of ladybirds prey on plant lice and aid in holding them in check. In a badly infested field of cabbages one is almost sure to find many specimens of the convergent ladybird, the thirteen- and fifteen-spotted ladybirds, and other kinds, all doing valiant work in destroying the cabbage lice.

FIG. 5.—*Eggs of syrphus fly*

Then there are the syrphus flies (Fig. 4) that lay their conspicuous white eggs (Fig. 5) right among the colonies of aphids. When the eggs of the syrphus flies hatch, the larvæ find themselves in the midst of living aphids, which prove very acceptable as food. One larva of a syrphus fly will devour many plant lice before it becomes full-grown. A syrphus fly is shown in Fig. 4. It is somewhat larger than a house fly and has yellowish bands running across the abdomen.

Plant lice are also subject to the attacks of several small, blackish, four-winged, fly-like insects (Fig. 6) that sting the aphids by laying their eggs inside the bodies of the lice. The eggs hatch and the tiny parasite lives inside of the body of the aphid, finally causing the latter's death. When the parasite becomes grown and is ready to emerge from the body of the aphid, it cuts a neat round door in the back of the louse and crawls out, ready in a short time to attack another victim. In Fig. 7 are shown

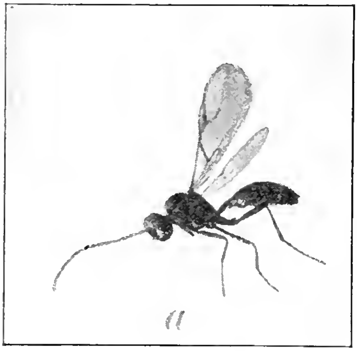


FIG. 6.—*Two parasites of the cabbage aphis*

aphids that have been attacked by one of these parasites and have the tiny doors cut in the top of their bodies.

LESSON FOR THE PUPILS

Method.— Plant lice are very common in summer on many plants, usually on cabbages, roses, apple trees, and the like. Young cabbage plants will grow well in a window of the schoolroom and the lice may be transferred to the plants and watched day by day. Their movements and habits will prove very interesting. The cabbage lice are covered with a whitish powdery material and do not seem to secrete much honeydew. If the secretion of honeydew is to be observed, plant lice from elm or maple trees, or from other plants, should be collected.

Observations for the pupils.—

1. How large is a plant louse? What is its color and shape? How many legs has it?

2. Has it any antennæ, or "feelers"? How many antennæ has it?

3. Do all of the plant lice have wings? How many wings do some of the plant lice have? Draw a wing of an aphid.

4. See if the tiny beak of an aphid can be found. It is carried on the underside of the body between the bases of the legs. How long is the beak? Note the beaks of the lice sticking into the cabbage leaf.

5. Examine cabbage leaves in summer or in fall for the swollen bodies of aphids with round doors cut in their backs. These have been killed by tiny parasites. Can the tiny black fly-like parasites be seen flying about the cabbages?

6. See whether ladybugs can be found among the lice. Try to find a syrphus fly and see whether the white egg can be located. The syrphus flies will be flying about it in the cabbage field and may look to you like bees.

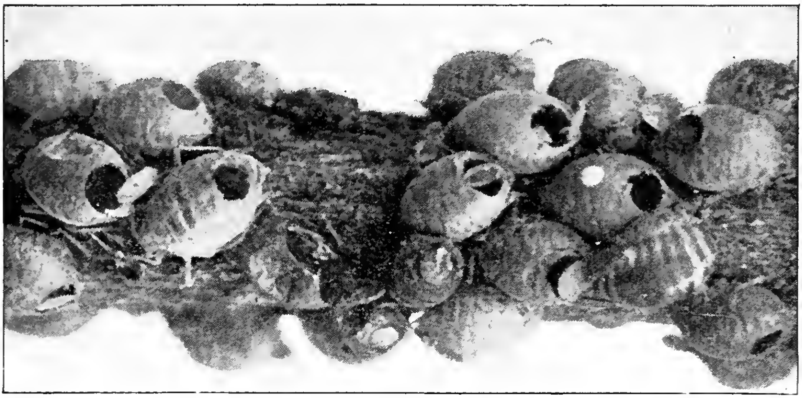


PHOTO BY SLINGERLAND

FIG. 7.—*Aphids that have been killed by parasites*

Editor's Note.— As this leaflet goes to press there has come to our attention an interesting fact in connection with the insect work. It appears that during the past spring and summer the apple-tree tent-caterpillars have been unusually numerous. A great many letters that we received from boys and girls mentioned this fact, and on consulting the Department of Entomology we were told that this pest is especially prevalent this year. In consequence, and unless the parasites that prey upon the insect have been numerous enough to hold it in check, there should be an excellent opportunity to find and study the eggs of the tent caterpillar this fall and winter. Have the children gather and keep them, as is suggested on page 95. The study of the methods of controlling the caterpillars will not only have an added interest but a direct practical application next spring. The question of the removal of breeding places, such as old hedges of wild cherry trees, might also be considered.

THE POTATO

ANNA BOTSFORD COMSTOCK

Many of our cultivated plants have interesting histories and the potato is of this number. It was originally a native of the Andes Mountains in Chile and Peru, although different species have been found irregularly as far north as Mexico and Colorado. It was cultivated successfully here before America was discovered, and was taken to Spain from Peru in the sixteenth century. Sir Francis Drake and Sir Walter Raleigh both carried it to England about 1586, but it did not come into use as a food plant until 1772, when there was a general failure of grain crops in western Europe and potatoes were planted in an attempt to avert famine. At this time there were but two varieties, one white and one red; now there are several hundred listed varieties.

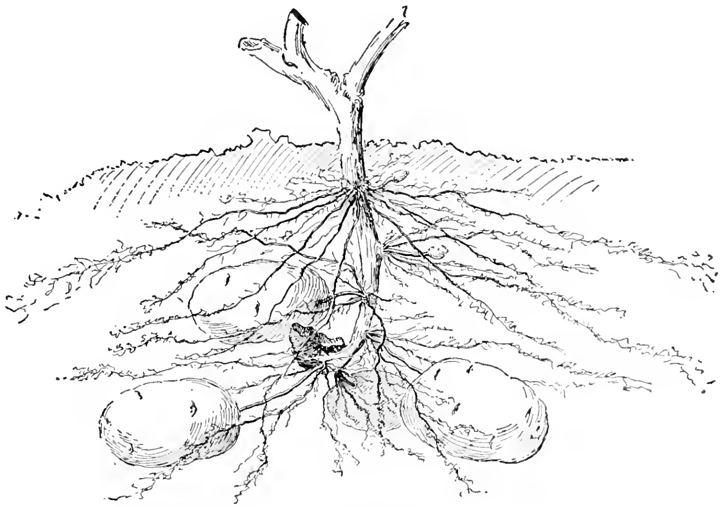
The Europeans have a standard for excellence in potatoes which is different from ours in America. Here we like a fairly large, mealy potato, grown on light, loamy soil. The Europeans prefer small, fine-grained potatoes that are harder and less mealy, such as grow on rich, moist, loamy soil. The Germans declare that the potatoes we serve on the table are fit only to feed to cattle.

As a plant the potato is interesting because it is so very forehanded, being able to reproduce itself in two ways. The white potato that we eat is not a root storehouse, as is the sweet potato; it is merely a stem tuber, a storehouse of food buried underground in order to nourish the stems of next year's growth. How do we know it is an underground stem enlarged? The proof is that the potato has buds on it, which we call the eyes; and these buds are arranged in a spiral, as the buds and leaves are arranged on the stems of the plant above ground; while the sweet potato, which has a root made into a storehouse, has no buds on it.

It is well worth while to "look a potato in the eye," although most persons never think of doing this. The pupil of the eye is the little tip of the bud, which under favorable circumstances will grow into a stem. The "eyebrow" consists of a scale, which represents a leaf. Note that on the potato stem above ground there is a leaf just below each sprouting bud, and this arrangement is exactly the same on the potato tuber.

The roots of the potato come from the main stem and not from the tuber. They lie below the tuber, as any one knows who has pulled up a potato plant during the time of digging. The use of the tuber to the wild potato plant was to keep it alive during the dry season in its South American home, a time when the plant itself must wither and die; and what though it die, since below the ground, filled with food and drink (the tuber consists of 78 per cent water and 18 per cent starch), is its food storehouse with plenty of buds on it, which will be thus nourished and started on a vigorous growth as soon as the season is again propitious.

It is astonishing how much food for plant growth there is in a single potato tuber. I once found a sprout that had grown from a potato bin along the corner of the cellar floor and then climbed the wall to the cellar window, a distance of fifteen feet. I remember looking at this sprout with something like awe; it had so longed for light that it had made all that



Underground part of potato plant in mellow soil

long journey to reach the life-giving sunshine; it looked pale and anæmic except at the point where it pushed against the windowpane, and that was healthily green. The mother potato was very much withered, having given up her substance to the sprout. Ever after, a potato always seemed to me a motherly creature, holding herself ready to help her growing children until she was withered and old. It was always a mystery to me, that she should know just how to select those eyes that would grow, and thus not waste her substance on too many children but give those that she did send out a better start.

Some persons merely cut up a seed potato and plant each eye by itself; but most persons think that this does not give the shoot the food that it should have to nourish it until the roots furnish the food supply. The usual practice is to plant a half or a quarter of the tuber instead. In thus preparing his seed the farmer makes cuttings of the potato, although he does not realize it.

But beside this underground storehouse the potato produces seed also, when grown under natural conditions. When I was a child, among my treasures were potato balls—the little greenish yellow or purplish balls that ripen from the flowers and are about the size of an ordinary marble. They consist of many seeds in a juicy pulp, something like a compact little tomato. But of late years it is only occasionally that these seed balls are produced in our potato fields. New varieties are started, however, by cross-pollinating the flowers and growing the seeds thus produced.

The potato blossom is very pretty. It is a five-pointed star of white or pale purple. The lobes of the corolla are ruffled at the edges, but smooth and greenish at the base; at the center is a brilliant yellow pyramid, consisting of five large anthers pressed closely together. At the center of this pyramid protrudes the green style of the pistil, quite beyond the tip of the anther cone. There are five long, slender sepal lobes to the calyx, which is sticky and hairy like the stem, being covered with short white hairs.

Those blossoms that are near the tip of the stem open first, and afterward those near the main stem open. The buds droop until ready to blossom, when they rise to show their pretty faces to the world and attract the visiting insects.

LESSON FOR THE PUPILS

Method.— This lesson should be given as early in September as possible. The pupils should have access to a potato field in order to make the studies. The study of the tuber itself may be made in the schoolroom.

Observations for the pupils.— 1. What is a potato? What is there about a potato to make you think it is an enlarged stem? Do you think that the potato stem was enlarged to provide food for us or for the next year's potato plant?

2. Examine a potato. Has it a stem at both ends? With what is this stem connected? Does the potato lie in the ground above or below the roots of the plant? Are the roots ever attached to the potato tubers?

3. How does the potato tuber differ from that of the sweet potato? From that of the crocus? From a beet or a turnip? What is the difference between an underground stem and a root?

4. Examine carefully the eye of a potato. Of what does it consist? Describe the "eyebrow." Do you know what this little scale represents? Are the "eyebrows" on the underside of the eye, or are they nearer the

tip of the potato than the eye? The potato is a thickened stem, and if we stand it upright like an erect stem would the "eyebrows" be above or below the eyes? Are there leaves on the potato stem just below each bud? Can you see how the little scale forming the "eyebrow" corresponds to the leaf in the axil to which a potato grows?

5. Find a long potato, place pins in each of the eyes, and connect the pins spirally with a string. How does this show that the buds on the potato, which is an underground stem, are arranged just as are the buds on the stem of the potato above ground?

6. Plant a whole potato in a pot and keep it warm and watered and in the light. After a time examine it. Do the buds in all of the eyes start to grow? Do those toward the base or the tip of the potato grow? How do the shoots look?

7. Cut out a single eye with a section of the potato attached, and plant it. After the shoot appears pull it up. Describe where the root came from.

8. What becomes of the seed potato as the plant grows? Why do we have to sprout potatoes that we keep in the cellar? If the sprouts begin to grow in the cellar, do they grow toward the light? Why?

9. How long does it take a potato crop to grow? On what kind of soil does it grow best? How many bushels grew in the United States in one year, as shown by the last census?

10. How many potatoes grow on an acre in your locality? What is the highest rate per acre on record?

11. Describe the leaves of the potato plant. How many stems come from the same root?

12. Describe the flower of the potato vine. If you have ever seen the potato seed-balls, describe them. Of what use are the seed balls?

13. Write an essay on the history of the potato, paying particular attention to the part this plant has played in the history of Europe.

HOW TO GROW POTATOES

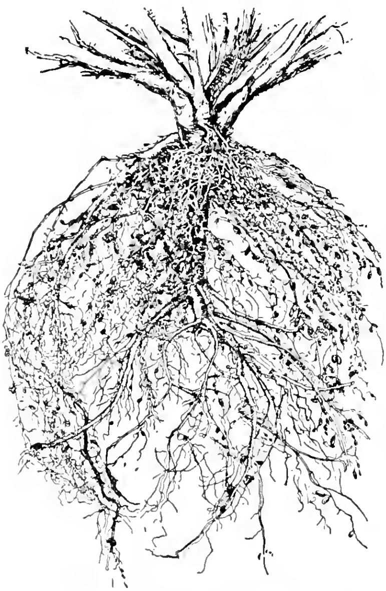
A. W. Gilbert

The successful growth of potatoes, as of any other crop, is based on certain laws that must be obeyed. The oversight of any one factor may mean failure. The potato is a plant that does not seem to have the power to adapt itself successfully to adverse conditions.

Soil.— The best soil for potatoes is a sandy loam, well drained but supplied with an ample amount of water. If the soil is not good, it must be improved by means of plowing, cultivating, fertilizing, and the like.

The more perfect the conditions surrounding the potato plant, the better work it will do. The first thing to find out is whether the soil contains the material necessary for the best results. Most soils contain the necessary ingredients in greater or less amount for plant growth. For example, all soils contain an adequate amount of iron, which is needed for the production of the green substances in plants; but most soils do not have enough available nitrogen, phosphoric acid, and potash for the best plant growth. The lack of one or more of these, together with lack of water, generally causes small crops.

The first step, therefore, if one would have a successful potato crop, is to consider the soil. If the soil does not contain the necessary ingredients, they must be supplied either by the use of commercial fertilizer or stable manure. Plant food in the form of commercial fertilizer is expensive, the nitrogen costing twenty-two and one half cents per pound, the phosphoric acid four and one half cents per pound, and the potash five cents. Therefore it is essential to learn how to make the best use of any of the materials already in the soil. Good cultivation is valuable because it admits plenty of air into the soil and prevents the loss of water by evaporation from the top of the soil. It also aids beneficial soil bacteria, allowing them to convert the soil nitrogen into an available form for the plants to use; and it keeps in check all harmful bacteria. This valuable nitrogen, costing over four times as much per pound as the other foods of the plant, may also be added to soils by the bacteria that grow on the roots of legumes, such as clover, alfalfa, peas, beans, and the like. Hence, for economy, a crop such as clover may well precede a crop of potatoes. In fact, most of the best crops of potatoes are grown on a clover sod, abounding with bunches, or tubercles, in which these bacteria live.



Roots of red clover showing nitrogen-gathering nodules

Fertilization.— No specific information can be given in regard to the kind or quantity of fertilizer for a potato crop. This will vary with the fertility and nature of the soil.

If the potato crop has been preceded by a crop of clover, only a small application of nitrogen may be necessary and this should be in an easily available (soluble) form. A small quantity of nitrate of soda will supply this nitrogen in the best way. The amount of phosphoric acid and potash will depend on the natural fertility of the soil. A fertilizer analyzing 3 to 4 per cent of nitrogen, 6 to 8 per cent of phosphoric acid, and 9 to 10 per cent of potash may be considered an average for most soils. The amount of this mixture per acre will depend again on many conditions; perhaps 600 to 900 pounds may be considered an average.

If the ingredients of this fertilizer are bought separately, they should be mixed thoroughly before applying. There should be a thin layer of dirt over the fertilizer so as to prevent the seed from being burned or injured. If large quantities of fertilizer are applied to the acre, two applications may be made instead of one.

In order to produce the best yields of potatoes, the ground should be prepared several years in advance; that is, a careful rotation of crops should have been followed so as to get the land in good tilth. A soil is thus made friable by plowing and harrowing and by the growth of roots for several years. In this length of time the soil will be rendered mellow by constant tillage and the addition of stable manure or other organic matter, and it should have good water-holding capacity and aeration.

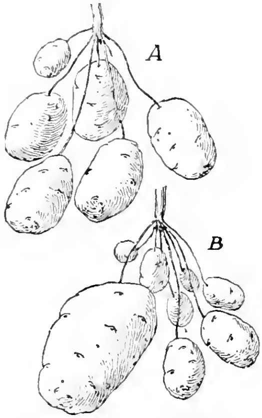
The best crop to immediately precede the potato is clover. It leaves the land well filled with roots and, being a nitrogen-gathering crop, the roots will retain an abundance of this valuable element of plant food.

Plowing.— The plowing should be done carefully. This may be either spring or fall work, except in hilly fields which may wash if plowed in the fall. Remember that the object of plowing is to loosen the soil so that the subsequent operation of harrowing may pulverize it, thus increasing its water-holding power and allowing the free circulation of air among the soil particles. Deep plowing is desirable, although if the ground has never been plowed very deeply this should be accomplished gradually and not all in one year. If very deep plowing follow shallow plowing, too much subsoil is brought to the surface at once and the crop suffers.

Plowing should be followed by harrowing, to be carried on until the soil is thoroughly pulverized. The kind of harrow to use will depend somewhat on the soil. In general, a disk or cutaway harrow is preferable, because if the work is thoroughly done such a harrow cuts the soil into fine particles. The use of modern machinery is very desirable in commercial potato culture. It saves expensive hand labor and does the work better.

Marking the field.— This is the next operation if the potatoes are to be planted by hand. It is often better to mark the field both ways; the seed pieces dropped at the intersection of the lines will thus form straight rows, permitting easy cultivation in both directions. Great care should be taken to have the rows straight, insuring ease of cultivation and of spraying.

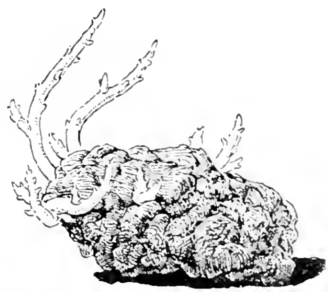
Seed.— Another matter of prime importance is the seed. A good crop of potatoes or of any other plant cannot be produced from poor seed. We must have good seed, as well as favorable conditions in which it is to grow. All plants are the result of two factors — environment and heredity. One is as important as the other and neither can be called all-important without the other.



Unit hills of potatoes. It is better to plant the small tuber from A than the large tuber from B

All that surrounds the plant — soil, plant food, climate, and care—must be right. Also, the plant must come from good ancestors, since it derives its producing power from its parents and grandparents. It is a waste of time and money to prepare and enrich a soil, and plant in that soil potatoes that do not come from high-yielding strains. Every tuber that is planted should have come from a hill of potatoes that gave a good yield. *It is much better to plant medium or even small tubers from high-yielding hills than to plant a large tuber from a low-yielding hill.* The character of the whole hill determines its value for seed. In the fall, many hills should be dug by hand and the tubers from the best of these hills saved for seed.

It is generally considered the best practice to use for seed the tubers that are of good size and shape and have been stored so that they have remained dormant. For the best results the seed should be plump and unsprouted. The tubers should be cut into about four pieces, each having several good eyes accompanied by a generous quantity of tuber. They should be planted immediately after cutting, as the seed pieces tend to bleed — that is, to exude water very rapidly, which injures them.


Withered potatoes that have sprouted make poor seed

Planting.— The seed pieces should be planted in most soils at a depth of four inches, covered carefully, and the soil made compact on top. Only one piece should be dropped in each hill. If the planting is done by the best machinery, the operations of opening the furrow, dropping the fertilizer and the seed, and covering it again are done in one operation. In this way time and labor are saved and the work on the whole is very satisfactory.

If the seed is planted by hand several distinct operations are necessary. First, plow a furrow about $4\frac{1}{2}$ inches deep, scatter some fertilizer in the bottom of the furrow near the hills, cover this with a little soil, and drop the seed piece on top. Next, fill the soil into the trench over the seed piece and firm it by pressure with the foot. The top of the hills or rows may be left slightly ridged.

Cultivation.— Good cultivation gives air to the soil in the best way and prevents the evaporation of water which comes from beneath, and it also kills the weeds that do so much harm to plants. Weeds injure the crop in many ways: by removing water and plant food that the potatoes need; by shading the ground; and, probably most serious of all, by excreting from their roots a poison that is injurious to the potato plants in a positive way.

In a few days after planting, when the sprouts have started but before they have come through the top of the ground, the farmer should go over the field with a weeder crosswise of the rows. This is a very essential operation, as it kills the little weeds when they are less difficult to kill and it levels the field in preparation for future operations.

Cultivation should be continued at regular intervals to kill the weeds and preserve the soil mulch until the potatoes are in blossom. After that it will do more harm than good, because it tends to break off the small feeding roots of the potato plant which are near the surface of the ground at this time of the year.

Hilling.— The first cultivation should be very shallow and merely scratch the top of the ground, but the last cultivation should throw the dirt up around the plants so as to prevent the young tubers from being scorched by the sun. Hilling also serves to remove many weeds and to cover up others.

Digging.— After the crop is thoroughly ripe and before there is danger of freezing, the tubers should be dug, allowed to dry by lying on top of the ground for part of a day, and stored in the cellar. At least a part of every field should be dug by hand for the purpose of finding the high-yielding hills from which seed will be chosen for next year's planting. In large fields the elevator diggers operated by horses are found to save time and expense. The machine is drawn along the row and the sharp plow in front lifts tubers and soil, the latter drops through the bars in the movable carrier, while the tubers are carried over and thrown in a row back of the machine.

Storage.— Potatoes should be stored in a cool place, away from the light and where they will not freeze. The temperature should be low enough so that they will remain dormant, that is, will not sprout. All potatoes that are to be used for seed should be especially well kept.

POTATO GROWING

DANIEL DEAN

(A practical farmer)

The potato was first found by white men in the high mountains of Peru. It thrives better in cool than in warm climates. In our South it is grown mostly in early spring or late fall in order to avoid the heat of summer. In Europe larger crops are raised than in this country because the climate is more favorable. In New York State the largest crops are grown when the seasons are cooler than usual. Extreme heat for a few days in summer greatly reduces the vitality of the plants and size of the crop.

Potatoes need a large amount of water. About 80 pounds of water must be transpired from the leaves for each pound of tubers grown. This is especially needed at the time the tubers are forming in the soil. The largest crops are usually obtained in New York State (except on Long Island) by planting about June 1, as usually the fall rains then come at about the right period in the growth of the crop. On the other hand, too much rain in July and August may cause conditions favorable to the spread of the late blight disease. This sometimes kills the tops and rots the tubers in a few days. The terrible famine in Ireland in 1846 was caused by the late blight rotting the potatoes, which constituted the principal food of the people.

More potatoes are usually grown in New York than in any other State. The average money return per acre is higher for this crop than for any other commonly raised in New York; also, it responds more profitably to extra care than do most crops.

On the other hand, success in potato growing depends on attention to a number of details, neglect of any one of which may ruin the crop or at least make it unprofitable. Among these are the proper kind of soil, good seed of the right variety, proper cultivation, prevention of damage by insects and diseases, and skill in marketing.

One great necessity with most New York soils is to secure an abundance of humus. As we know, soil is mostly made up of small particles of rock. One of its most essential ingredients, however, is humus — the organic remains of plants that have lived on it. This organic matter decays easily under cultivation and furnishes readily available food to the growing crop. Soils full of humus, such as newly cleared forest land and our western prairies when first cultivated, are among the richest in the world. We should, therefore, grow the potato in connection with other crops that will supply plenty of humus. This is most easily obtained by means of heavy sods, especially of clover, by plowing under in the fall the straw of grain crops, and by the use of barnyard manure. If straw is allowed to rot in stacks, or meadows are mowed until they become thin, the conditions will not be favorable for potatoes.

Humus not only supplies food for the plants, but is also very important as a means of holding water in the soil for their use. Water dissolves the elements in the soil which are used by the plants, and holds those elements in solution. It is taken in by the plant roots and the water transpired from the leaves, leaving the plant food behind. Humus in the soil greatly increases its productivity.

Since the potato is so easily affected by adverse conditions, it may be helped by the use of fertilizers. By this means it receives plant food in easily available form, and the crop is kept in healthy condition when otherwise the plants might be stunted or even ruined. Consequently the best growers, particularly those of Aroostook County, Maine, and of Long Island, use 1,000 to 2,000 pounds of fertilizer per acre.

Fall plowing is often of great benefit in preparing the soil for potatoes, particularly if straw or other humus-making material is plowed under. This rots by spring and is in better shape for the use of the crops. On most sods a second plowing in spring, with a small amount of harrowing, is better than dependence on the harrow alone for spring fitting. Small applications of fertilizer may be applied in the row to give the plant a start. Large amounts of fertilizer are of more value if put evenly through the soil with a grain drill and are not so likely to injure the sprouts.

Potatoes should be planted as deep as the soil and climate will permit, from two to six inches. In sandy soils it is best to plant deep and cultivate nearly level. If the soil holds water strongly or if much rain falls, as in Maine, it is best to plant shallow and ridge up the plants in cultivation.

The question of planting hills in checks, or of planting closer in drills, depends on the fertility of the soil and the number of weeds likely to grow. Some poor soils will not grow the tubers large enough if the hills are close together. In such cases hills are better than drills. Rich soils will grow larger crops if the plants are closer together in drills. Weeds are harder to kill in drills than in hills.

Large seed pieces increase the size of the crop over small ones. On most farms, 10 to 20 bushels of seed per acre planted in drills, or 8 to 10 bushels per acre in hills, will be the most profitable amount to use. If the seed is too small the plant may not get a good start; if too large, the increase in crop does not pay for the increased cost of seed. In seasons when seed is high, such as 1912, small pieces may be used and increased care given the crop. When seed is cheap, large seed is often profitable.

Different varieties vary greatly in their adaptability to different soils. One of the most profitable practices in potato growing is testing for the best variety for a particular soil. Many new seedling varieties are being produced every year and are often sold at high prices. It must be remembered that our standard varieties are the ones that have proved best out of thousands. Bliss Triumph, Early Rose, and Irish Cobbler are the best early varieties. For late, Green Mountain and Carmen No. 1 do best on Long Island, Rural New Yorker No. 2 in the counties near Pennsylvania, and Sir Walter Raleigh in the northern part of the State. Gold Coin is very successful in many sections. For trials it is best to get several of the varieties that grow well in the vicinity. Plant in adjoining long rows, measure or weigh products carefully, and repeat for two or more years in order to find the best yielders. So-called " blight-proof " varieties should be avoided, as they are usually late in maturing and all yet tried are undesirable in some particulars.

Round or oblong and smooth white potatoes of good quality sell best, so late varieties for the main crop should have these qualities. Some of the best early varieties are red.

Every one knows how different hills vary in yield from almost nothing to several pounds. Sometimes this may be due to better soil or to larger seed pieces; other hills may have been injured in some way; but often the high or the low yield is due to the natural ability of the hill to produce well. Separating these high-yielding hills from the rest pays better for the amount of work necessary than does anything else in potato growing. *This must be done when digging.* The hills should be dug by hand, keeping each product separate, and the best saved. The next year the best ones are planted in a special plot. The key to success by this method lies in the fact that using large numbers of hills to start with gives a much better chance of finding the best strains than if selection is made from a few hills only.

Many of the hills selected as best the first year are good merely because they had more fertile spots of soil or had in some way a better opportunity to yield. In the second and succeeding years the seed from such hills will drop back to its normal product, leaving as high yielders only those hills that are such because of their natural superiority.

If a more complicated method is desired, after the poorer hills have been eliminated the hills may be bagged separately and an equal weight of seed from each, perhaps two pounds, cut into an equal number of seed pieces and planted in short rows. The products of these rows may be kept in separate crates for planting the next year. Any one who does this will be surprised to see how the progeny will resemble the parent hill in number, shape, size, color, and tendency to diseases.

Cultivation after planting has for its principal objects killing the weeds, saving the water in the soil by preventing evaporation, and making plant food available. Cultivation between the rows should be deep at first, but shallow later so as to prevent injury to the roots of the plants. The weeder is a valuable tool to kill weeds in the row. It must be used before they get a start.

The original potato plant, when wild, blossomed before the tubers set. Now under cultivation both processes overlap. This usually comes in a period of hot weather and at a time when late blight is most active, and is the danger period in the life of the potato. If many roots are cut, the crop receives a shock from which it never fully recovers and it is prevented from making the yield that it might make. The whole profit on a crop may be lost by late hilling in dry weather.

Potatoes are subject to the attacks of several enemies, the worst of which is the late blight and rot. This disease is carried through the winter in the tuber and passes into the soil after planting.

When the soil is wet the spores pass from the seeds to the surface of the soil and come in contact with the leaves, in which they produce the disease. In damp, muggy weather the entire crop may be killed in a few days. The spores later fall from the leaves to the ground and, if the soil is very wet, may attack and rot the tubers. Dry weather checks the progress of the disease. Spraying with bordeaux mixture, made of sulfate of copper, lime, and water, is almost always profitable. The copper in the bordeaux kills the blight germs when they touch the leaf that is covered with it. The spray should be applied early in order to be on the leaf ahead of the blight.

The time to spray is just *before* a rain if possible. The blight spreads only in wet weather. The growth of the plant constantly forks new leaves. The first rainstorm is the time these most need protection.

We never know what season blight will come. The gain from spraying in one year when blight occurs will pay for several years' spraying. Spraying with bordeaux mixture seems to have a tonic effect on the potato even when no blight is present. It also reduces the damage from several of the less important potato diseases.

Potatoes are subject to the attacks of several insect pests. Probably the one that does the most damage is the black flea-beetle, which pierces many small round holes in the leaves. It does not eat poisons but bordeaux helps reduce the damage. The common potato bug is best killed with paris green or arsenate of lead. When the bordeaux also is used, the paris green cannot burn the leaves, sticks better, and is spread more evenly on the leaves, so that much less is needed.

Hand sprayers are used for small areas, barrel pumps and horse-power sprayers for the larger areas. In all cases the plants should be well covered at each spraying. The higher the pressure, the finer the spray and the better the results.

The scab is another disease that hurts the sale of potatoes. To prevent it, soak the seed for two hours in a solution of a pint of formalin in thirty gallons of water, and then plant on clean ground.

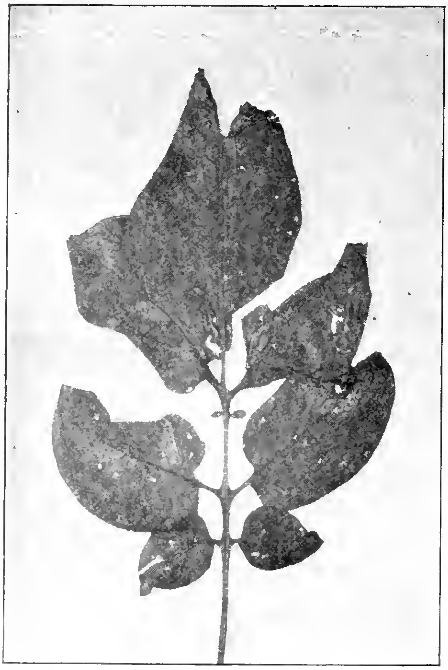
Care must be taken not to dig potatoes for winter storage until the tops have been dead ten days or more. Blight germs from the leaves may rot the tubers, especially in wet weather.

Potatoes in storage should be kept cool and dry, particularly if intended for seed. Loss from shrinkage, rot, and loss of vitality of the seed is least if the temperature can be kept just above freezing.

TWO DISEASES OF THE POTATO PLANT AND THEIR CONTROL

M. F. Barrus

As has already been shown, the potato is one of the most important plants grown in the State. Whatever affects its vigor or destroys its growth, reduces the yield and therefore is of exceeding interest to us.* In this article are presented the stories of the downy mildew and the scab, the two most common and destructive diseases of the potato.



Potato leaf affected by the downy mildew
(After Geneva Bul. 241, Plate XII)

THE DOWNY MILDEW OF POTATOES

History.— The downy mildew originated in South America, the home of the potato, and probably was early associated with that plant. It did not attract general attention until 1845, when the potato crop in England, Ireland, Scotland, and other countries of western Europe, and also in the northern United States, was nearly or entirely destroyed by its ravages. This destruction of the potato crop

* Of the diseases affecting this plant the following may be mentioned: *early blight*, a disease affecting the leaves; *downy mildew*, or *late blight and rot*, affecting the leaves, stems, and tubers; *Fusarium blight* and *rot*, affecting the vines and tubers; *rhizoctonia*, affecting the stem and forming a scurf on the tubers; *scab* and *bacterial rot*, affecting the tubers only.

brought about the Irish famine of 1846. Much was written about the disease at that time and its cause was correctly determined. Other epidemics have occurred at intervals since. The loss from this disease in New York State alone during the three years from 1903 to 1905 is estimated at $40,000,000. The disease is now to be found in all humid climates where potatoes are grown, but the fungus that causes the disease does not thrive well except in temperate regions.

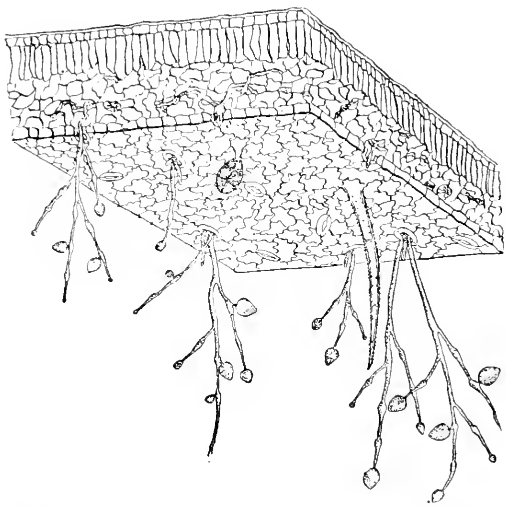
Potato vine killed by the downy mildew
(After Geneva Bul. 241, Plate X)

Symptoms.—On the leaves the first signs of disease are leaf spots having a water-soaked appearance. This is particularly noticeable when the affected leaf is held to the light. Later this spot blackens and dries, but often a water-soaked area at the margin indicates the continued activity of the fungus. These spots have an indefinite margin and are one half inch or more in diameter, sometimes involving the entire leaf and leaf stem. On the underside of the spot may be noticed a moldy or mildewy growth. This may serve to distinguish the downy mildew from other spot diseases of the leaf.

On the stems, watery spots develop which later turn brown or black and become dry. The foliage beyond the affected area then dies from lack of moisture.

On the tubers, the lesions when first noticeable are small discolored spots not so large as the end of one's finger. If the skin of the tuber is scraped away at this point, a reddish brown color, characteristic of the blight rot, is observable. These spots are sometimes sunken, forming little pits. Later, and often during storage, the lesion extends over the surface of the tuber or two or more lesions unite to form a large, sunken, discolored area. Bacteria sometimes enter the tuber through these lesions and produce a soft, slimy rot with a bad odor, which is quite different from the typical blight rot.

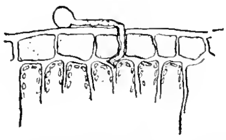
The cause of the downy mildew.— The downy mildew of potatoes is caused by one of the lower fungi, known to botanists as *Phytophthora infestans*. This fungus lives over winter in the form of very minute vegetative root-like strands, called a mycelium, within the tissues of the diseased tubers. If the storage room is moderately warm and moist the mycelium continues to grow, obtaining food from the cells of the potato and extending the rotten spots as it grows.



Section through a part of a diseased potato leaf showing the spore stalks, with spores attached, extending down through the breathing pores of the leaf

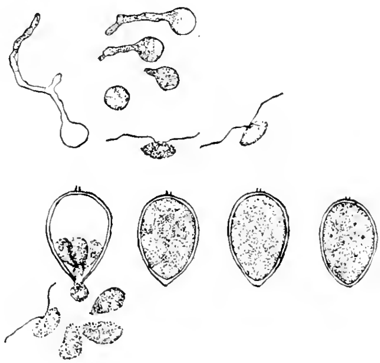
When a diseased potato is planted, the mycelium produces the fruiting stalks of the fungus on the cut surface. These are small branched stalks that extend out into the spaces between the soil particles and bear at their extremities a small pear-shaped spore corresponding to the seed in higher plants. When the spore is fully formed it is pushed to one side by another branch extending out from the end of the first one and producing at its extremity another spore. In this way a single stalk may produce as many as fifty spores; and as several hundred stalks may be found on the cut surface of a single diseased potato, it is easily seen that thousands of spores may be produced under fairly warm, moist conditions.

The spore germinates in the soil by the production of several swarm spores — animal-like bodies destitute of cell walls. These move about in the soil water and when the soil is saturated probably make their way to the surface, where they come in contact with the lower leaves of the potato plant that are often found resting on the surface of the soil after a rainstorm. The swarm spore soon germinates by sending out a slender tube, called the germ tube. This tube secretes an enzyme that dissolves enough of the leaf surface to allow the passage of the germ tube within. It makes its way between the leaf cells where it branches in several directions, forming the mycelium. Other enzymes are secreted that kill the protoplasm of the leaf cells, and the nutritive cell sap contained within passes into the spaces between the cells where it is absorbed by the mycelium. Little side branches (haustoria) also extend directly into the cells and absorb the nutritive substances found there. As cell after cell is invaded in this manner, they present a watery appearance which later turns brown and dry upon the death of the cells. Usually only the lower leaves of a few plants here and there show these spots, so that they are easily overlooked and a casual observer would say there was no blight present. No real loss has occurred and if the weather continues dry thereafter there will be no further development of the disease. But if another storm period occurs a few weeks later, these spots serve as sources of infection from which spores are produced by the millions and distributed by wind or other agencies to neighboring plants.



A germinating swarm spore showing germ tube entering leaf

These spores are produced on the extremities of fruiting stalks identical with those formed on the cut surface of the potato. They are produced by the mycelium within the leaf and extend through the underside of the diseased area of the leaf. They are usually produced during rainy or moist weather extending over a period of several days. The spores borne on them are short-lived under air-dry conditions, and must soon germinate and gain entrance to the host plant if they are to reproduce the fungus. They may be blown to healthy leaves, but if moisture is not present within twenty-four hours they will die. If moisture is present, however, they will germinate within an hour and produce swarm spores, which in their turn germinate by the production of an infection tube. This enters the leaf in the manner previously described and a spot is developed.



Below from right to left are shown four stages in the formation of the swarm spores. The way in which the swarm spores germinate is shown above

(After U. S. Dept. Agr.)

Many of the spores fall to the ground and germinate there. The swarm spores make their way through the soil to the surface of the young tubers, which they likewise penetrate, and a decayed spot is produced at this point. If the spores of the fungus come in contact with the potatoes at digging time, subsequent infection will take place. When the vines are infected it is wise to wait until after they are entirely dead before digging. Infection before or at the time of digging is responsible for much of the rot that occurs in cellars later.

A tuber showing the dry rot caused by the fungus that produced the downy mildew of the leaves

Weather conditions largely determine whether this disease will be destructive in any year. Common observation has shown this to be so true that many people believe that rainy weather during the summer is the cause of the disease. You can see, however, that the disease would not occur in rainy seasons if the fungus were absent; nor would it be destructive should the season be dry, even though the fungus were present. Rainy periods during the growing season are favorable for the development of parasitic fungi, as for higher plants, and it is during such seasons that fungous diseases are most common.

Control.— From our study of the life history of the parasite it is evident that there are two methods open for the control of this disease; namely, to keep the fungus causing it from getting a start, and to protect healthy vines from infection. Since the disease starts from affected tubers, it would seem that we might treat such tubers in some way so that the mycelium of the fungus would be killed, or we might exclude those tubers altogether. Treatment of seed tubers to destroy this fungus has not been very successful, because a method severe enough to kill the mycelium has also killed the eyes, or undeveloped sprouts, of the potato. A treatment with hot air has been recommended, but this is not convenient for most farmers. Certainly, diseased tubers should not be planted. One should obtain seed tubers from fields that were free from the disease, or should carefully sort out and discard all tubers showing any rot. Even then, some of the fungus may slip through and the disease in the field start from this.

If one were perfectly sure that all tubers planted by him were free from this disease and that there were no neighboring fields within a half mile from which the spores of this fungus could be carried, he need not fear that the disease would develop in the vines of his potatoes; but since one cannot be sure of these conditions, it is wise to protect all the vines from infection. This can be done successfully by spraying them thoroughly with bordeaux mixture several times during the season. This mixture dries on the vines and is not washed off easily by rains. When the germinating swarm spore secretes the enzyme that dissolves the cuticle of the leaf, some of the copper in the bordeaux mixture, if present, is released from its combination with the lime and, penetrating the young infection tube, destroys it before it has been able to enter the leaf. In order, therefore, to protect all parts of the vine it is necessary to have all parts covered by the mixture. The potato vine grows throughout the summer and the new growth made after one spraying should also be protected by a second application, and so on throughout the summer.

A field of potatoes of which one row that was not sprayed was entirely killed by the downy mildew

(After Geneva Bul. 264, Plate XV)

We have learned that infection takes place during rainy or foggy weather because it is during such weather that the spores are produced, are scattered, and germinate. Therefore it is important to make the application before the rainy period comes. Such periods are forecasted by the Weather Bureau, and by studying the daily weather map one may soon learn to forecast storms.

In general, it may be said that five to seven applications should be made, depending on weather conditions, making the first when the plants are six to eight inches high. When potato beetles are troublesome, paris green should be added at the rate of 1 pound to 50 gallons of the mixture. Other poisons, such as arsenate of lead, arsenite of soda, or arsenite of lime, may be used in place of paris green if desired. Experience with lime-sulfur in place of bordeaux mixture has not been entirely satisfactory. In order to do thorough work, high pressure and nozzles producing a fine mist or fog of the mixture are necessary.

Preparation of bordeaux mixture.— Bordeaux mixture is made by mixing a dilute solution of copper sulfate (blue vitriol) with a dilute solution of lime. The mixture may be made of different strengths by using different amounts of the copper sulfate and lime to a given amount of water. A mixture made by using three pounds of copper sulfate and three pounds of lime to fifty gallons of water is probably strong enough to control this fungus; but because of the stimulating action of bordeaux mixture on the potato plant, a strength of five pounds each of copper sulfate and of lime to fifty gallons of water is usually recommended, and this is indicated by the formula 5–5–50. To make bordeaux mixture of any strength, proceed as follows:

Make a stock solution of copper sulfate by dissolving 45 pounds of copper sulfate in 45 gallons of water. A gallon of the solution will then contain one pound of copper sulfate. If the crystals placed in a gunny sack are suspended so as to be just immersed, they will dissolve in the course of three or four hours.

Make a stock solution of lime by placing about a bushel of good stone lime in another barrel and slake by adding water slowly, being careful not to "drown" the lime. When all has become pulverized by the slaking, add water to make a paste, after which enough more may be added to make 45 gallons. This should not be allowed to dry out. Hydrated lime that does not require slaking may be used in place of stone lime, but air-slaked lime should never be used.

Fill the sprayer about three fourths full of water. If a 5–5–50 solution is desired, 5 gallons of copper sulfate stock solution should be added to this water for every 50 gallons of mixture to be made. Stir until the solution is well diluted, and add 5 gallons of the stock solution of milk of lime.

While the solution of lime is being added to the dilute copper sulfate solution in the sprayer tank, the material in the tank should be stirred constantly. The sky-blue bordeaux mixture will result.

The mixture should now be tested with a few drops of a solution of potassium ferrocyanide. This is made by dissolving crystals of potassium ferrocyanide in soft water. Five cents' worth of crystals dissolved in a pint of water will provide enough of the solution to last throughout the season. Should a brown-colored precipitate result when a few drops of this solution are added to the bordeaux mixture, it would indicate that more limewater is needed to neutralize the copper sulfate solution. When sufficient lime is added no precipitate will be formed by the potassium ferrocyanide solution. Bordeaux mixture not properly neutralized will burn the foliage of plants when applied to it.

POTATO SCAB

This disease is characterized by a roughened, brown, corky area on the surface of the tuber. While these affected areas extend but slightly below

Potato tubers badly affected with scab

the skin, the appearance presented by scabby potatoes renders them less valuable than smooth ones. The yield also from fields where the tubers are badly scabbed is inferior. So that it is desirable, from the grower's point of view, to grow clean potatoes.

Potato scab is common throughout the United States and Europe where potatoes are grown. The surface of a tuber may be roughened by worms and grubs, but this is unlike the scab. In Europe several organisms are supposed to cause this disease, but in this country a fungus named *Oospora scabies* has proved to be the cause. It is almost impossible to find this fungus on scabby potatoes that have been stored for some time, but if one examines closely such potatoes as they are dug he will notice a film quickly disappearing, composed of a grayish hair-like growth. While it is next to impossible to find evidence of this fungus on scabby potatoes that have been stored, nevertheless it persists until they are planted and may then spread to the young tubers as they are formed.

The fungus also seems able to persist in the soil for a year or more. Even healthy tubers planted on such land will produce scabby ones if conditions favor the fungus.

It has been noticed that an alkaline condition of the soil is favorable for the development of this fungus. Lime, wood ashes, and often manure tend to make the soil alkaline. The statement often made by farmers that wood ashes make potatoes scabby is explained in this way. The scab, however, is caused by a fungus, and no matter how alkaline the soil may be the tubers will not be scabby unless this fungus is present.

There are, then, two conditions to be observed in guarding against this disease: plant *clean tubers* in *healthy land*. If tubers absolutely free from scab cannot be obtained, the cleanest should be selected and these treated by soaking them for two hours in a solution of formalin made by diluting 1 pound of commercial formalin (40 per cent formaldehyde) with 30 gallons of water. The treatment should be made before the tubers are cut and preferably just before they are planted, as there is then less danger of subsequent infection. A convenient way is to immerse a sack of tubers to be treated in a barrel of the solution.

The treated tubers must be planted on land that has not been in potatoes for the past two years, preferably after a clover sod, and in soil that is not alkaline. It is wise to practice a rotation of crops in which potatoes come once in three or four years. Potatoes, oats, meadow, potatoes, might be such a rotation. When it is necessary to apply lime in order to grow clover, the application should be made in the fall after the potatoes are harvested. By the time the land is planted again to potatoes, the alkalinity will be greatly reduced and the fungus, if present, will have died out.

In order to insure the potato crop against these two and against other diseases we must, then: (1) reject all diseased tubers; (2) treat selected seed with formalin; (3) plant treated seed on land free from organisms that infest potatoes; (4) spray the potatoes thoroughly during the growing season. Even then they may become affected with some disease, but the chances are good that they will not. One cannot afford to grow potatoes at all if he cannot afford to take these precautions.

WHEN TO SELL POTATOES

K. C. LIVERMORE

In the Northern States potatoes can be stored for several months after they have been dug, and each year the farmer who raises potatoes to sell is confronted with the question, Shall I sell from the field or hold for a higher price? In answering this question wisely, two things must be considered: first, what is the price likely to be several months after digging? second, how much will it cost to store the potatoes?

The price of potatoes fluctuates more widely than that of most general farm products. These fluctuations in price are the result of variations in supply. The tendency is for people to use about the same quantity of potatoes the year round; but when there are not enough to supply the usual quantity, the price goes up and some consumers use less. When there are more potatoes than are usually eaten, the price drops so as to encourage people to use them more freely. The quantity of potatoes consumed in the United States is increasing year by year as the population increases; at present we use on the average about 325,000,000 bushels each year, or about 3.5 bushels per individual. When the total production is less than normal the price tends to be higher than the average, and vice versa.

Thus we can predict, to a certain extent, the price of potatoes if we know the acreage planted and the probable yield. The Crop Reporter gives this information. This is a report published monthly by the Bureau of Statistics, United States Department of Agriculture, and can be obtained free by any one. It gives the acreage, condition, yields, and prices of the different crops, and also the number and value of different kinds of live stock on farms. These figures are obtained from a great many farmers all over the country. Also, a shortage of the potato crop in Europe tends to hold the price up in this country by cutting down the importation.

If we decide in the fall that the price will go up, the next question is, Will the advance be sufficient to pay for holding? The cost of storing is greater than many persons realize. It includes shrinkage of the potatoes, interest on the money that is tied up, cost of the extra work of handling the potatoes, use of the storage cellar or building, and risk of loss by fire. Most of these items do not necessitate a direct cash expenditure and for that reason are often overlooked, but they are, nevertheless, actual cost items.

Potatoes shrink in two ways: they lose in weight, and some of them rot and must be thrown out. So the place in which they are stored and their condition in the fall have much to do with the amount of shrinkage. The storage place should be cool and moist and the potatoes should be free from scab and blight diseases. When stored in cool cellars, the shrinkage is usually 5 to 10 per cent. Sometimes it has been as high as 20 per cent, and when rot is bad the shrinkage sometimes amounts to 50 per cent. But under good conditions we should expect a shrinkage of about 8 per cent. For every 100 bushels of potatoes stored in the fall, we should then count on having only 92 bushels in the spring. If potatoes are worth 50 cents in the fall the shrinkage will cost four cents per bushel.

A farmer who sells his potatoes in the fall can use the money to pay a note and thus save the interest that it bears. Or he can invest the money and receive interest for it. Or, better still, he can buy some good stock. Anyway, he can use the money; but the farmer who stores his crop loses the use of it. So another item of cost in holding potatoes is interest on the money tied up. The interest on 50-cent potatoes for six months at 5 per cent would be a cent and a quarter per bushel.

One of the big items of cost is the extra work. This includes putting the potatoes into the storage pit or cellar, sorting them again, and taking them out of storage. The cost of this varies with conditions. Figures given by a number of growers who frequently hold the crop average four cents per bushel.

The use of the storage cellar or building is another expense. This should be included because the money invested in such buildings should bear interest, and the buildings depreciate every year. About 10 per cent of the value of the buildings, or that part used for storage, is what it costs each year. This would amount to a fraction of a cent to two cents per bushel — let us say, on an average, one cent per bushel.

Fire insurance would ordinarily cost less than a cent per bushel.

Assuming the potatoes to be worth 50 cents in the fall and adding these items together, we have

	Average (cents)
Shrinkage	4.00
Interest	1.25
Extra labor	4.00
Use of buildings	1.00
Fire insurance	.12
Total	10.37

These figures agree with estimates given by farmers, a number of whom have said that an advance of 10 cents in price per bushel just about covers the cost of holding. Thus, in order to make a profit on the holding, it would be necessary to receive more than this amount.

In a bulletin from the Maine Agricultural Experiment Station, the writer expresses the opinion that 50 cents for potatoes direct from the field is as good as 70 cents in the spring. A member of the Long Island Potato Exchange considers a 20-cent advance on 60-cent potatoes necessary to make holding profitable to the grower.

Several potato growers who have watched the markets for many years have said that in the long run it pays better to sell directly from the field than to hold. This is probably true, and if one were to choose between holding and selling in the fall as a regular practice, the latter is what he should do.

But it is also true that in some years it would pay the farmer to hold his crop. By learning what the total potato crop in the United States will be and the condition of the European crops, he can tell what the price is likely to be. If it seems that potatoes will advance more than enough to pay the cost of holding, it would be advisable to hold. If the advance is only a little greater than the cost, it would be better to sell in the fall.

GROWING POTATOES IN THE SCHOOL GARDEN

E. F. McDONALD

(State Education Department)

The question of the rural school garden is one that presents difficulties and many methods have been suggested as to the best manner of procedure. It is believed, at the start, that good results can be gained by limiting the scope of the work to the type plant of the current year. Boys and girls will gain more of general and particular value through the study of soil preparation, seed selection, growth, spraying, and care demanded by the potato plant than through more diversified study. Hence, it is recommended, where there is an opportunity, that a potato plot be maintained and that simple experiments be conducted to make clear, by field demonstration, the facts contained in the regular articles on potato culture appearing in the leaflet.

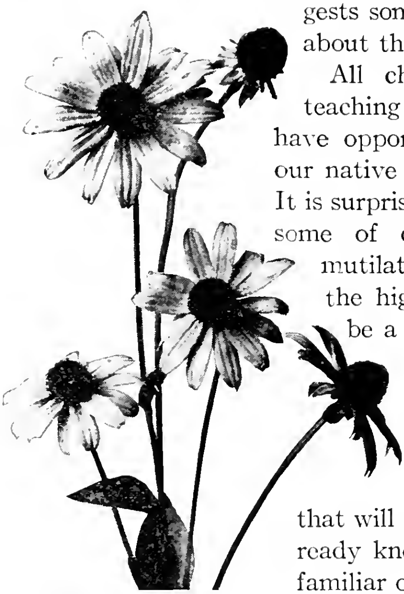
The plot need not be large; an area twenty feet square, or even less, would be sufficient for the object intended. Certain rows should be sprayed once, others twice and three times, and also check rows left. During school days the plot can easily be kept in excellent condition by the pupils under the direction of the teacher, and during vacation the trustee should appropriate a small amount of money to one of the pupils to give it proper care; or the crop might be sold for the benefit of the person who has taken care of it during the vacation.

Under the direction of the district superintendent, a town or district exhibit could be held, prizes awarded, and interest thus created for future work along similar lines.

PLANT STUDY

THE EDITOR

Perhaps no one of the nature-study lessons for this year offers more opportunity for interesting work than the recognition of plants. It suggests some informal discussions that often bring about the most valuable nature interest.



Black-eyed Susan

All children enjoy the wild flowers. In teaching them to recognize a few each year we have opportunity to discuss the preservation of our native flora, which is a most important lesson. It is surprising how many persons carelessly uproot some of our rarest plants, or thoughtlessly mutilate shrubs and trees as they walk along the highways. Respect for wild life should be a part of every child's education.

It would be a good plan to place on the blackboard a list of plants for study this year, and find how many the children know. Ask for descriptions, and then proceed to suggest observations that will add to their knowledge of the plants already known. Send them on a quest for the unfamiliar ones and ask them to gather but one or two specimens of the flowers that are scarce.

The specific differences in plants become very interesting to boys and girls. Send the class out to look for a trillium that is different from the first one brought to school in spring. Have them note differences in the habit of the plant, in the blossom, or in the leaf. Have as many specimens as possible of the lily family brought to school. Note any points of similarity in the plants of near kin.

Probably all of our boys and girls know a willow tree, but very few know what a large number of different kinds can be found in this State. Encourage the pupils to search for the willows that differ in any way. Learning to note the differences in plants nearly related tends to develop accuracy of observation, so essential in all life work.

The *black medick*, one of the plants to be recognized this year, is a familiar weed but is not known to all children by name. Should the teacher find one of the plants near the schoolhouse, it would be well to send the boys and girls to see it; or better still, to describe the plant some day before school closes and have the boys and girls search for it and report on their success the following morning. Such a lesson will take but a few minutes, yet it may result in much development for the pupils, as: (1) Interest in the description of a plant. (2) Actual observation of plants to find the one described. (3) The exercise will give opportunity for a good oral language lesson. (4) Interest will be awakened when the pupils learn the relation of this weed to some of the useful plants in the same family.

PLANTS TO BE RECOGNIZED IN 1912–1913

I. T. FRANCIS

The marsh marigold.— This plant belongs to the crowfoot family. The stems are hollow, smooth, ascending, with undivided leaves. The flowers have no petals, but the yellow petal-like sepals give them a bright yellow color. The plant grows about one foot high and is found in swamps and wet meadows. Frequently it is called cowslip and meadow buttercup.

Marsh marigold

Among the plants in the crowfoot family are the *columbine*, *buttercup*, *larkspur*, *goldthread*, *virgin's bower*, *anemone*, *hepatica*, or *liverleaf*, and *meadow rue*.

The trillium.— The trillium, or wake-robin, is a low, smooth, unbranched herb, growing from a short scarred rootstock. The plant has a large terminal flower, below which are three leaves arranged in a circle around the stem. The leaves are broad and netted-veined. The flower has three white, pink, purple, or greenish petals and three green sepals that persist until the many-seeded berry ripens. The trillium grows in rich woods and blossoms in early spring.

The trillium is a member of the lily family, and has among its kin the *hyacinth*, *lily of the valley*, *Solomon's seal*, *asparagus*, *lily*, *tulip*, *onion*, and *garlic*.

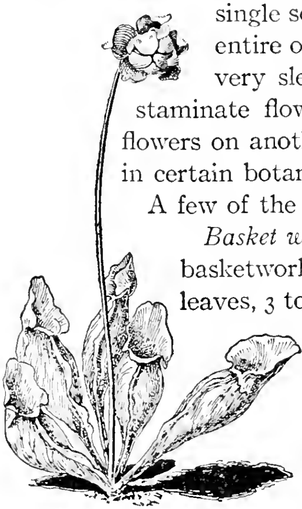
The black medick.— This plant, sometimes called nonesuch, is a trailing, clover-like plant with three separate leaflets that are toothed. The small yellow flowers are in heads or very short spikes. The pods are small, curved, one-seeded, and black when ripe. It is a common plant along roadsides and waste places. It was introduced from Europe.

The family to which the black medick belongs is the pulse family. Some of its kin are the *alfalfa*, *bean*, *pea*, *sweet clover*, and *clover*.

The pitcher plant.— The pitcher plant, or sidesaddle flower, belongs to a group of marsh plants that have pitcher-like leafstalks, in the cavity of which a fluid (with properties approaching those of gastric juice) is secreted. The tube is hairy within, with downward-pointing, stiff hairs. The single nodding flowers are borne on a leafless or nearly leafless stem, arising from an underground part of the plant. The flower has five sepals and five petals.

This plant belongs to the pitcher plant family and has but few near kin. In bogs of Virginia and southward there is a flower called "trumpet," which is the only relative of the pitcher plant in our part of the country.

The willow.— The willows are trees or shrubs that have buds with a single scale. The leaves are mostly long and pointed, entire or glandular-toothed. Usually the branches are very slender. The willows are diœcious, that is, the staminate flowers are borne on one tree and the pistillate flowers on another. As many as 51 different species are listed in certain botanical works.



Pitcher plant

A few of the more common willows are as follows:

Basket willow, or *osier*, the twigs of which are used for basketwork. It has lance-linear, entire, slender-pointed leaves, 3 to 6 inches long and satiny white underneath.

The *black willow* has a rough bark and narrow-lanceolate, taper-pointed leaves, often downy when young, green and smooth when older, except the short petiole and midrib. It grows on the banks of streams and lakes.

The *crack willow*, or *brittle willow*, has smooth leaves from the first, green on both sides or only slightly paler beneath. The tree is tall and slender. The twigs are very brittle at the base, easily breaking away and growing into new plants when set in the ground. This tree is planted for shade and ornament.

The *weeping willow* is a large tree with rough gray bark and slender, green, elongated, drooping twigs. The leaves are at first silky, but quickly become smooth. This tree is planted for ornament, and has spread along river banks and lake shores.

The *white willow* is a large tree, the leaves of which are ashy gray or silky white on both sides except when old. It is variable and often mixed with crack willow. The forms with yellow twigs are cultivated.

Some twenty species of willow are found growing wild in the North-eastern and North Central States, but it is difficult even for botanists to identify them.

The willows belong to the willow family, in which we find but one other kind of plant, the *poplars*, or *aspens*.

The partridge berry.— The partridge berry, squawberry, or twinberry is a pretty trailing evergreen herb common in dry woods, especially under evergreen coniferous trees. The leaves are small, round-ovate, very smooth and glossy, bright green, sometimes with whitish lines, short-petioled. The flowers are attractive and sweet-scented. The fruit is edible. It is scarlet (rarely white), remaining over winter.

The partridge belongs to the madder family. Here we find the *bedstraw*, *buttonbush*, *bluets*, and *buttonweed.*

The cherry.— The cherry is closely related to the peach and plum, and like them it has a fleshy fruit with a hard stone. It usually grows to be a good-sized tree, but some species are only shrubs. The flowers, usually white, vary from small to large and are borne sometimes in clusters of a few flowers springing from one point or as a number of blossoms on an elongated axis. There are five petals and five sepals. The inner layer of bark is usually somewhat bitter. The fruit varies from yellow or red to black or purplish black.

The *sweet*, or *mazzard cherry*, and the *sour*, or *morello cherry*, are rather commonly cultivated in orchards and gardens. The flowers of both are large, but the fruit of the mazzard is sweet and juicy, while that of the morello is sour and acid. The sweet cherry tree has a pyramidal form and reddish brown bark, while the tree of the sour cherry has a lower and rounder head and gray bark.

The *wild black*, or *rum cherry* is a very widespread and hardy tree. The leaves are rather long and have sharp teeth along the margin. The fruit is small and purplish black. The small white flowers are borne in graceful clusters on a long axis.

The *chokecherry* is also a rather common wild tree. The inner bark has a rank, disagreeable odor, and the fruit, which is red turning to dark crimson, is rather bitter.

The *wild red*, *bird*, *fire*, or *pin cherry* springs up somewhat commonly in rocky woods, and especially in places in which the forest has been recently cleared. The fruit is light red, very small, and sour. The flowers are borne many in a cluster.

The daisy.— The daisy belongs to the composite family, as do also the *thistle*, *aster*, *chrysanthemum*, *goldenrod*, and *dandelion*. What we call the daisy flower is really a cluster of a great many flowers borne close together on a head. The corolla of the flowers in the outer circle of the cluster is developed into a long, white, strap-like part, called a ray, giving the whole head the appearance of one flower, and the circle of green bracts about the cluster seems to correspond to the calyx of a single flower.

There are a number of species of this family that are called daisies. The *oxeye*, or *white daisy*, sometimes called whiteweed, is one of the common weeds of our pastures and meadows in the summer. There are twenty to thirty white spreading rays, surrounding a bright yellow disk. The leaves at the base of the plant are oblong and coarsely toothed. The stem leaves are clasping and the upper ones are smaller and almost entire.

The *yellow daisy*, or *Black-eyed Susan*, has a large flower head with ten to twenty yellow rays and a purple-brown disk. The heads are larger than in the white daisy and the stems are often simple, or branched near the base. The leaves are nearly entire, the upper ones oblong or lance-shaped. This is a common weed of the fields in some localities, especially in dry soils.

The anemone.— The anemone is an erect perennial herb with leaves that proceed from the root or base of the stem near the ground, and two or three opposite or whorled stem leaves constituting an involucre some distance below the flower cluster. The sepals are few or numerous, colored, and petal-like. The petals are wanting.

The *tall anemone* grows in woods and meadows. The plant is hairy and grows two to three feet high.

The *wood anemone*, or *windflower*, is low, has a simple stem, and grows from a thick, thread-shaped rootstalk. The sepals, four to seven in number, are white, pink, blue, or purple.

The anemone belongs to the crowfoot family and has for near kin the *virgin's bower*, *marsh marigold*, *larkspur*, *columbine*, *hepatica*, *meadow rue*, and *buttercup*.

" *As whispers for a moment rest*
Upon the brink of sound,
Here fragrant breezes blossom-drest,
Half visible are found."

JOHN B. TABB

" *The orchard trees are white,*
For the bright May sun is shining,
And the blossoms show
Like a drift of snow
From a cloud with a rosy lining."

SELECTED

" *They are all in the lily bed cuddled together—*
Purple, yellow-cap, and the baby-blue;
How they ever got there you must ask the
April weather,
The morning and evening winds, the sunshine
and the dew."

NELLIE M. HUTCHINSON

WEEDS

J. L. STONE

A WEED has been defined as "a plant out of place." Professor Roberts, as a result of some experiments in the thickness of seeding corn, once said, "The worst weed in corn is corn." A more common conception, and one that is more satisfactory in this connection, is: "A weed is a plant injurious to agriculture and to horticulture."

Weeds growing in crops cause great reduction in yield and consequent loss to farmers. It has been estimated that the loss from injury by weeds in the United States is not far from $100,000,000 annually.

Weeds affect crops injuriously in a number of ways. They rob the crop of plant foods that otherwise would be available for a more perfect development of it. They often draw heavily on the soil moisture, robbing the crop of its much-needed supply. This is especially harmful in some cases. The crop plants growing among the weeds cannot develop leaves normally: In the leaves the plant food is elaborated, and from them the water in which it was taken up is evaporated. If the leaves are dwarfed and stunted for want of light and air due to the crowding of weeds, they cannot elaborate sufficient plant food for the normal development of the crop. In many instances the weeds actually crowd out part or all of the crop plants.

Some weed seeds are difficult or impossible to separate from the cereal grains, and the grains are depreciated in commercial value because of the presence of these weed seeds.

It is not the purpose of this lesson to go into the methods of eradicating certain pernicious weeds after they are established in the soil, but to suggest preventive measures regarding weeds in general.

A given amount of effort will do more toward the suppression of weeds if directed against the production of their seeds in the vicinity, or the introduction of them from elsewhere, than it can do by fighting them after they are established in the fields. It is a case in which " a stitch in time saves nine."

The chief source of supply of weed seeds in any locality lies in the badly tilled fields, the neglected areas, and the unkept roadsides. Fields that are tilled as thoroughly as they should be for the sake of the crops growing on them usually do not produce much weed seed. This statement will not hold in the case of cereal crops growing on land infested with mustard, chess, and the like. Thorough cultivation of the land, cleaning up of the hedgerows, and mowing of the fence corners and roadsides, are among the first steps to be taken in the suppression of weeds.

The sowing of impure seed is an important source of weed perpetuation. In oats we are likely to find mustard, Canada thistle, and ragweed; wheat or rye may carry chess or cockle; grass and clover seed may carry a large variety of pernicious weed seeds, such as the daisy, wild carrot, and plantain.

There is no excuse for sowing impure seeds. Pure seeds can be obtained. Impure seeds should be either cleaned or rejected. In the case of grass and clover seeds the experiment stations will examine and report on the purity of samples, or, better still, the farmers may supply themselves with a hand lens and a seed bulletin and they will soon be able to test seeds for themselves.

Probably the most dangerous means of weed distribution at the present time is in the mill and brewery by-products that are sold for stock food. The grain screenings, containing large numbers of weed seed, are added to these by-products in many cases. Users of such feeds should examine them critically and reject them if they contain live weed seeds. There should be effective laws to prevent the selling of seeds or feeds infested with pernicious weed seeds.

Stable manure is always a fruitful means of weed dissemination unless great care is taken to keep weed seeds out of it, or unless the manure is thoroughly composted before being applied to the land. City manure is even more likely to introduce troublesome weeds than country manure, but city manure is rarely purchased except for farms on which the tillage is fairly thorough, thus holding the weeds in check.

Itinerant threshing machines, when allowed to come on a farm without having been cleaned out thoroughly, often bring certain weed seeds from an infested farm to one heretofore free from the kind brought in. It is well to insist that the machines be thoroughly cleaned before coming on the farm.

Hay and straw used for packing often carry weed seeds long distances to localities not infested with them. It is well to burn such material in order to avoid this danger.

SOME COMMON WEEDS

PAUL J. WHITE

Purslane, cr "pusley."— This weed is very common, especially in the rich soils of gardens. It is a sprawling plant, growing flat on the ground. The leaves are thick, fleshy, and dark green in color; the stems are reddish; the blossoms are small and yellow, are about one fourth inch across, and appear at the ends of the prostrate branches about the first of July. The plant continues to blossom and ripen seeds until frost.

Purslane is closely related to our common garden portulaca; in fact, it is sometimes called wild portulaca. It is one of the common weeds that have been introduced from abroad, and is a native of the tropics. This weed is not entirely devoid of good qualities. The writer well remembers gathering it for pigs in the early days of Kansas. It was also used for greens by the early settlers.

Purslane ("pusley")

It is very difficult to destroy purslane. Like most plants having thick, fleshy leaves, it dies hard. Plants that are cut off with the hoe may live for weeks and even ripen seeds. Also, they sometimes take root again if the ground is loose and moist. If the plants have begun to blossom, it is safer to cut them with a sharp hoe and remove them from the garden.

Bindweed.— One of the very worst weeds in the State is the bindweed. It is not so common as some other weeds, but when it gets into a field or garden it is next to impossible to get it out.

Bindweed is sometimes called wild morning-glory. The pink blossoms are smaller than those of the cultivated morning-glory. The weed has a twining habit and when it is abundant it winds around other plants and smothers them. It increases both by seeds and by underground stems. The smallest part of the creeping root is sufficient to start a new plant.

This pest appears most often in rich fields and gardens. It will spread in a circle from a single plant until the whole garden is infested. Many ways of destroying it have been tried, the most of which have been unsuccessful. The only sure way to destroy it is to cut the plants off as fast as they appear. Any kind of plant may be killed if it is not permitted to send stems or leaves above ground. In cultivating a field containing bindweed, one should be careful to avoid dragging pieces of the roots from place to place on the tools. The weed may be widely spread in this way.

Bindweed

Pigweed, or redroot.— Nearly every boy and girl knows this weed. It probably takes its name from the fact that it is so much relished by pigs. The weed lives only one year, yet it produces an enormous number of small, shiny, black seeds. It may be distinguished from almost all other weeds by its rosy pink root, somewhat resembling a beet. The garden cockscomb is a near relative of pigweed; the seeds of the two plants are much alike.

Pigweed is very persistent in cornfields and in other cultivated crops. It is almost sure to appear after the last cultivation of corn. It grows tall and rank, taking from the soil moisture and plant food that are needed by useful plants. The only way to control it is by persistent cultivation and hoeing. The straggling weeds may be removed by hand pulling.

Canada thistle.— This plant is too well known to need description. It spreads by means of seeds carried by the wind or sown with clovers, grasses, or oats. A cultivated crop that is carefully tilled helps to destroy it. It can be destroyed by mowing twice a year, in June and August. It should not be allowed to blossom. If the plants are not too numerous they may be cut off below the surface of the ground and a spoonful of salt put on the fresh cut. If persisted in as often as they appear, this method is usually effective.

Pigweed, or redroot

Wild carrot.— Wild carrots do not spread from the roots, but they produce a great number of seeds. These seeds have been known to live in the ground several years before growing; therefore the plants must be repeatedly pulled or cut off. They are not troublesome in plowed land, but are common in old meadows.

ONE GRAIN, ONE GRASS, ONE CLOVER, TO BE STUDIED IN 1912–1913

E. G. MONTGOMERY

I. OATS

Oats are the most extensively cultivated cereal in New York State. The value of the crop, as compared with other cereal crops, is shown by the following statistics for 1910:

Crops	Value
Oats	$19,000,000
Corn	16,000,000
Wheat	10,000,000
Barley	1,500,000

FIG. 1.—*True panicle*

There are only four States with an oat crop more valuable than that of New York, namely, Illinois, Iowa, Minnesota, and Wisconsin.

About 4.3 acres out of every 100 are devoted to oats in New York. The average yield is 31.3 bushels and the average value is $13.44 per acre. The part of the State showing the highest production of oats is comprised in the counties bordering on the south shore of Lake Ontario, while the east half of the State produces very little oats.

It would be interesting to find how your own neighborhood compares with other parts of the State in oat production. Find by inquiry what percentage of the land in your district is devoted to oat culture, and its average yield and value.

Kinds of oats.— When the shape of head (or panicle) is considered there are two kinds of oats, known as the *true panicle* (Fig. 1) and the *side panicle* (Fig. 2). The oat grain is also of several colors, as white oats, black oats, red oats, yellow oats, and gray oats.

There are several kinds of oat *spikelets*, as shown in Fig. 3. Some have only one grain and others have three. In some varieties a long *awn* is borne on each grain. How many kinds of oat spikelets can you find?

Oat grains vary also in shape, certain varieties having long, slender grains, while in others the grains are short and plump. There are 400 kinds of oats. How many kinds can you find growing in your neighborhood?

Parts of grain.—The oat grain can be separated into two parts, known as the *hull* and the *kernel*. (See Fig. 4.) The whole is called a *grain.* The hull has no food value, but the kernel is very nutritious. In making oatmeal the hull is first removed and only the kernel is milled. Oats constitute a valuable food for young growing animals or for horses at hard labor, but they are not used in fattening stock.

FIG. 2.—*Side panicle*

Food value.—The food value of the oat grain depends on the percentage of hull to kernel. About 25 per cent of a good oat is hull, but a poor oat grown in a bad season or on poor soil may have as high as 40 per cent hull. (Determine the percentage of hull in a sample of oats by first weighing a small sample and then removing the hull and weighing again.)

Manner of growth.—Oats usually produce more than one head from a single seed. As the farmers say, the oats "stool," that is, branch at the ground and send up several stems from each seed. When sown thickly, not more than two heads are produced from a seed; but if the seeding is thin and the soil rich, as many as five heads may be produced from a single seed.

Examine oat plants on various kinds of soil and see how many heads are produced to each seed.

Editor's note.—The oat crop in New York State is so important that the teacher should take opportunity to discuss it whenever interest is shown. A few test questions that can be answered from the foregoing text will probably lead the girls and boys to think about the subject. Place the questions on the blackboard and have the older pupils consult farmers in the neighborhood and reference books, before answering the questions.

FIG. 3.—*Spikelets*

Let one of the pupils place on the blackboard drawings from the illustrations (Figs. 1 and 2), and find out how many of the class have ever noticed that some oats have true-panicled heads and some side-panicled heads. Appoint a committee of older boys to gather material for the study of oats next year. This will lead to observational work.

Questions. — In which States do we find oats most extensively grown? How does New York stand in the production of oats? What is the value in dollars of the oat crop of New York State? In what parts of the State do we find the most extensive oat fields? What percentage of the land in your district is devoted to oat culture? How many kinds of oats are there? How many kinds can you find in your neighborhood next summer?

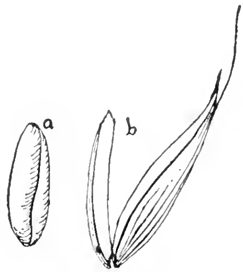


FIG. 4.—*Oat grain. a, Kernel; b, hull*

Who grows oats most extensively in your district? Is the crop sold or used at home? If oats are not grown on some of the farms in your neighborhood, can you find out why? What effect has the kind of soil on the growing of oats? Do oats require a large or small amount of moisture?

II. TIMOTHY

The hay crop is the most valuable single crop produced in New York State. Its annual value is about $70,000,000. Altogether there is about five million acres of hay in the State, and about four million acres of this hay is timothy, or timothy and clover mixed; so we see that timothy is the most valuable of all the crops in New York.


Head of timothy

The name "timothy" comes from Timothy Hansen, of Maryland, who is said to have introduced the seed from England in 1720. Timothy is sometimes called Herd's grass, after John Herd, who is said to have found it growing wild about 1700.

Why do we cultivate timothy? There are about 1,380 species of grasses, either wild or cultivated, growing in the United States, yet only a few of these are cultivated to any extent. How many cultivated grasses can you name or collect? How many uncultivated grasses can you find growing wild?

A grass, in order to be cultivated, must have two important qualities: first, it must produce seed in abundance; and second, it must yield a large quantity of good forage.

Many of our native wild grasses are excellent in every way, but produce such a small quantity of seed that it cannot be procured at a sufficiently low cost to sow meadows. A few other grasses yield plenty of seed, but the forage is coarse and does not make good feed for cows and horses. We find that there are only a few grasses that produce both good seed and good forage.

Grasses are known as " bunch " grasses or " sod " grasses. Timothy is a sod-forming grass, because each bunch tends to spread every season until bunches near one another intermingle and form a sod.

Have you ever seen the corms on a timothy plant? A corm is similar to a very small potato and grows underground. If you dig up a timothy plant in the fall, a large number of corms will be found; they are swollen parts of the underground stem. These corms give rise to new plants and are an important means by which the timothy plant propagates itself from year to year. In fact, the old timothy plants and roots appear to die out more or less every year, and if it were not for these corms there is some doubt as to whether a timothy meadow would last for more than a year or two.

Timothy plant

How long does a timothy meadow last?

When the farmer cuts timothy for hay he has two points to consider: first, he must not cut it when too green or when in blossom, or it will make dusty hay; also, the crop increases about one fourth in weight from the time it is in bloom until it is ripe, so that he does not secure so large a yield when the hay is cut in blossom. On the other hand, ripe hay is not relished by animals; also, allowing the hay to ripen exhausts the roots and weakens the sod for another crop. The proper time to cut is about 7 to 10 days after blossoming, when the seed is in the " dough " stage but not ripe.

A neighborhood study of timothy.— By inquiry find out what proportion of all the land in your school district is in hay; in cultivated crops; in pasture; in forest.

How much of the hay land is pure timothy? How much is timothy and clover mixed?

How much hay per acre is produced in your district?

Improving timothy sods.— The average yield of timothy in New York State is 1.1 ton per acre. Compare this with the yield in your neighborhood.

A heavy dressing of manure has often doubled the yield of old meadows. At the Cornell University farm an old meadow yielding

$1\frac{1}{4}$ ton of hay was made to yield 3 tons by applying the following fertilizer per acre:

200 pounds sodium nitrate
100 pounds acid phosphate
50 pounds kainit

This is a good fertilizer for most old timothy meadows.

III. ALSIKE CLOVER

Alsike clover seems to have first come into extensive cultivation in Sweden, in the village of Syke, or Alsike. It was introduced into France about 1800 and into England 30 years later, and probably into America about the same period. It has not been in extensive cultivation for a great length of time; the contrary is true of red clover and white clover, both of which have been cultivated at least 2,000 years.

It would be interesting to find out how long alsike has been cultivated in your neighborhood.

A study of the plant.— In June it is possible to find full-grown plants of white, alsike, and red clover. If you cannot study the plants at this time, they should be collected and dried, or, better, preserved in a formalin solution.*

On comparing the three clovers it will be found that the alsike has leaves resembling those of the white clover, but the general appearance and the stem are more like those of the red clover. Alsike also has smooth stems, as has white clover, but the blossom has more red than does that of white clover and it is larger. In fact, the blossom appears to be about halfway between white clover and red clover. Alsike is supposed to be the result of a cross between these two clovers, and it really does partake somewhat of the characteristics of each.

The alsike clover, however, has one quality that the red and the white do not have, and this is quite important to know. Red clover and white clover will not grow on many soils, which are said to be "acid," until large quantities of lime are added to "sweeten" the soil. The alsike will grow on acid soil, and is found growing well in many places where red clover cannot be grown. Redtop grass also will grow on the same kinds of soil that are suited to alsike, so we often sow redtop and alsike clover together for meadow or pasture.

Uses for alsike clover.— Alsike clover is a valuable feed, either as hay or pasture; but since it does not yield so heavy a crop as does red clover for hay, and is not so long-lived as white clover for pasture, the alsike

* A good way to keep green material for future study is to preserve it in a formalin solution. Make the solution by adding two ounces of formalin (costing 10 cents) to one gallon of water. Keep the solution in glass fruit jars. At any time when it is desired to preserve green material, merely place it in the solution and leave it there. The material will keep fresh and green for several months, or even years.

is not generally sown on land where these other clovers do well. However, where the soil will not grow red or white clover without lime, it will often grow alsike very well. Alsike is especially useful on wet pasture, and, on the whole, it is a really valuable plant.

Field studies.— It would be well to make a field survey of the waste lands and roadsides in your neighborhood in early June, when the alsike is in blossom and most easily recognized, in order to find on what kinds of soil it seems to be growing wild.

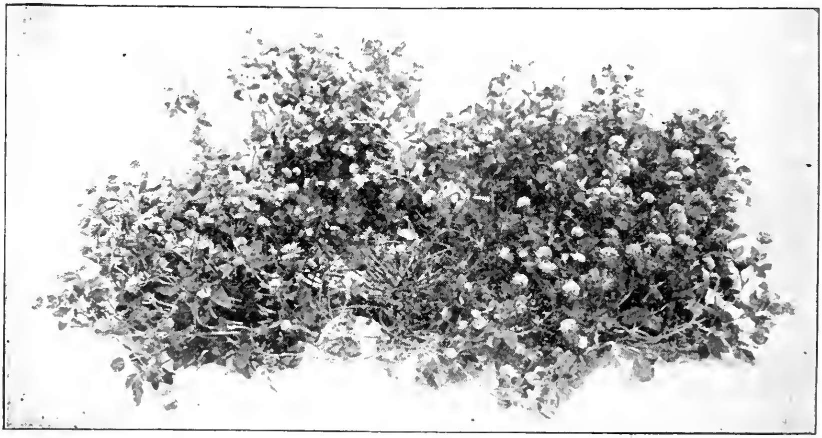
Find out by inquiry whether there is any land in the neighborhood on which some one has tried to grow red clover and failed. Has he tried alsike clover, and, if so, with what success?

Learn to identify alsike clover before it blossoms, when in blossom, and when the heads are ripe.

Does alsike clover spread by the stems, creeping over the ground? Do white clover and red clover spread in the same way?

Dig up a plant of alsike and see whether you can find any tubercles on the roots?

Get a packet of alsike clover from a seedsman and learn to identify the seed alone or when mixed with other seeds.



Alsike clover

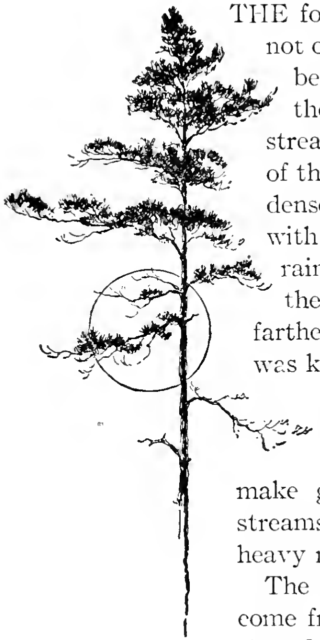
"Again I see the clover bloom,
And wade in grasses lush and sweet;
Again has vanished all my gloom
With daisies smiling at my feet."

JOHN BURROUGHS

TREE STUDY

John Bentley, Jr.

I. OUR FORESTS



THE forests and woodlands of our State are valuable not only as a source of wood and lumber, but also because of the beneficial effects they have on the supply of water. Nearly all of our large streams and rivers rise in the mountains or hills of the State, which were originally covered with a dense growth of timber. The ground was covered with leaves, and the trees broke the fall of the rain so that, instead of rushing down the hill, the water soaked into the ground and reappeared farther down as springs. Thus the flow of the water was kept regular and even, and because of this the water was clear. After the forests were cut down the leaf litter was washed away or destroyed, and soon the heavy rains began to make gulleys in the land; so that sometimes the streams were high and at other times low, and after heavy rains they were frequently muddy.

The contrast is very marked between streams that come from mountains covered with timber and those that flow for a long time through treeless regions. Those persons who have crossed the States of Montana, Nebraska, Kansas, or Wyoming know that the rivers in those sections are all very muddy; while the rivers in the States of New York, Pennsylvania, and West Virginia, and in other Eastern States in which there are many mountains covered with timber, are comparatively clear and clean. This is because the forests hold the soil in place and prevent it from being washed away by the heavy rains.

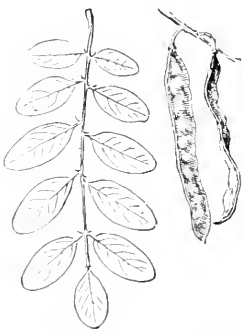
It is important, therefore, to preserve the woodlands and timber at the headwaters of our streams and rivers, and if we desire good, pure, clear water for drinking purposes we must see that the springs and small streams which form the source of our water supplies are protected by a good growth of timber.

In the development of this country a great deal of timber has been destroyed. Many times some careless hunter or traveler, passing through the woods, has left a camp fire burning and the wind has come up and blown the fire into a mass of leaves and dry sticks, setting the woods on fire. This fire, perhaps small at first, grew to be a destructive forest fire, burning many acres; and not only destroying the timber, but burning all the leaf mold on the ground so that many years must elapse before trees can grow well. Railroad locomotives send out a great many sparks, which in dry weather frequently start small fires that soon develop into large ones. In this way much timber has been burned every year. Mr. Graves, the Forester for the United States Government, makes the statement that since 1870 fifty million acres have been burned over by forest fires, resulting in a loss of fifty million dollars each year.

Another cause of damage is insects. Beetles bore into the trees and kill them, or caterpillars eat the leaves off the trees and cause them gradually to die; so that between the fires, the insects, and the lumbermen, the woodlands and forests of our country have disappeared very rapidly. It is necessary for us to begin immediately to take care of our forests, and this can be done in two ways: first, by protecting them against fire and using them wisely without waste or destruction; and second, by planting new trees or sowing seed in places where trees will grow but where there are no old trees to furnish seed for new growth. Even in small communities much can be done toward helping to save our forests if each one will do his part. Boys and girls should be taught the danger of leaving a fire unguarded; it should always be extinguished before they leave the woods. They should also be taught to protect the young trees that are coming up, so that these will not be trampled on or uprooted. A most valuable nature-study lesson would be to teach the pupils to gather some seed and sow it in treeless places. They will then be doing something that in years to come will contribute greatly toward the welfare and prosperity of the community.

II. THE LOCUST TREE

Last year we studied the white pine, which is one of the most important of all the coniferous, or cone-bearing, trees native to this country. This year we have for special study the *locust* tree, which is one of the broad-leaved trees. We have already learned that the cone-bearing trees furnish a very large proportion of the timber used in our country, and that the hardwoods, or broad-leaved trees, are perhaps not so generally useful. For certain purposes, however, the carpenter or the builder frequently has to turn to the hardwoods for what he wants, either for hardness or durability or for the beautiful grain and satin-like finish of which hardwoods are capable. We all know that a handsome piece of mahogany or curly birch or bird's-eye maple is much better suited to the making of



Leaf and fruit of common locust

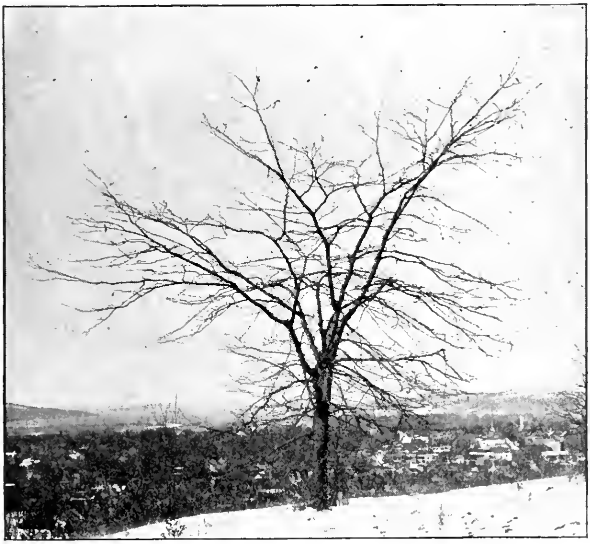
A common locust tree in winter

fine furniture and the interior finishing of a house than is the spruce or pine. Each class of trees has its own uses: the pines, spruces, and firs are especially useful in construction work and framework, for which such qualities as strength, medium weight, and durability are required. The hardwoods are chosen for finishing and trimming, as well as for furniture and cabinet making, for which beauty and elegance are wanted in addition to strength.

Unfortunately, not all hardwoods are equally attractive, even when carefully worked and smoothly polished. In order to be handsome and useful for furniture or interior finish, a wood must possess a certain degree of hardness, so that it will take a fine polish; and in addition to this, it should have a rich color, or a well-marked grain, or both. White oak, sycamore, mahogany, birch, red gum, black cherry, and maple when it has a " curly " or a " bird's-eye " grain, are all much used for furniture or interior finish and for panel work; while beech, chestnut, elm, basswood, hickory, locust, and a great many others are not so much used for these purposes, but are nevertheless very useful for special purposes because of the toughness or hardness of their wood. The locust, which we are to study at this time, is especially useful for posts, poles, ship timbers, or any other purpose that demands toughness and strength combined with durability in contact with moisture. Many woods will decay rapidly when they are subjected to the moisture in the ground or to the ordinary changes in the weather. A good quality of the locust, however, is its durability, especially when in contact with the soil or exposed to the weather. Some of the great railroad companies, which use each year many thousands of railroad ties, have recognized the durability of the locust and are growing and cultivating locust trees on their own land to supply ties, posts, and poles.

In what way does a locust tree differ from other common trees that we see around us? How can we recognize a locust tree when we see it? In the first place, we should know that the locust is one of a family of plants which is very useful to man — *the pulse family.* This family includes many plants whose fruit or seeds are edible and supply food for man and beast. Peas, beans, and lentils are used by man as food, and they are very valuable foods indeed because they are so rich in proteids. The locust tree, true to the characteristics of its family, bears fruit consisting of a number of dark, orange-brown seeds, about 3–16 of an inch long and usually with irregular darker markings, enclosed in a reddish brown pod 3 to 4 inches long. The presence of the pods, which persist from the time they ripen in the fall until early spring, is one of the distinguishing characteristics of the locust. In the spring the tree may be recognized and identified by its foliage and flowers. The leaves are 8 to

14 inches long, with 7 to 19 leaflets, making what the botanists call a compound leaf — that is, a large leaf composed of several smaller leaflets all growing from the same stem. The leaflets are $\frac{1}{2}$ to $\frac{3}{4}$ inch broad, about $1\frac{1}{2}$ inch long, and generally have a perfectly smooth edge. They are a dull dark green above while the under surface is paler, and in the fall they turn to a clear yellow. The flowers, which appear late in May or about the first of June, are borne in loose, drooping clusters; they are creamy white and very fragrant. A locust tree in full bloom is indeed a very beautiful sight.



A honey locust tree in winter

Where the soil is good the locust tree grows very rapidly when young. It puts out many roots in all directions, which seek the moisture in the soil. Frequently they are so close to the surface of the ground that a number of shoots are sent up. These soon grow and make a thicket of young locust trees. These young trees are very attractive, but they use up a great deal of the moisture in the ground. If, therefore, the old tree is to grow to a good size, it is well to cut the sprouts each year and to keep the ground near the parent tree clear. When a number of locust trees are growing together and are all of about the same age, as in a plantation, there will not be so many sprouts.

The young locust tree grows very rapidly, and at the same time the wood that it produces is hard, strong, and heavy, and is usually a pale yellowish brown in color. Because it is so durable it is useful as posts, railroad ties, or any other kind of timber that is exposed to changes in the weather and dampness in the soil.

The locust tree has an enemy that often destroys it—the locust borer (*Cyllene robiniæ*), an insect that does its destructive work in the form of a grub. It bores holes in the trunk and branches, keeps the tree from growing as it should when in a healthy condition, and may destroy it. In September the beetles—which are about three fourths of an inch long and of a velvety black color with bright golden-yellow markings—gather in large numbers on the bark of the locust trees and lay their small white eggs in the crevices of the bark, in clusters of seven or eight. These eggs soon hatch into little grubs, or worms, of a yellowish color, about three fourths of an inch long. They bore into the bark and work industriously, mining through the softer tissues of the wood until winter overtakes them. They then rest until the warm weather of spring revives them, when they begin work in April or May even more vigorously. They extend their burrows into the wood of the tree, sending out chips and sawdust, by which their work is often detected. The grubs become full-grown about the middle of July, at which time they go through the metamorphosis common to beetles and emerge early in September as beetles.

After a few seasons of this kind of work the tree is doomed. It ceases to make normal growth; it is covered with great scars and wounds, and, like the unprofitable fig tree of the Scriptures, is fit only to be cut down and burned. The sooner it is burned, the better, for if done while the grubs are in it they are killed and prevented from extending the injury to some other tree.

Nothing is known to prevent the destruction of the black locust by the locust borer. About the only thing that can be done is to watch the plantation closely, and if it is found that one or two trees have been attacked it is better to cut these down and burn them immediately, so as to prevent the insects from attacking other trees in the plantation. This seems like a somewhat rigorous measure, but after the insects have once made inroads into a tree it is practically impossible to get them out without destroying the tree.

If the locust tree is cared for and protected against these borers, it should soon become large enough for fence posts.

Observations for the pupils

1. Did you ever see a locust tree as large as an elm? as a maple? Is the bark smooth and gray, like that of the beech tree, or is it rough, and dark in color?

2. Note whether the bark on the branches has prickles on it. Are they stout and strong, or can they be easily broken off? Did you ever see a

locust tree blown over by the wind? Do you think good strong roots would hold a tree in position against hard winds and storms?

3. What do the flowers of the locust tree resemble? Notice the leaflets of the locust on a bright, sunny day, and then on a still night; notice how they have folded together; or in cloudy, cold, or rainy weather, see how the leaflets behave. It is one of the habits of members of the pulse family to fold their leaves together at night. If there are pods on the tree, how many seeds are in the pods? How are they fastened to the pods?

4. In winter notice how the winter buds, which contain the beginnings of next summer's leaves, are protected by being depressed and covered with a scale-like covering, the inside of which is lined with a woolly growth. The tree makes all this careful preparation against cold weather, which might injure the tender leaves in the buds.

5. If you can find a locust tree that has been cut down and sawed into logs, count the rings of growth on the end of one of the logs. How many rings are there from the center to the edge? Does the tree show a rapid growth?

6. If a tree is injured, sap will flow from the wound. If the locust tree that you are observing has been damaged by the borers, notice how the sap has run. Be careful not to cause trees needless wounds by chopping into them or by severely bruising the inner bark.

7. The purpose of the bark is to protect the growing part of the tree, which is just under the bark. How thick is the bark on the locust tree? The sap carries water and plant foods from the roots to the leaves and from the leaves to the growing parts of the tree. That is why it is so important to keep the bark from being injured, for if the bark is cut or bruised or bored into by insects the tree loses sap and is weakened.

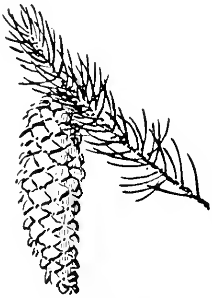
8. Compare the blossoms on the locust tree with the blossoms of the common sweet pea of the garden. Compare the fruit with the pea or the bean, grown in a garden.

9. Take some of the seeds of the locust and soak them in hot water (not boiling, but about 135 to 150° F.) for several hours. Do this for three or four successive days, or until the seeds swell, taking care not to let them dry out at any time. Plant them in soil in a box that can be kept in a warm, sunny place, and compare them with seeds sown at the same time but not previously soaked in hot water. Give them water each day in order to keep the soil moist. See how many days it takes for the soaked seeds to germinate. Have the seeds that were not soaked begun to show signs of germinating? How do you account for the success of locust trees in growing from seed in nature?

10. The presence of nodules on the roots of legumes is a family characteristic. Look on the fibrous roots of young locust trees and see whether you can find nodules.

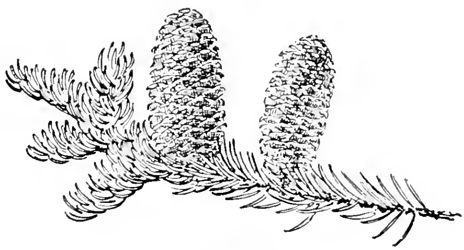
III. RECOGNITION OF TREES IN 1912–1913

The following characteristics will be helpful in recognizing the trees that are to be studied this year:



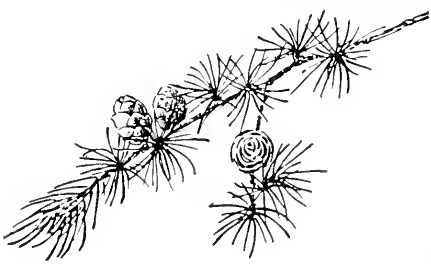
Norway spruce

Spruce, fir, and tamarack.— Norway spruce, which is not native to this country but is extensively planted as an ornamental tree in parks and on lawns, grows to a height of 70 to 80 feet and can be distinguished from the firs, which it resembles closely, by its four-sided needles and by its long, light brownish yellow cones. The needles of the balsam fir are flat and have a light gray streak on the underside. The cone is dark purple when young, turning dark brown after it is fully ripe and has shed its seeds. The bark of the spruce is a reddish gray in color, while the bark of the balsam fir is a light gray and frequently has small blisters on it which contain the fluid resin, used in the arts under the name of Canada balsam. The larch tree, or tamarack, can be distinguished from the spruce and fir by its needle-like leaves, which grow in clusters of ten or more and which fall off at the end of the growing season just as do the leaves of the broad-leaved trees. In the summer time the tamarack has a sparse, fringe-like foliage that gives very little shade.



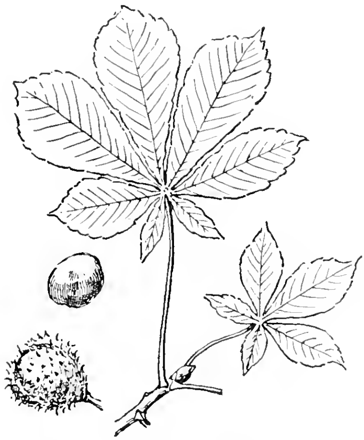
Balsam fir

Flowers of the tamarack.— About the time that the leaves are coming out, in early May, the flowers of the tamarack are very beautiful and are worthy of close inspection. The male, or staminate, flowers have many yellowish anthers on short stalks, arranged spirally. The female, or pistillate, flowers are composed of many rose-red scales, also arranged spirally, and are accompanied by rose-colored bracts with long green tips. When the cones are present on the tree they give it a warmth of color that harmonizes very beautifully with the feathery foliage, which is also unfolding at the same time.



Tamarack, or larch

Horse-chestnut.— The horse-chestnut belongs to a family that has some species native to the Southern and Western States. The buckeye of Ohio belongs here. The European species is the one most commonly planted in this part of the country. The horse-chestnut can be distinguished from other trees by its compound leaves, which have seven leaflets growing from a common point rather than distributed along the central stem as in the locust. The flowers are very beautiful in the spring, and the large nut, which ripens in the fall, is well known to every boy and girl.



Horse-chestnut

Alder.— The alder is a member of the birch family and its leaves resemble those of the birches somewhat, but are more rounded at the end. A very noticeable feature of the alder is the presence of the catkins (staminate flowers), which are formed in the late summer but which remain in a dormant condition until the following spring. The pistillate flowers are formed in the spring, and after being fertilized develop into a cone-like fruit.

The alders that rural teachers in New York State are most likely to find in their work are *Alnus incana* and *Alnus rugosa*. Another alder that is frequently planted and found in cultivation is the European black alder, *Alnus vulgaris*. This has been reported as escaped from cultivation in some places, and might therefore be found in unexpected places. In contrast to the native alders that have been mentioned, the European black alder has a distinctly tree-like habit of growth, and under favorable conditions would reach a height of 50 feet or more. The writer believes that rural teachers would always be able to distinguish this form of tree from our common alders by its habit of larger growth.

Alder

Elm.— The elm tree is one of the largest and most graceful of the trees native to New York State. It frequently branches a short distance from the ground and forms a large spreading crown, the shade from which covers a great deal of the space about it. The leaves are placed obliquely on the stem. The base of the leaf is unequal, that is, one side is longer than the other. The flowers appear early in the spring, before the leaves, and the fruit or seed, which is winged on the margin, ripens as the leaves appear. The wings have sharp points and are curved at the apex so as to make a sort of notch.

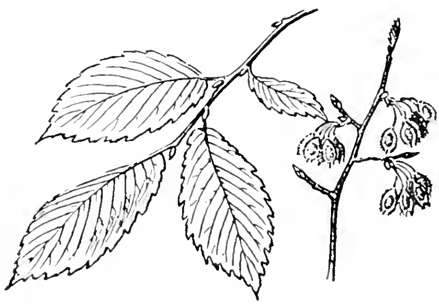
Poplar

Poplar.— The poplar is one of the most widely distributed trees in this country, ranging from the Atlantic to the Pacific Coast and all through the northern tier of States. The leaves are smooth, dark green above and grayish green beneath. The stem of the leaf, called the petiole, is flattened so that the slightest wind causes the leaves to rustle and shake, and because of this the tree is called in many places the "quaking aspen."

IV. PROPAGATING TREES IN SCHOOL GARDENS

The tree nursery.— The fact that the raising of trees in a nursery occupies one to three years, and that much of the work can be performed during the time the schools are in session, makes this kind of work very desirable for schools. Besides, a tree is of permanent value. After being raised from seed and cared for in the school garden, it can be set out to grow in some place where it is needed. It then becomes not only an object lesson, but a thing of beauty and of permanent value, reflecting honor and credit on those who have been thoughtful enough to plant it and care for it.

The work of starting a school-garden nursery should be begun only on a small scale, so as not to become too large to handle later on when the trees need more attention. If each pupil has a share and an interest in raising but one or two trees apiece, the pleasure derived from this work will be just as great as if he tried to raise a hundred or a thousand; and think of the large number of trees that would be set out, even if only one or two are planted each year by each pupil!



Elm

The first thing necessary to start a tree nursery is to have some seed, and the next is to have a suitable place in which to sow it. Let us begin with a very few kinds of trees and see whether we can be successful with these; perhaps we can attempt later to raise the more difficult kinds. The seeds that are easiest to gather are those of the oaks, the maples, the locust, the ash, the hickories, and the beech.

The soft maple matures its seed in the spring, from the first to the middle of June. The hard maple, and all of the other trees mentioned, mature their seeds in the fall and must be gathered in the fall. In practically all cases, tree seeds must be gathered chiefly by hand. Certain classes of them, such as locust seeds, acorns, and hickory nuts, which fall readily with the wind and frost, may be gathered from the ground after they have fallen. The seeds of the hard maple and the ash should be picked from the tree or collected from the ground as soon as they fall.

Storing the seeds.— The hulls of seeds such as walnuts and hickory nuts can be dried and removed, and the nuts spread out to dry in a cool, airy place. Acorns from those kinds of oaks whose acorns are difficult to remove from their cups may be left in storage with the cups attached. The seeds will keep better if allowed to dry slightly, so as to avoid molding. The interval between collecting and storing for winter may be used to dry the seeds.

The best way to keep seeds is to store them in bags hung in a dry cellar, or to " stratify " them in sand in a pit out of doors. This pit should be situated on raised ground, so as to insure good drainage, and it is often desirable to provide protection against mice and squirrels by means of wire netting or boards. Cover the bottom with a layer of clean sand, two or three inches deep. On this spread a layer of nuts, and then another layer of sand, until all the seeds are stored. The whole should be covered with earth to a depth of four to six inches. A mulch of leaves and hay spread on top, and then boards or stones to keep from washing, may be an advantage. The freezing that takes place during the winter will not injure the seeds, but rather will assist in opening the hard shells, thus making germination easier in the spring.

Preparing the seed bed.— In the spring preparations should be made for sowing the seeds in seed beds. The size of the plat of ground needed will depend, of course, on the amount of seed to be sown and the number of pupils who are to sow the seed and maintain the beds. Level or gently sloping ground is preferred to steep ground, in order to prevent washing. Ground that has been under cultivation for a year or more is better than fresh ground, if you are sure that it is free from cutworms and is in good condition. A loose sandy loam is preferable to a clay, and it is most important that the soil should be rich, mellow, porous, and well drained. The ground should be spaded deeply, worked over, and thoroughly pulverized by raking and harrowing until all clods, stones, and rubbish have been removed.

As a rule, the seeds of the broad-leaved trees should be planted in rows about 12 to 18 inches apart. This will allow plenty of room for cultivation after the seedlings have begun to come up. A square rod of ground will accommodate 11 rows 18 inches apart, and each row should be able to grow successfully about 50 seedlings, making a capacity of 550 trees for the plat. This, of course, is for hardwoods, and it is recommended that the children experiment with them in preference to the conifers, which are much more liable to disease and more difficult to raise.

Time of planting.— Early spring is usually the best time to plant tree seeds, except those of species such as the silver maple, red maple, white elm, and any others that mature in the late spring. It would be difficult to keep these seeds over the summer, and consequently they should be planted as soon as they mature. White oak acorns should be planted in the fall. If they are kept over winter only a few of them will germinate, and such as do germinate will be slow in getting started; but, as a general rule, the sowing of most tree seeds should be done as early in the spring as the ground can be worked.

Nuts and acorns of good quality may be planted two or three inches apart in the row, while smaller seeds, such as those of the maples, ashes, and elms, should be spaced about a half inch or an inch apart. The depth of planting should never be greater than twice the average diameter of the seeds. It is better that they should be planted a little too shallow than too deep, because if planted too deep the sprout is often unable to push its way through the soil.

Cultivation.— Care must be taken to see that weeds are frequently removed, and the more attention and cultivation that can be given throughout the summer, the better will be the results at the end of the growing season. If rains do not furnish enough moisture, the beds should be watered once or twice a week. A mere sprinkling of water will not do. Whenever the moisture fails, a liberal watering should be given; and in order to prevent too rapid evaporation, watering either in the early morning or late in the afternoon is the best.

After the first season it may be desirable to protect the trees during the winter by a mulch of straw or leaves, which should be six inches to a foot in depth and held in place by poles or slats to prevent the wind from blowing it away.

Transplanting.— When the trees are one year old, all except the very slowest-growing are ready to be transplanted from the seed bed to a transplant bed, or to a small plantation where they can still have some care and attention. During this second year, they should have more room for the development of both root and crown. The protection afforded by older trees is often of great value; therefore, if possible, the transplant bed may be partially shaded by a row or grove of older trees. Spring is usually the best season of the year in which to transplant trees. Care should be taken to see that they are transplanted before the growing season begins, in order not to interrupt the spring growth. In removing the seedlings from the seed bed, great care is necessary to secure all the rootlets of the seedling. It is best to put a spade into the soil five or six inches to one side of the young tree and pry it up, bringing with it considerable of the earth about the rootlets. In this way the tree may be removed without danger of destroying too many of the small roots.

Some trees, such as the hickories and the oaks, have a large taproot. This may be reduced by cutting off about one third. The top of the seedlings should be trimmed back until it is approximately the same size as the root system. During the course of transplanting the young seedlings from the seed bed to the transplant bed, great care must be taken to protect the rootlets from the action of sun and wind. It is best to select a cloudy or damp day, and even then the use of wet burlap or other coarse cloth in which to wrap the roots is strongly advised. The transplant bed, or bed in which the one-year-old seedlings are to be temporarily set out, should be prepared in the same manner as described for the seed bed. The trees, however, should be spaced more widely. The rows may be made two to three feet apart, and the trees spaced about one foot apart in the row. This allows of easy cultivation. If the ground is very dry when the transplanting is done, it would be well to dig the hole in which the tree is to be set and fill it with water some time beforehand, in order to be sure that the soil around the roots is moist. A mulch of two to three inches in depth, composed of loose, fine dirt, or a mixture of dirt and leaves, may be left around the tree in order to conserve the moisture after the tree is transplanted.

The trees will be ready for final planting at the end of the second year. Especially the trees with large taproots, such as the hickories and the oaks, should be set out at the end of the second year, otherwise the labor involved in transplanting is difficult and expensive. The planting should be done in a manner to conform with the object of the plantation. If the purpose is to beautify the ground around the home, it will be better to group the trees in favorable position rather than to plant in formal rows. If it is desired to fill up gaps in the woodlot, the larger openings may be used in which to plant the trees. If, however, the purpose of the plantation is for a windbreak or some similar use, it may be advisable to plant in either double or triple rows.

Editor's note.—Should any teacher in New York State obtain results in propagating trees in the school garden, we should like to know about it.

TWO FRUIT TREES

H. B. KNAPP

THE CHERRY

THE cultivated cherry is not a native of this country; it came from southeastern Europe, where many of our fruits originated. There are many species of the cherry growing wild in the United States. A few of these give promise of being useful and valuable some day, but as yet they do not compare with those from the Old World.

This fruit is steadily growing in importance. There are already a large number of cherry orchards in western New York and in other sections of the United States. The fruit is used chiefly for canning, and is a very delicious fruit for this purpose.

Cherries may be divided into two groups — the sweet and the sour. The trees differ greatly in appearance and in habits of growth. The sweet cherries are large, vigorous, upright-growing trees with reddish brown bark, which separates in rings. The flowers appear at the same time as the leaves. The sour cherries are low-growing trees with spreading, bushy heads, much resembling in size and shape the head of the peach tree. The flowers appear before the leaves. It is the sour cherry that is chiefly grown on a commercial scale, although the sweet cherry is gaining in favor for this purpose.

Both sweet and sour cherries are divided into groups, and these groups in turn are made up of different varieties. There are four distinct groups of sweet cherries: the *Mazzards*, which grow wild in eastern United States, not desirable in themselves but furnishing good stocks for other groups; the *Hearts*, large, soft, heart-shaped cherries, either light or dark in color, represented by the Black Tartarian and Governor Wood; the *Bigarreaus*, also heart-shaped, but very firm and meaty, the Napoleon Bigarreau being a common variety; and finally, the *Dukes*, light-colored, not so sweet as the other groups, and represented by the May Duke. These classes have been mixed by crossing, until now it is very difficult in many cases to tell in which group a variety belongs.

The sour cherries are separated into the *Amarelles* and the *Morellos*. The Amarelles are light red cherries with uncolored juice, the Early Richmond and Montmorency being well-known varieties. The Morellos are dark red, more acid than the Amarelles, and have a colored juice. The English Morello, grown for so many years, belongs to this last-named group.

The cherry is propagated by budding, in the same way as are the apple and pear. The stocks used are the Mazzard, which has been mentioned, and the Mahaleb, a European species. Of the two stocks the Mazzard is the better, because it makes a larger, more vigorous tree. The nurseryman prefers to use the Mahaleb, however, as it effects a union with the scion more readily and does better in the nursery row. Cherry trees are usually set out at two years from the bud, although one-year-old trees may be used. Sour cherries are set 16 to 18 feet apart, and the larger-growing sweet cherries are planted 25 to 30 feet apart.

The tree does not require much pruning. Most of the fruit is borne on spurs on two- or three-year wood, although spurs are found on much older wood. Some fruit is often found at the base of the one-year wood, and these cherries are usually the largest and best. These do not grow on spurs, but come from a single bud; consequently, as soon as the fruit is borne, no further growth takes place. This accounts for the long, bare spaces often found at the base of the one-year wood. In general, we do not wish to encourage a large amount of wood growth in a single year, and as heavy pruning induces wood growth we prune but lightly. Three to five branches are used to form the head. In the sweet cherry the central-growing shoot, or leader, is removed, in order to keep the head as close to the ground as possible. The head of the sour cherry is thinned out and cut back but little.

Cherries thrive in a warm, well-drained soil that is not too heavy. A gravel is suitable for most varieties, although the sour cherries do better on the heavier soils than do the sweet cherries. Clean culture should always be practiced. The cultivation should be shallow, as the roots are close to the surface. A cover crop should be sown in midsummer, to remain on the ground until the following spring.

Cherries are picked a few days before they are fully ripe. They should always be picked with the stems on unless they are to be canned at once. They should be gathered by the stems instead of by the fruit. The small, one-quart baskets are commonly used, and these are placed in larger packages.

The cherry tree will thrive with as little care as any of our fruit trees, and responds as readily to skillful treatment. It should be planted on every farm or in every garden.

THE QUINCE

The quince is not a native of this country, its first home being in Asia and southeastern Europe. It has been known and used for at least two thousand years. In spite of this fact, the fruit does not compare in importance with our other common fruits, the apple, pear, peach, cherry, and plum. This may be explained in part by the fact that the quince is not a pleasant nor an agreeable fruit to eat in its fresh or raw state. It is used chiefly for canning and making jelly.

The quince is a short, bushy-growing plant, seldom reaching a height of more than 15 feet. If allowed to grow as it will, it often resembles a bush more than a tree, but by careful pruning the tree shape may be obtained. The growth each year is short and much twisted and distorted, unlike the straight, shapely shoots of the cherry and the peach. The leaves are oval, dark green above, and downy below. The quince is very closely related to the apple and the pear, belonging to the same family, but it is not quite so hardy as these fruits. The fruit is five-celled, like the apple and pear, and contains several seeds in each cell. All the fruit is borne on wood of the same season's growth. In other words, when the buds begin growth in the spring they form leafy shoots, and on these shoots the blossoms soon appear. The flowers, which are borne singly, resemble closely those of the apple, but are larger and more showy. They shade from pure white to a distinct pink, and are so attractive that the quince is sometimes kept for a flowering shrub.

The quince thrives best in a rich, rather moist but well-drained soil that contains a small amount of clay. Sandy soils are not so suitable, as they dry out very quickly. The young trees should be set 12 to 15 feet apart, depending on the variety and the richness of the soil. Clean culture should always be practiced, but cultivation should cease shortly after midsummer, in order that the wood may be mature and hard before cold weather comes. It is always well to sow a cover crop of rye, buckwheat, or cowpeas, to remain on the ground during the winter and protect the roots, which are very close to the surface.

The quince is propagated in a number of ways. One of the most common methods is by budding, as with the apple and pear. Another common method is by mound layering, which is performed in the following manner: In the spring the bush is cut back so severely that many new shoots are sent out during the summer. The next spring, the earth is heaped or mounded around these shoots, leaving but a few inches above the surface of the soil. These shoots take root, and the following fall or spring they are separated from the parent plant and set out.

The pruning consists in keeping the head fairly open to air and sunlight and in cutting the young wood back each year in order to thin the fruit and to insure a good growth of wood for the succeeding season.

The fruit is extremely tender, bruising very easily, and therefore must be handled with great care. It ripens at about the same time as the pear, or even later. It is marketed in peck baskets, in bushel kegs, or in half-barrels. The most common varieties are the Orange, the Champion, and the Rea.

The quince is easy to grow and should be planted in every home garden.

I PLOW

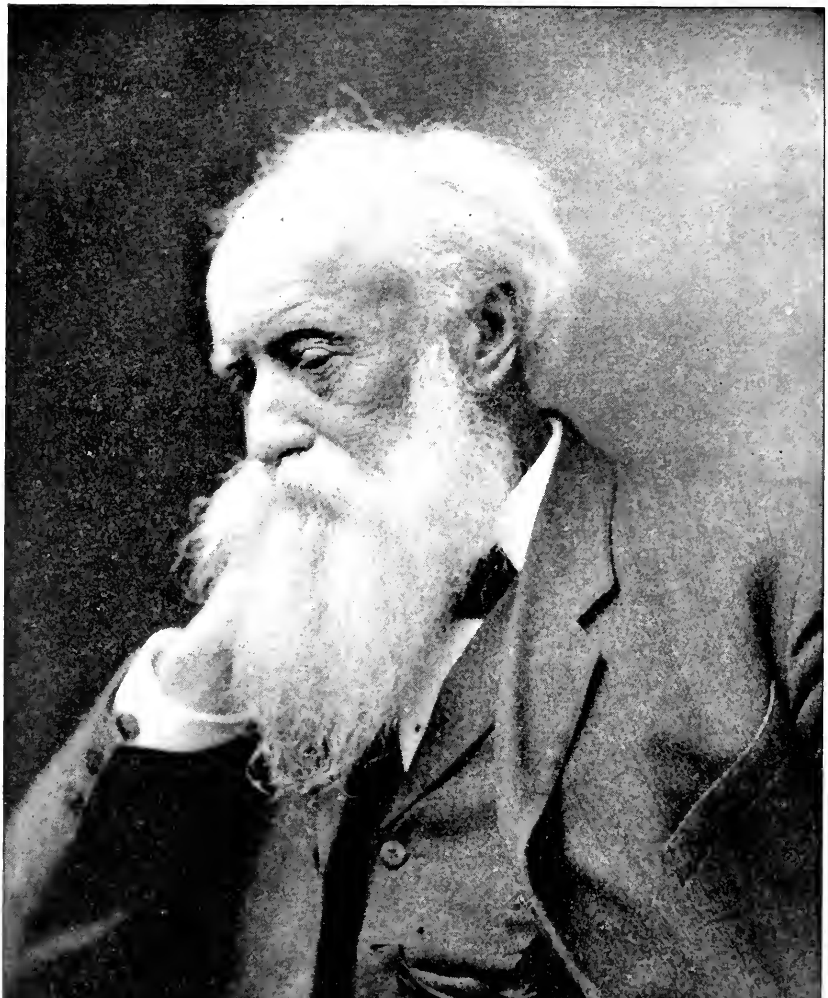
L. H. Bailey

Quick smell of the earth, I am come once more
To the feel of th' soil and the sky before
To the tang of th' ditch and wift of the bough
With stamp of my team and grip of my plow.

I am blowing again with th' wind and rain
  I am falling with frost and snow
Yearning once more with the fields that have lain
  Through the months of the drouth and flow,—
You shall hear the clank of my plow and chain
  Where my hard-harnessed horses throw
And follow the welts that I rip in twain
  As I turn up the lands below.

Jangle and crunch in the far-windy morn
  Cut and grind through the singing sod
Stone and high-hummock and thistle and thorn
  Root and stubble and rolling clod
Puddles that break into furrows foreshorn
  Helm of the handles, plow-point's prod,—
With hale of great harvests my bouts are borne
  Over th' vasts of the glebes of God.

Mete to the mark are my furrows full-set
Hard with the muscle and marrow and sweat
Straightforth is the way and the fields are rife
High over the heights of the hills of life.



"Away with clocks and sun-dials! Time and I
Have made a compact — this to be my boon —
To hear the evening thrush, and know the hour,
Yet feel it noon."

JEAN DWIGHT FRANKLIN

JOHN BURROUGHS

The Editor

A naturalist, writer, farmer, living and working in our time; such a man is John Burroughs, and every boy and girl should know something of the life he leads in his home, Slabsides, and of his rich contribution to the nature literature of the world. A deep sincerity marks his personality and work.

Every teacher should try to have in the rural school library three or four volumes of Burroughs's works. When the weather permits, he might take the boys and girls out of doors and read a chapter or two selected to meet the age of the children. The simplicity of the life of this great man and his way of nature seeking will be suggestive to both teacher and pupils.

Burroughs says that he is not always in sympathy with nature-study as it is taught in the schools. "Such study," he states, "is too cold, too special, too mechanical; it is likely to rub the bloom off nature; it misses the accessories of the open air and its exhilarations, the sky, the clouds, the landscape, and the currents of life that pulse everywhere." This message should be considered by teachers. The schoolroom work should always be suggestive for live out-cf-door interest and intelligent observation.

By courtesy of the *Atlantic Monthly* we are able to present the following excerpts from an article entitled "Fifty Years of John Burroughs," by Dallas Lore Sharp:

"Take Mr. Burroughs's work as a whole, and it is beyond dispute the most complete, the most revealing, of all our outdoor literature. His pages lie open like the surface of a pond, sensitive to every wind, or calm as the sky, holding the clouds and the distant blue, and the dragon-fly, stiff-winged and pinned to the golden knob of a spatter-dock.

"All outdoor existence, all outdoor phenomena, are deeply interesting to him. There is scarcely a form of outdoor life, scarcely a piece of landscape, or natural occurrence, characteristic of the Eastern States, which has not been dealt with suggestively in his pages: the rabbit under his porch; the paleozoic pebble along his path; the salt breeze borne inland by the Hudson; the flight of an eagle; the whirl of a snow-storm; the work of the honeybees; the processions of the seasons over Slabsides; even the abundant soil out of which he and his grapes grow and which, 'incorruptible and undefiled,' he calls divine.

* * * * * * * *

"Mr. Burroughs is not an idylist but an essayist, with a love for books only second to his love for nature; a watcher in the woods, a tiller of the soil, a reader, critic, thinker, poet, whose chief business these fifty years has been the interpretation of the out-of-doors.

* * * * * * * *

"For my part, when I take up an outdoor book I am glad if there is quiet in it, fragrance, and something of the sameness and sweetness of the sky. * * * There is a clear sky to most of Mr. Burroughs's pages, a rural landscape, wide, gently rolling, with cattle standing beneath the trees.

* * * * * * * *

"Not many men ought to live by the pen alone. A steady diet of inspiration and words is hard on the literary health. The writing should be varied with some good wholesome work, actual hard work for the hands; not so much, perhaps, as one would find in an eighteen-acre vineyard, yet Mr. Burroughs's eighteen acres have certainly proved no check—rather, indeed, a stimulus—to his writing. He seems to have gathered a volume out of every acre; and he has put a good acre into every volume. *Fresh Fields* is the name of one of the volumes, *Leaf and Tendril* of another; but the freshness of his fields, the leaves and the tendrils of his vineyard, enter into them all. The grapes of the vineyard are in them also.

"Here is a growth of books out of the soil that have been trimmed, trained, sprayed, and kept free from rot. Such books may not be altogether according to the public taste; they will keep, however, until the public acquires a better taste. Sound, ripe, fresh, early and late, a full crop! Has the vineyard anything to do with it?

"It is not every farmer who should go to writing, nor every writer who should go to farming; but there is a mighty waste of academic literature, of premature, of chicken-licken literature, because the writers do not know a spade when they see one, would not call it that if they knew, and need to do less writing and more farming, more real work with their hands in partnership with the elemental forces of nature, or in comradeship with average elemental man—the only species extant of the quality to make writing worth while.

"Mr. Burroughs has had this labor, this comradeship. His writing is seasoned and sane. It is ripe, and yet as fresh as green corn with the dew in the silk. You have eaten corn on the cob just from the stalk and steamed in its own husk? Green corn that is corn, that has all its milk and sugar and flavor, is cob and kernel and husk, not a stripped ear that is cooked with the kitchen air.

"Literature is often stripped of its human husk, and cut from its human cob: the man gone, the writer left; the substance gone, the style left—corn that tastes as much like corn as it tastes like puffed rice—which tastes like nothing at all. There is the sweetness of the husk, the flavor of the cob, the substance of the corn to Mr. Burroughs."

Following is a list of school editions of the works of Burroughs, so inexpensive that they may be purchased by any rural district in New York State. They will make a valuable addition to any nature library. Every school should start a library fund to which the pupils make some contribution. Boys and girls will be interested in books that they help to buy.

	Postpaid Paper	Postpaid Linen
Birds and Bees	15c.	....
Sharp Eyes, and Other Papers	15c.	25c.
Birds and Bees and Sharp Eyes in one volume	....	40c.
A Bunch of Herbs and Other Papers	15c.	....
Afoot and Afloat	15c.	25c.
Bird Stories from Burroughs	....	60c.
Squirrels and Other Fur Bearers	....	60c.

Houghton Mifflin Company
4 Park Street
Boston, Mass.

QUOTATIONS FROM THE POEMS OF JOHN BURROUGHS

" From out the white and pulsing storm
I hear the snow-birds calling;
The sheeted winds stalk o'er the hills,
And fast the snow is falling.

* * * *

" Like children laughing at their play
I hear the birds a-twitter,
What care they that the skies are dim
Or that the cold is bitter?

" O cheery bird of winter cold,
I bless thy every feather;
Thy voice brings back dear boyhood days
When we were gay together."

" Again the sun is over all,
Again the robin's evening call
Or early morning lay,
I hear the stir about the farms,
I see the earth with open arms,
I feel the breath of May."

" The cradlers twain, with right good-will
Leave golden lines across the hill
Beneath the midday sun.
The cattle dream 'neath leafy tent,
Or chew the cud of sweet content
Knee-deep in pond or run."

IMPROVEMENT OF RURAL SCHOOL BUILDINGS AND GROUNDS

THE EDITOR

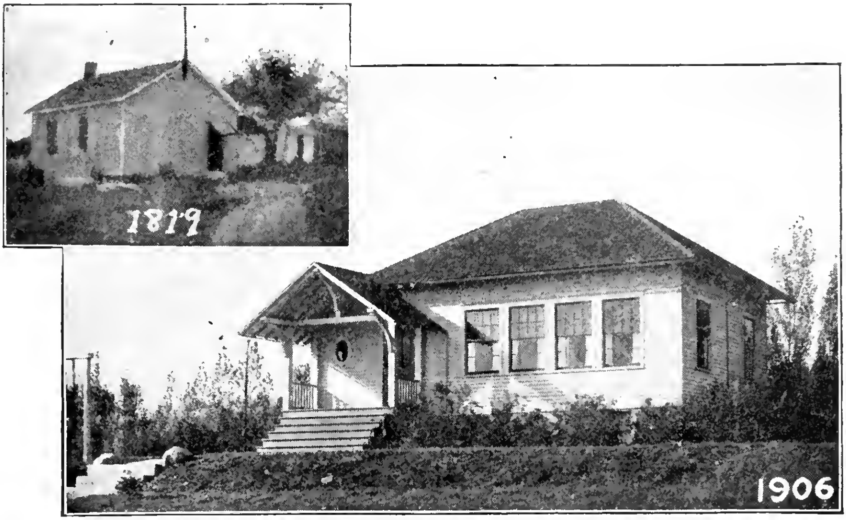
There was a child went forth every day;
And the first object he look'd upon, that object he became;
And that object became part of him for the day, or a certain part of the day, or for many years, or stretching cycles of years.
The early lilacs became part of this child,
And grass, and white and red morning-glories, and white and red clover, and the song of the phœbe-bird,
And the third-month lambs, and the sow's pink-faint litter, and the mare's foal, and the cow's calf,
And the noisy brood of the barn-yard * * * * * *
And the apple-trees cover'd with blossoms, and the fruit afterward, and wood-berries, and the commonest weeds by the road; * * * * * *
And the school-mistress that pass'd on her way to the school, * * * * * *
The village on the highland, seen from afar at sunset — the river between,
Shadows, aureola, and mist, the light falling on roofs and gables of white or brown, three miles off, * * * * * *
These became part of that child who went forth every day, and who now goes, and will always go forth every day.

WALT WHITMAN

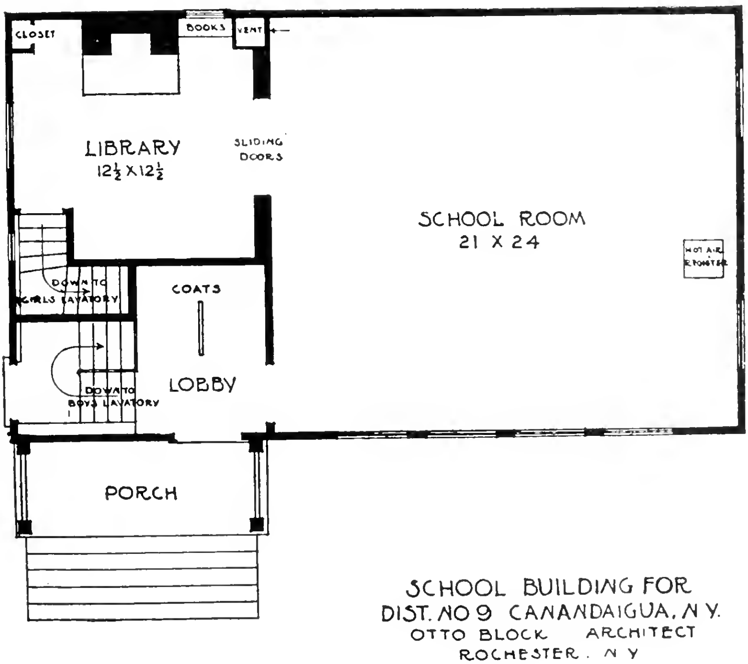
Throughout the United States effort is being made to have school surroundings fitting places for boys and girls. New York State should be one of the foremost in this movement so vital to better citizenship. Every individual who takes part in such philanthropic work will be making history that will count toward progress through all time.

The matter of consolidation of rural schools is being considered in many places and seems to be a wise plan for some communities. There are, however, many persons who feel that the rural school, if properly cared for and under the direction of a wise teacher, has many advantages over the consolidated schools. Which is the better will doubtless be demonstrated in the future. At present it is the duty of every individual in country districts to take an interest in the school surroundings, whether the plan for consolidation be worked out or whether the district school be made a place in which boys and girls are getting the educational opportunity that is their right.

To tell what can be done and what should be done to improve school buildings and grounds, is not so convincing as to tell what has been done. We wish, therefore, to call attention to improvements made in a rural school in the neighborhood of Canandaigua. All persons interested in the development of the rural schools of New York State will be impressed with the results of the efforts made by Mr. C. F. Booth and his associates of Canandaigua, who have placed before the State a concrete piece of work that reflects credit on the public spirit and is certainly a most valuable contribution to the entire neighborhood. Doubtless, in many other



The old and the new rural school building. District No. 9, Canandaigua



Plan of the new building

districts in this State philanthropists are ready to help in developing more attractive school surroundings. We hope that the article by Mr. Booth in this issue of the leaflet will give inspiration for a beginning. It would be well to note particularly, in connection with the improvement of the Canandaigua school, the following:

1. A good architect was employed.
2. The planting is of such nature that it will be of great educational value to the boys and girls, as well as an ornamental landscape feature that will benefit the entire community.
3. The library has a fireplace.
4. In the new plan proper lighting was considered.
5. There are good blackboards.
6. A color scheme was carried out.
7. There was consideration of the teacher's comfort.
8. Individual enameled drinking cups are provided.
9. There is an endowment fund, the interest of which will be used for the future care of the grounds.

THE RURAL SCHOOL, DISTRICT NO. 9, CANANDAIGUA, ONTARIO COUNTY

C. F. BOOTH

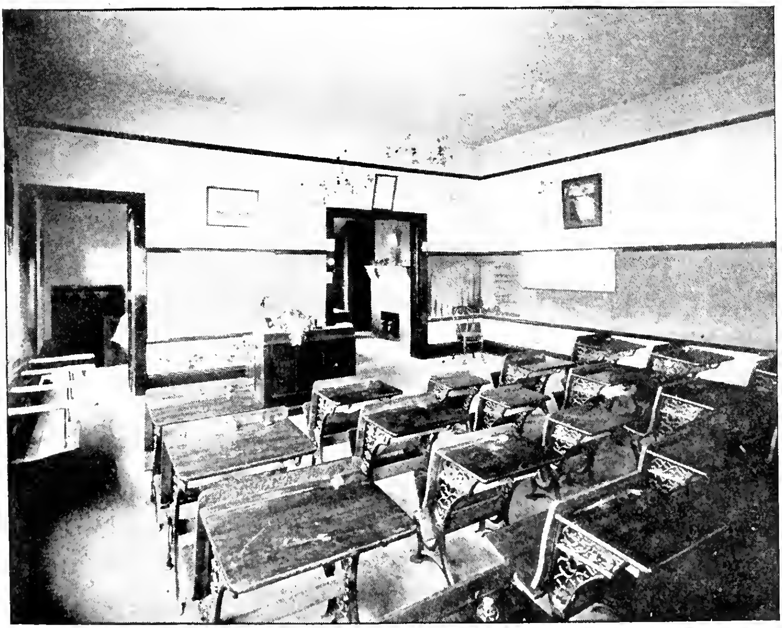
Before any improvements were made in the rural school building of District No. 9, but little could be said of the place in which the boys and girls were spending the greater part of their young lives. The schoolhouse consisted of a one-room structure, built in 1819, with the usual stove in the center. The grounds were completely occupied by the building. The outbuildings were partially in the highway on borrowed territory.

The present school building has grounds consisting of an acre of good land, graded and terraced, with a hedge of Lombardy poplars (100 trees) in the rear and on the side of the lot, forming an attractive background for the white building. There are nine elms, one white pine, eight Norway maples, one Norway spruce, three hemlocks, one English walnut, twenty-four dogwood trees, one shrub of white honeysuckle, twenty-four shrubs of spiræa, twenty-four Dorothy Perkins rosebushes, twenty-four shrubs of barberry. The plan of the new building, page 175, will explain itself. The light is from the east and north of the schoolroom. There is a slate blackboard on the west side and another back of the teacher's desk.

The color scheme is as follows: the ceiling, and the side walls as far down as the picture molding, are cream color; the main part of the room, pale green; the library, terra cotta; the fireplace in the library, red pressed brick.

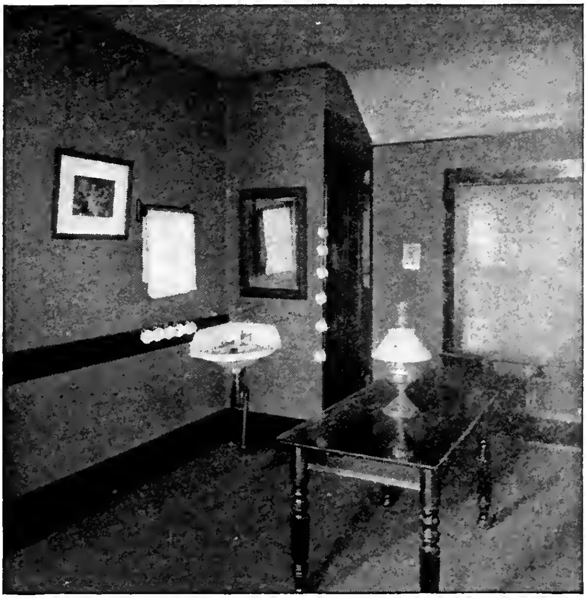
In the library are bookcases and a private locker for the teacher, a lavatory bowl, and individual drinking cups.

Library of the new building



Schoolroom of the new building

In order to do good work one must be inspired by a good motive. My reason for the work in District No. 9, Canandaigua, was that the schoolhouse and its grounds were the most neglected places in the neighborhood. A beautiful lake shore drive passing homes with all modern improvements which were a pleasure to look on, presented in marked contrast the place in which boys and girls, the best assets from these homes, were receiving their education. The schoolhouse was built in 1819, the deed calling for no more ground than that on which the building was to stand. The outhouses were on land that belonged to the public highway.



Section of library. Note individual drinking cups

At the time I took up the work, many of the school patrons felt that the wisest plan was to close the school and send the pupils to the town. I do not believe in this method when it is possible to avoid it. I believe that children are better cared for near their homes than when they go to and from school in a carryall with an indifferent driver and no supervision; remaining in town all day, where in order to maintain order and a fair citizenship we must have churches, Y. M. C. A.'s, and a police force.

Very often the reason for closing the rural school and sending the children to town is because it is cheaper and the patrons are not willing to assume the duties of the school and dignify those duties by their interest and cooperation. In our district to-day, I am happy to say that we are hearing little of the closing of rural schools.

One of the first things that I did was to ask Mr. F. G. Benham, who owned the farm of which the school lot was a part, to give us an acre of land. This was at once granted on condition that I could carry out the plan of improvement. I then appealed to the citizens of the village, who enjoy the lake drive, for help in the enterprise and received $300. A meeting of the taxpayers was next called, at which a resolution accepting the money and land was passed and a levy of $2,000 made. Then, with the united efforts of school commissioner and people, we accomplished the election of a trustee in sympathy with the work we were trying to perform.

With the gift of land and money, and $2,000 of the district money, we went to work. We had an engineer of good standing to lay out the grounds, and I think this was a most important step. We next engaged a good architect, who said at once that our plans could not be carried out with the amount of money we had. I told him that I was raised on a farm and never lifted a stone when I could roll one, and I believed we could do it. I proceeded, however, to get more interest and help. The workmen entered into the spirit of the thing, working hard and overtime and deducting a goodly amount from their bills. By the end of the year all was finished and paid for.

But this is not all. Later there was donated to the school a swing, which is a beginning in the interest of recreation apparatus for the boys and girls. We then remembered that we had a friend in the gas and oil business. I asked him if he would like to have the honor of presenting us with a steel flagpole. As a demonstration of his response, we now have a flag flying from a 40-foot steel pole set in concrete. There are many persons who like to do things if they have definite understanding of the need and value of their contributions.

We are now planning for an endowment fund, the interest of which will be used for the care and improvement of the school grounds, the district to look out for the building. The raising of an endowment fund is valuable for the community. It means looking ahead, a consideration of the future. The school will work for it; the people will work for it.

We want to raise $1,000 for this fund. At my lake home last summer an entertainment was held for the first annual endowment fund benefit. This will bring together each year patrons and friends of the school in the interest of an educational enterprise.

Editor's note.—We shall be glad to hear from every rural district in which improvement of schoolhouse and grounds has been made within the past five years. Photographs will be helpful in using such information for the benefit of others.

SUGGESTIONS FOR TEACHERS

EDWARD M. TUTTLE

The first pages of this leaflet contain the point of view from which we regard the work in Nature-Study and Elementary Agriculture. Following this are notes outlining the work for the year and presenting certain fundamental considerations. We shall now mention some specific ideas that may be of value to the teacher who desires to secure the interest of his pupils and the cooperation of the community. While we are particularly concerned with the work in Nature-Study and Elementary Agriculture, we are in no sense blind to the fact that it is but one portion of the school curriculum. With this in mind we venture to make the following suggestions, not as our own, but as a result of the experience of persons who have actually been successful in this work.

1. *How to secure interest.*— In many schools the work with nature is new and teachers find difficulty in securing active response from their pupils. It seems that once an interest is created, the expansion of the subject is very simple. To secure the first attention a comprehensive and detailed examination of some one or two common objects has been found valuable. Something that the children see every day of their lives should be taken and carefully studied with them. The exercise will reveal facts regarding the object which the children have never before realized. After one or two repetitions this appears to create a spontaneous desire to see whether other familiar objects possess characteristics usually hidden from the ordinary observer. Once this spirit of inquiry is gained and when it is guided and directed by the teacher, the rest follows naturally. This presupposes that the teacher is prepared. One of the most significant remarks that has recently come to our attention was made by a teacher of thirty years service with notable success, who, when asked what was the secret of her work, said, " I try to be always ready " — ready, that is, to cooperate intelligently with the pupils in their efforts to name and explain things.

2. *The teacher's responsibility.*— We are more and more impressed with the responsibility borne by those who guide the developing years of children. To be the means of helping a single individual to truly find life in its all-round wholesome fullness is a privilege, which with most teachers is multiplied many times. The child's mind is very imitative and it is most surprising to see how much it is influenced by the teacher whom he sees each day. Literally hundreds of children's letters that have come to us during the past twelve months have contained near the end one very significant sentence, always in the same few words— " My teacher is very neat." What an opportunity to keep before the pupils character and personal habits that are worthy of imitation!

3. *The community.*— There come to us constantly two points of view, as follows: the trustees and the community deplore the incompetency of the teacher and the consequent lack of progress by the children; the teachers complain against the low salaries and the lack of appreciation of their efforts on the part of the community. It would seem that often both are partly right, yet the burden in the task of improving conditions lies with the teacher. First, he must be willing to give more service than he is paid for. Then he must endeavor, by frequent contact and absolute openness, to secure the confidence of trustees and parents. Too often the latter are in the dark as to the purposes that the teacher has in mind and are consequently quick to brand as a fad any departure from the customary school work. But let the teacher meet the trustees informally and outline his plans and talk things over, and let him meet the parents collectively in a meeting at the schoolhouse and individually outside; and if he is earnest in his desire and serious in his purpose to do his best, confidence will not long be withheld. Entire frankness and a ready spirit of cooperation and unselfishness will go a long way toward improving matters. It would follow also that the teacher's opportunity to do effective work increases in proportion to the length of time during which he has been associated with the children and the community. Thus, a second year in the same school is more valuable in its results than the first year and this is increasingly true with each succeeding year. We realize that it is often difficult for the teacher to remain in the same school owing to the necessity for earning more money, which the community is unwilling to pay. It has been demonstrated, however, that if the teacher who has first made it his business to give his best service will then meet the community halfway, a compromise can be effected and a gradually increasing salary established. Once such a tendency as this is established, the rural community takes pride in its own progressiveness. This is a desirable end toward which to strive. It is, however, quite clear that the teacher must be the one to take the initial step, and that

this can be done only when there is present an unselfish ambition to render service without thought of immediate recognition of worth. Later, even though the recognition is no more sought than at first, it will usually be given.

4. *The schoolhouse and grounds.*— Something has already been said in this leaflet regarding the importance of having the schoolhouse and the school grounds clean and attractive. On page 176 is an article illustrative of the success of one school in this line. With a little encouragement from the teacher, the children will come to feel a pride in having pleasant surroundings and there are many ways in which they can help to make and keep them so. We should like to see a general movement throughout the State to acquire more land around school buildings. Too often one sees a school yard sixty feet square when there are open fields on three sides. Land is a desirable school asset. It affords opportunity to do a little attractive planting around the building; it gives a much-needed and proper place for recreation that is essential even in the country; and it serves as a place to conduct a few simple experiments in elementary agriculture, which will undoubtedly differ from any home operation and which will serve as a practical application of the ideas suggested in the schoolroom. Land costs little to maintain; the first cost is the only large item. Ten, twenty, thirty years from now many a rural community will be glad to have a good-sized piece of ground for school property. The time to make provision for this is now. The teacher might well take the first step by talking the matter over with the trustees and parents.

5. *Aids to the study of nature.*— A **museum** which will provide a place for the collection and exhibition of specimens is a valuable help in this work. It may be started in a very simple way by putting things on a shelf. Later a small cabinet may be available. It is interesting and surprising to us all to find how many things there are when we see them all at once. In last year's leaflet we printed the following list as suggestive of collections that might be made:

(1) The different types of soil found in the neighborhood: sand, silt, clay, muck, and sandy, silty, and clay loams.

(2) Common seeds of vegetables, flowers, and farm crops.

(3) Common grasses: timothy, redtop, meadow fescue, Kentucky blue grass, orchard grass.

(4) Common legumes of the farm and garden: red, white, and alsike clovers, alfalfa, peas, beans, vetch, soy beans.

(5) Common cereals: corn, wheat, oats, rye, barley, buckwheat.

(6) Ears of corn: flint, dent, pop, sweet. Procure ears showing the qualities that good ears should have. A lesson in corn judging may profitably be given.

(7) Fertilizers: nitrate of soda, dried blood, ground bone, acid phosphate, muriate of potash, and as many others as are used in the neighborhood.

(8) Feeds for farm animals: bran, middlings, gluten feed, buckwheat middlings, and others in use. The local feed merchants and seedmen might lend their aid in supplying samples of these feeds as well as samples of fertilizers and seeds.

(9) Fruit. In the fall, different varieties of apples, pears, plums, and grapes could be collected, probably with much enthusiasm by the children. Part of an afternoon could be given for a short talk on fruit growing by a local fruit-grower, after which the samples of fruit could be eaten. Similar collections of root crops and vegetables might be made, not with the idea of keeping them in the school for a long time but as one of the best means of teaching children to become familiar with the common things of their farms.

(10) Flowers and weeds. These can be pressed and used as the basis for the school collection. Begin with the most common plants and enlarge the collection slowly in order that the children may become familiar with the plants studied.

(11) Leaves of trees. Press the leaves of some of the most common trees, adding to the collection slowly enough for the children to learn as they go.

Plants are always attractive and wherever possible they should be grown in the schoolroom. For this purpose a **window box** is good, especially one in which flowerpots are set instead of the plants being grown in the box. In this way the arrangement can be frequently changed, new plants added, or the individual plants taken home in cold weather.

A **terrarium** is merely a box with screened sides and top, containing earth, stones, and plants in the bottom. In it can be kept any live animal that it is desired to study for a limited time. This is a handy method for close study.

The **Babcock milk test** has met with great response wherever tried. The small four-bottle outfits cost $5 and can be obtained from any good dairymen's supply company. Many of the larger schools will find this a valuable piece of apparatus to own. We have four of these outfits, which it is our purpose to lend for a month at a time to those schools that apply for them. In this way we can reach some thirty-five schools during the year. If you desire one we shall be glad to place your name on the list. The only cost will be the express charge one way.

We reprint from last year's leaflet the following, which we consider a very valuable line of work and which can be done largely outside of school by those interested: Encourage the pupils to take an interest in all that relates to their own **county.** Have pupils begin work in connection with the county. Let one get all the information he can regarding the physiography: the highlands, lowlands, streams, lakes, and the like. Encourage him to find all he can from his own observation, from farmers, and from books, and to bring to school pictures of natural scenery of his county. Another pupil might take the political geography of the county: townships, cities, villages, and what each contributes to state and national welfare. A third, the agricultural interest of the county: What successful farmers live in it? What farms have specialized work? What is the most important farm crop in the county? What important crops might be raised that are not now raised? What forest land does the county possess? How large is the grange in the county? What work does the grange accomplish for better living in the county?

Lastly, every school should be steadily increasing its **library.** Books are the records of facts that we could not otherwise obtain, and as such they are worth caring for. Many teachers ask for a list of books on nature-study and elementary agriculture. We reprint, therefore, the list that we recommended a year ago, with some corrections and additions:

(a) Write to The Department of Agriculture, Washington, D. C., asking to have the school placed on the mailing list for the monthly list of publications and to have the following sent to you:

1 set of Farmers' Bulletins suitable to the locality.

1 copy of the list of Publications for Free Distribution.

1 copy of the list of Publications for Sale.

1 copy of each of reprints of areas that have been surveyed by the Bureau of Soils in your State.

(b) Write to The Geological Survey, Washington, D. C., enclosing 15 cents in stamps and asking for the three geological survey maps that cover your region.

(c) Write to the Mailing Department, College of Agriculture, Ithaca, N. Y., asking for complete sets of:

Cornell Rural School Leaflets.

Cornell Reading-Course Lessons for the Farm.

Cornell Reading-Course Lessons for the Farm Home.

In writing, state that these bulletins are desired for the school library.

(d) Write to the Experiment Stations at Geneva and Ithaca, N. Y., for available bulletins and reports. Request also that the school be placed on their mailing lists.

(e) Obtain the use of a Traveling Library from the State Education Department. These libraries are loaned to rural district schools and may be kept for the entire school year, the fee being \$2 for 25 volumes and \$1 for each additional 25 volumes. Write to the Division of Educational Extension, New York State Education Department, Albany, for information regarding the method of obtaining one of these traveling libraries.

(f) Write to the nearest Weather Bureau office asking that a weather map frame be given your school and that weather maps be sent daily throughout the school year. In New York there are Weather Bureau stations at Buffalo, Albany, Binghamton, Ithaca, and New York City.

Books for the library

Traveling Library — Division of Educational Extension, State Education Department, Albany, N. Y., 50 volumes, loaned for the year	$3.00
Nature Study Leaflets (bound volume) — Extension Department, College of Agriculture, Ithaca, N. Y.	.30
Burkett, Stevens, & Hill — Agriculture for Beginners, Ginn & Co., Boston	.75
Mann — Beginnings in Agriculture, The Macmillan Company, New York	.75
Bessey and others — New Elementary Agriculture, University Publishing Company, Lincoln, Nebr.	.60
Hunt — Cereals in America, Orange Judd Company, New York	1.75
Wing — Milk and its Products, The Macmillan Company, New York	1.50
Roberts — The Horse, The Macmillan Company, New York	1.25
Henry — Feeds and Feeding, W. A. Henry, Madison, Wis.	2.00
Warren — Elements of Agriculture, The Macmillan Company, New York	1.10
Bailey — Garden Making, The Macmillan Company, New York	1.00
Plumb — Types and Breeds of Farm Animals, Ginn & Co., Boston	2.00
Comstock — Handbook of Nature-Study, Comstock Publishing Company, Ithaca, N. Y., postage 35c	3.25
Hodge — Nature-Study and Life, Ginn & Co., Boston	1.50
Keeler — Our Native Trees, Charles Scribner's Sons, New York	2.00
Mathews — Field Book of American Wild Flowers, G. P. Putnam's Sons, New York	1.75
Blanchan — Bird Neighbors, Doubleday, Page & Co., New York	2.00
Comstock — Insect Life, Comstock Publishing Company, Ithaca, N. Y.	1.75
Stone & Cram — Animal Life, Doubleday, Page & Co., New York	3.00
Burroughs — Songs of Nature, McClure, Phillips & Co., New York	1.20

INDEX

CORNELL

Rural School Leaflet

[SUPPLEMENT]

Vol. 6 ITHACA, N. Y., SEPTEMBER, 1912 No. 1

TO ALL TEACHERS:

The September number of the Rural School Leaflet contains subject matter in nature-study and agriculture as outlined by the New York State Syllabus for 1912–1913. This leaflet will be sent to every teacher in New York State who makes request for it. We ask that all city teachers desiring the leaflet apply first to their city superintendent. If he cannot supply a copy, apply to us.

In addition to the September leaflet we shall issue leaflets for boys and girls in November, in January, and in March. On receipt of the pupils' names these leaflets will be sent to teachers and children in rural districts and in communities of three thousand inhabitants or less.

We hope the teachers will encourage the children to write letters to Mr. Tuttle in reply to the leaflets, describing some experience or asking questions that cannot be answered at home or in school. Each letter should give, in addition to the child's name and address, the name of the township and the number of the school district.

In order to enable us to handle our large correspondence and mailing lists with promptness and accuracy, we urge that the teacher observe the following:

1. Do not apply for other than the September leaflet unless you are a teacher in a rural district or in a community of three thousand inhabitants or less.

2. Send us on the attached blank (page 3) the names of all boys and girls in your school. Before returning the blank be sure that it is properly filled out.

3. Be sure to give full name and address, together with township and number of school district, in all communications sent to the College.

We are very anxious to reach young men and young women in rural districts. Last year we asked for the names of young men and received a large number. This year we want to obtain a list of young women. Will you send us, in the spaces below, a list of young women in your district between the ages of 14 and 22? In doing this you will not only be giving us information that it would be difficult to obtain in any other way, but you will be coming into closer touch with your community. As soon as we are able to do so, a special message will be sent to these young persons.

In spite of the fact that our funds for the year are very much limited, we hope to cooperate with the teachers of the State in every way possible, working together in order that the year may be one of distinct progress toward a better rural education.

Address all communications other than children's letters to

(MISS) ALICE G. MCCLOSKEY,
COLLEGE OF AGRICULTURE,
ITHACA, N. Y.

NAMES OF YOUNG WOMEN BETWEEN THE AGES OF 14 AND 22

....	....
....	....
....	....
....	....
....	....
....	....
....	....
....	....
....	....
....	....

ALL TEACHERS IN RURAL SCHOOLS AND IN VILLAGES OF THREE THOUSAND INHABITANTS OR LESS MAY RECEIVE LEAFLETS FOR THE CHILDREN BY SENDING US A LIST OF THE PUPILS' NAMES IN THE SPACES BELOW. CHILDREN'S LEAFLETS WILL BE SENT IN NOVEMBER, JANUARY, AND MARCH.

WE HAVE NO FUNDS THIS YEAR TO SEND CHILDREN'S LEAFLETS TO CITY SCHOOLS.

Teacher's name..

Post-office address..

....

Number of school district..

Name of township..

Name of county..

Name of district superintendent..

Number of teachers in the school..

Number of pupils in your charge..

NAMES OF PUPILS

....	....
....	....
....	....
....	....
....	....
....	....
....	....
....	....
....	....

Fill out and return to

(MISS) ALICE G. MCCLOSKEY,
COLLEGE OF AGRICULTURE,
ITHACA, N. Y.

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post-Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME { MARTHA VAN RENSSELAER, *Supervisor*
MRS. IDA S. HARRINGTON, *Assistant Supervisor*

VOL. I. No. I | ITHACA, N. Y. OCTOBER 1, 1911 | FOOD SERIES No. I

THE CARE AND FEEDING OF CHILDREN.—PART I

FLORA ROSE

This is called the " century of the child," for at last the world is awake to the fact that right care of little children must be regarded as a serious responsibility. At a time when agriculture and industry are advancing so rapidly, this question is receiving sincere attention: Is the welfare of the human baby of less importance to the prosperity of the home or the community than the welfare of crops or animals or inanimate machines?

In many farm homes, the farmer has a wider and more scientific knowledge of the needs of the young calves and chickens, of the newly sprouting wheat and corn, of reapers and binders, than the woman on the farm has of the baby whose life is so dear to both mother and father and of such prospective value to the community. In city, town, or village, the man has a more intimate and accurate understanding of the delicate machinery he handles, of the industry he fosters, of the business of the firm he serves, than the woman possesses of that most intricate and frail organism, the human infant. The baby needs more intelligent handling and more careful cherishing than the young of other animals, than infant industries or intricate machines, if it is to develop into healthful, efficient manhood or womanhood.

Responsibility in caring for and rearing children is of as great importance to the race as responsibility in any conceivable line of industry, yet parents have little training for it. Mothers and fathers rarely possess any definite scientific knowledge of the real conditions governing childhood and youth. If prosperity is to increase, if the efficiency of men and women is to be made greater, it must be through a better understanding of the needs of childhood.

The three factors of greatest importance in determining the welfare of the child are *inheritance*, *environment*, and *food*. It is vital to the progress of the race that children should be well born, that the parents should be strong and untainted, that they should pass on good habits of mind and body to the next generation. It is not, however, within the scope of this bulletin to attempt any discussion of this abstract subject. Only the more immediately present conditions will be considered here.

CARE OF THE MOTHER

Thoughtful care of the child should not be deferred to the time of its birth. It should at least begin with the care of the mother from the time she knows that she may expect the little one. Much misery and ill health on the part of both child and mother may often be prevented by an understanding of the conditions which prevail at this time and by giving better attention to a hygienic regimen for the mother.

The period of the greatest growth during the lifetime of the human being is during the nine months previous to birth. When the child is born, it is about five million times as large as the germ from which it has sprung. During the first year of its life growth is only about threefold, and after this it progresses much more slowly until maturity is reached. While right conditions are extremely important during the first years of life, they are supremely important during the prenatal period. During these months, muscles, bones, and nerves, the foundation for all organs and tissues, are formed. This is the time when the human being is created and the rest of life concerns itself with the development and education of that which is now produced. It is therefore vital to the welfare of the future individual to have the best possible environment during this period of fundamental growth. Nature has done her best by hiding the developing baby snugly away where it shall be protected as far as possible from outside interference; where it can be kept constantly and unchangingly warm; where its food can be supplied regularly and unfailingly from the blood of the mother; and where, from day to day, it shall be as free as possible from change or disturbance. During the whole prenatal or "before-birth" period of its existence, the mother supplies both food and environment for the growing organism. It is only through the mother that the child can be reached, that its nutrition and general welfare can be controlled. It is therefore the mother with whom we are primarily concerned.

Exercise of the right kind is as necessary now as at any time. A false pride should never stand in the way of outdoor exercise. Exercise out of doors with a free untroubled mind keeps both body and brain in better condition, keeps the muscles plastic and strengthens them for the trial which has to be endured. If only more thought were given to this one question of muscular development in women the danger and sufferings of childbirth would be very greatly reduced. Severe, overtaxing exercise or very hard work should be avoided. The ordinary housework instead of being harmful is generally distinctly beneficial. Running a heavy washing machine, working long hours at a sewing machine, bending for hours over fine sewing, fancy work or embroidery, riding horseback, in fact, any long-continued or straining effort should not be attempted by the average woman. In various States the constant hard work with long hours in factories is now regarded as sufficiently detrimental to women during this period to require legislation to prevent it. It should receive equal attention in the home. Overworked, worn-out mothers tend to produce weak, sickly children—and sickly children are not an asset to family or community.

The clothing should be light, loose and warm. The wearing of clothing which constricts waist or abdomen is not only unwise but dangerous both to the health of the mother and to the life of the child. Corsets should be discarded. This is not a time for false pride.

Fresh air is very important, for the body needs now as never before to rid itself as quickly as possible of all poisonous wastes. Well-ventilated sleeping and living rooms, plenty of sunshine and fresh air, outdoor exercise whenever possible, should be the rule. Growth and development are stimulated by sunshine and fresh air, food is more readily digested and assimilated, and the whole organism is in better tone. A tendency to anaemia may often be corrected by a regimen of right food, fresh air, and light outdoor exercise.

The diet should be carefully regulated. Food is needed as usual to supply all the needs of the mother for energy, repair and building of tissue, and elimination of waste products. Besides this, provision must be made for the demand upon the mother by the child. The baby is born with bones and muscles; blood vessels and nerves; with a supply of iron stored in its body sufficient to make good for the first year the deficiency of iron in milk. All the materials used for this growth and for storing are drawn from the blood stream of the mother. While the actual amount of tissue built into the body of the baby during the nine prenatal months is not very large it is very important. If the food of the mother lacks greatly in anything, or if her health is such as to interfere with right assimilation of food, both mother and child may suffer. When the growth or development is stunted by malnutrition before birth, no subsequent care will completely overcome the bad results. If the defects in diet are slight, the development of the child will probably not be interfered with, but the mother may suffer. The rule is that nature cares most for the new generation and will protect the child at the expense of the mother. The supply of food needed for the child's development will be drawn from the mother's blood even at a considerable cost to her. If the diet is very poor or the defect in nutrition is very great both mother and child suffer.

Food for the mother.—Protein, so essential for the growth of the new organism, is best included in the form of milk and eggs, or some well-cooked vegetable protein food as legumes and cereals. Meat should be eaten in but limited amounts since it increases the work of the kidneys and they should be spared as much as possible at this period. In removing meat from the diet one source of iron is withdrawn. Eggs, green vegetables and legumes will more than make good the amount withdrawn.

Fats should be eaten only in such amounts as may easily be borne. Fat as it occurs in cream, milk and eggs is better than fat in meats, in rich pastries or fried food, since the latter form is less easy to digest. The digestive organs are doing double duty and should not be overtaxed. Besides this, the organs of digestion are often somewhat crowded and have not their normal ability.

Sugars and starches should be eaten as they occur in cereals, legumes, nuts, fruits and vegetables, for in this form not only the energy of these two food-stuffs is supplied but other substances needed in the diet are increased, particularly mineral matter and bulky material.

Mineral matter.— There should be an abundance of mineral matter at this as at all times, iron for red corpuscles, phosphorus to stimulate growth, lime for bones. This will be supplied by a diet rich in fruits and vegetables, milk and eggs. Frequently the diet lacks some one element of mineral matter, as iron or lime, or it may lack mineral matter as a whole. Anaemia, decayed teeth, or derangement of the whole system may result, and the results of such diet are more than ever emphasized at this time.

Acid-producing foods.— Many of the foods produce what is called an acid reaction in the body. While such foods are important in nutrition, it is equally important that they should not predominate but should be balanced by what is known as base-forming foods. In meat, eggs and cereals as a whole, acid-forming elements predominate. Base-forming elements predominate in milk, fruits and succulent vegetables. Hence the necessity of including fruits and succulent vegetables in the dietary.

Constipation should never be allowed to continue for any length of time. The intestines should be kept free from any accumulation of waste matter, as poisonous substances result which are absorbed into the blood stream of the mother and interfere with her health and with that of the child. A tendency toward this disorder may be overcome in most cases by right regulation of the diet and proper exercise. The following laxative diet is suggested:

Diet for constipation.—Whole wheat or graham bread; stewed prunes; properly cooked cabbage and onions; well-cooked oatmeal; shredded wheat; plenty of fruit, fresh or cooked; abundance of vegetables; if in normal health, six or eight glasses of water a day.

To sum up, a well planned diet will contain eggs, milk, cream, well-cooked cereals, fruits and vegetables, meat in small amounts; it should be easily and completely digested; rich foods requiring great effort to digest should be omitted.

Cheerfulness is always a means toward good health. Gloominess may be the result of digestive disturbances but it may also cause them. Melancholia interferes with the mother's digestion and general assimilation of food. This may affect the composition of her blood and thus disturb the nutrition of the child whose food reaches it indirectly from her blood vessels. The same result may occur during the nursing period, and many a grieved or angry mother has seen the ill effect of such emotion in a lessened or changed supply of milk.

Prenatal influence.— The old idea that melancholy at this time perpetuated itself in the disposition of the child, thus marking it for its lifetime, has been proved untrue. Gloom does cause malnutrition and a poorly nourished mother may produce a sickly child. A sickly child is a suffering one; and may it not be allowed to be melancholy under such conditions without blaming a mysterious prenatal influence?

Gradually we are forsaking some of our former beliefs concerning this prenatal influence. We know now that birth marks are not due merely to a state of mind in the mother but to a condition of body, to some interference with nutrition, to some diseased or inherited condition of the germ, to some blow sustained by the mother which has affected the growing child; but not to a mother's sudden fright or fear or mental attitude unless these have caused actual bodily harm to her and to the growing child, or have so seriously interfered with her nutrition as to affect the food supply of the child. In other words, the prenatal bugaboo has been routed.

THE BABY

The newborn baby receives and deserves our sympathy. All at once it is called upon to face new and very strange surroundings, to exercise recently developed functions, to adjust itself to a new set of conditions. A new food supply has to be digested by a previously untried digestive apparatus; a new way of taking oxygen begins through lungs never before called into play; previously circumscribed limbs are now free and must be exercised; and often, worst of all, it is faced by a large acquaintance of persons as ignorant of it and its real needs as it is of them. Its education now begins. A pathetic little figure, we must agree!

Our great ignorance of the growth and development of the human organism during the nine months it lies so snugly hidden away makes us feel that an unbridgable chasm separates the child which is born from the child before it is born. This very fact leads to much of our ignorant management of the small baby. In the few moments or hours which are occupied in accomplishing the entrance of the child into the outside world, there has not been time for it materially to change its needs. It has been accustomed to uninterrupted quiet, to a sightless, possibly a soundless, and a certainly monotonous period of existence in which to accomplish a most wonderful growth and development. Its food has been supplied automatically, and under normal conditions satisfactorily. When it is born it is just an immature and undeveloped bit of humanity ready to use the newly developed functions, ready to be educated and trained to use others, but not ready to share largely the lives of the more completely developed. It still needs and should have something approximating as closely as possible the previous environment but which will be consistent with its new responsibilities of digesting its own food, getting rid of its own wastes, taking in its own oxygen, wearing clothes to supply its need of warmth, learning little by little to move its muscles, to correlate its actions and to adjust itself to other human beings.

Training the baby.— What the newborn baby is we know. What it is to be will depend about equally on two factors, inheritance and environment. A good inheritance may be marred by a bad environment, but the reverse is also true, for a poor inheritance may be in part overcome by careful training. It is a fatal mistake to think that education begins with school years. It begins with the first breath the child draws, and the education or training of the infant is as important in determining its ultimate characteristics as any education that may come later. This is the period for establishing regular physical habits which will not only be the basis for future health but which will give the first foundation for an idea of obedience to law. If the child learns during the first year of its life to adjust itself to regular hours of sleep, to regular meal times, to a regularity of various body habits, its training is made easier for all future time. Irregularity of meals is the cause of many unnecessary deaths among children and where it does not actually destroy life it often leads to permanently impaired digestive functions. Irregular sleeping hours wreck many nervous systems. Vicious habits in later years may often be traced to a lack of systematic training in infancy. Parents should have a realizing sense of the necessity for beginning the child's training immediately and of the danger of even one day's delay.

Sleep.— There should be long hours of quiet sleep for the baby, interrupted only by giving food at regular intervals, by the daily bath or by a change of clothing. Its chief functions now are to eat and sleep and not to furnish a center of interest for an admiring group of relatives. The baby is not a plaything; it is an individual in the process of making and its chances should not be wrecked. If sleep is interfered with at this age the nervous system does not develop normally. About twenty hours out of twenty-four should be spent asleep. During sleep the baby should be turned occasionally to avoid cramped and uncomfortable positions and strained muscles. If the mouth opens while the child sleeps it should be gently closed.

As the child grows older the waking periods will be longer. At two years, thirteen or fourteen hours of sleep may be enough; at three years, eleven or twelve hours. There will be considerable variation in this with different children, some requiring more, others less sleep. In any case there should be a systematic regularity of bed hours.

From birth to the end of the first year the child should be undreessd and settled for the night by six o'clock or seven o'clock. After the night feeding at ten or eleven o'clock it should sleep undisturbed until five. During the day it should sleep at first most of the time and gradually less until only a morning and an afternoon nap are needed. Until the end of the second year the child should have a morning nap and should be undressed for it when possible. It may have a short afternoon nap also if this seems needed and does not lead to disturbed sleep at night. Its bed hour at this age should be about seven.

All during the years of childhood the bed hour should be regularly early, up to the eighth year not later than seven o'clock or eight o'clock, and not later than nine o'clock until after the fifteenth year. It is sometimes necessary to infringe upon this rule but the occasion should be exceptional.

Constant late hours with attendant irregularity of sleep tend to a disordered nervous system. The child should sleep through the night and should rise at once on waking. If sleep is restless or disturbed it is usually due to digestive disturbances and can be corrected by some modification in the diet or some change in the time of feeding. Restless sleep usually goes hand in hand with eating between meals and habitual irregularity of the meal time and the bed hour. It should be looked upon as something requiring immediate investigation and correction.

Exercise.— The first exercise which the normal baby takes is a vocal one. Its cry establishes the power of the lungs to do their work. Thereafter a certain amount of lusty crying each day strengthens the vocal chords, the muscles of throat, chest, abdomen and back, and gives the child a good wholesome stirring up of general activities, through an increased circulation of blood. For the first week the exercise attendant upon the daily changes of clothing, occasional turning during sleep, and normal crying is sufficient. After this, exercise may be given by wheeling the child in its carriage a few moments at a time several times a day, or by carrying in the arms, by gentle rubbing or massage, and by allowing the child to kick and squirm, freed from all clothing, for five or ten minutes at night when undressing and in the morning when dressing. As soon as a child creeps it usually exercises sufficiently by itself. Children should not be encouraged to walk at too early an age; as premature exercise of any function is very harmful.

Play, games, and toys.— As the child grows older and its exercise takes the form of play, thought should be given to a selection of games and toys. Those should be suggested and chosen which will lead to an all-around muscular development, as balls for arm and shoulder muscles, ladders or bars for the back, and the like. The discovery that play is useful and that games and toys have other than a pleasurable meaning is a new one. Now we know that play is a vital form of exercise for the growing child, so we encourage it and organize it and include it in our school curricula. The playground and the play-hour are as important factors in the education of the child as the schoolroom and the daily lesson.

Fresh air is very necessary to the baby. If the weather is warm and the baby is protected from sun and wind it may sleep out of doors during the daytime after the first three or four days. If the weather is cold it must be gradually accustomed to the change of air by opening the windows for a short period several times a day. This does not mean that the room should not be well ventilated at other times. By the end of the first month the child should have a daily outing. If well wrapped and rightly protected from cold, from too much light and from wind, the child may spend most of the day out of doors, even in moderately cold weather, and will be all the better for the treatment. This applies to the frail child as well as to the healthy one. Out-of-door sleeping for children as well as for adults, is now recognized as an excellent curative for the feeble ones and an excellent preventive for the robust ones. The sleeping rooms of growing children should be thoroughly ventilated. In winter-time this can be accomplished best by opening the window and tacking a piece of muslin over the opening. The air sifts through and drafts are prevented. If the child does not react to cold, strenuous treatment must be avoided.

The schoolroom should be better ventilated. Serious as well as minor illnesses are often traceable to dirty, badly ventilated schoolrooms.

Bathing.— After the healthy baby is a week old it should be given a daily bath. The bath acts as a tonic to the healthy baby. It is comforted and filled with well-being in the present and braced and hardened for the future. The baby's body becomes warm and often moist in its many wrappings, and the bath cools and cleanses and relieves. Irritability and fretfulness are sometimes a direct result of a clogged skin, and the child can be quieted by a good bath. If the baby is feeble or does not react well the frequency of bathing will have to be regulated according to its endurance, but the body may still be cleansed daily with a dampened sponge. The best time for the bath is during the morning, midway between two feedings, that is, about ten o'clock. It should not last longer than five minutes. The temperature of the water should be about blood heat, 99° F. during the first weeks. This is gradually lowered until at the end of the first year, a temperature of 80° F. is reached. Only good unscented soap should be used in very small quantities, and it should be thoroughly rinsed from the body. If left to dry on the body it soon irritates the delicate skin. Corners of the eyes and nostrils should always be washed. During the first year or year and a half the mouth should be wiped out with a swab or soft cloth and the teeth should be cleansed with this. Great care should be given the teeth all during childhood. Teeth decayed through lack of care or disease are a source of danger to the child's health. They should be cleaned regularly at least twice a day. After the child is two years old this is best done with a small, soft toothbrush.

Often uncomfortable chafing and irritation result from a neglect of the genitals. These parts should be carefully cleansed each day, as irritation due to neglect may result in future bad habits and consequent ill health.

Clothing.— Nothing which concerns the baby has been more radically changed in recent years than its clothing. The long, heavily betrimmed dresses, with irritatingly stiff ruffles and yards of uselessness have gone;

the pinning blanket with its diabolical power of repressing necessary freedom has been discarded. The length and strength of the binder has been limited.

The ideal to seek in providing the child's clothing is looseness, lightness, warmth and cleanliness.

The binder is still worn and should consist of a bias unhemmed strip of flannel 28 inches long and about four inches wide. This binder is easily washed, exerts an even pressure, is elastic and yields to the movement of the child's body, and supports the abdomen without uncomfortable binding. It is pinned in place with small, strong safety pins. This is worn until the child's abdominal muscles are strong. It should be kept clean and changed with the rest of the clothing.

The shirt.— The next garment is the shirt. This should be of fine, soft material. The best fabric for shirts is a mixture of part silk and part wool, or part cotton and part wool. This mixture shrinks less and hardens less in washing than all wool.

The diaper is best made of a soft grade of cotton diaper. It should not be too large nor have too many thicknesses as it interferes with right development of the bones of both pelvis and legs. A better arrangement is to provide square pads made of soft cotton and easily washed and place these in the center of the diaper before it is pinned on. The diaper should not be so tight as to constrict the child's pelvis and back, nor so thick as to spread the bones of the legs. Much harm is done by careless adjustment of this garment. The diaper may be fastened to the shirt with safety pins.

The slip.— Over the diaper and shirt in cool or cold weather should go a flannel slip, in summer one of some lighter material. It should be a simple garment hanging loose from the shoulders and having sleeves. It should be about eight or ten inches below the feet and is more convenient if made by the same pattern as the dress but one-half inch smaller. It is best made from a mixture of cotton and flannel and requires careful washing to keep it soft.

The dress or slip should be made one-half inch larger in all measurements save length and one inch longer than the flannel slip. It should be made of some soft white cotton material without dressing and should never be starched. The simplest, prettiest and most comfortable baby dresses are made without tucks, without trimming, and with soft, simple bands at neck and wrist.

Socks may be used, but if the child's clothing is drawn well around the legs no further protection is needed. Stockings which pin to the diaper are sometimes advocated. The objection to these is, they are often wet with the diaper and must be changed and washed each time, or else they are a source of danger rather than protection to the baby.

Night clothes.— Flannel, stockinet, or canton flannel make good night clothes. The little night slip should be made in the same plain way as the dress but should have a draw string run in the bottom of the hem. This can be drawn together at night and protects the child's feet against cold during the sleeping hours.

None of the clothing which the child wears in the day time should be kept on at night. The child should be completely undressed and allowed freedom of limb for a few moments with gentle massage or rubbing, and should then have fresh, dry, warm clothes, consisting of a shirt, a clean diaper and pad and the night slip. The clothing worn during the day should never be worn at night but should be hung where it will air thoroughly and should be warmed before being put on in the morning.

The clothing should frequently be washed as it absorbs the moisture and secretions from the baby's body and then ceases to be the same source of warmth and comfort. Diapers should not be dried and worn again after wetting. They should first be washed and sunned. No clothing which the baby wears should ever be starched.

Short clothes.— The age at which clothing should be shortened differs with the season and the vigor of the child, the present tendency being to shorten the clothes as soon as possible.

Shoes.— When the child begins to walk and the feet need protection, care should be taken in selecting the foot gear. Soft moccasins with shaped soles and lacing over the ankle are best, as these do not press the foot out of shape. Small, strapped slippers or soft shoes made with broad spreading toes and soft soles are excellent. No shoe should be worn which in any way contracts or constricts the foot. A well-shaped foot means much of health and comfort to the adult in later years.

Regularity of intestinal movement.— With the healthy baby the habit of freeing the bowels with regularity may be established during the first month or two of life. The child should be carefully supported over the chamber night and morning at about the hour when evacuation usually occurs. The association of idea is quickly set up and the habit soon becomes fixed. The early establishment of this habit has more than one virtue. It lessens the number of soiled diapers, thus ensuring more hygienic conditions for the household and less work for the one in charge, and it hastens the day when the diaper may be altogether discarded. The same method of training may be applied in teaching the child to urinate regularly or at least to make its wants known.

The infant should never be allowed to pass even one day without at least one free intestinal movement. It may sometimes be necessary to accomplish this with sick or feeble children by giving an enema to soften the fecal matter. Drugs should never be given except under the advice of a competent physician. With artificially fed babies, obstinate constipation is often due to defective feeding and may be overcome by a judicious use of thoroughly cooked oatmeal water. Lack of water may be also one cause of this trouble with babies. The habit of a daily movement once established should be carefully fostered as the child grows older. Time should be allowed for this process as for others. A common cause of chronic constipation in later years is the morning hurry in childhood which may interrupt and destroy the child's regularity of habit. Physical functions are just as important as mental ones. It would be better to miss a few lessons than to make brain and body sluggish with retained wastes.

Food for the infant.— Nutrition is of supreme importance during the first years of childhood. Much of the unnecessary waste of life during infancy and childhood is due not to Providence but to wrong methods of feeding. The digestive apparatus of the child at birth is no more developed than the rest of the body. It has never been used thus far and is delicate and relatively feeble in its action. The stomach is merely an enlargement of the digestive tract and lies almost perpendicular to the rest of the alimentary canal. This explains the ease with which a baby rids itself of any excess of food, or food which causes distress.

Until birth the baby's supply of food has reached it through the blood of the mother. No effort of preparation has been required on the part of the child. After the baby is born it must begin to digest its own food and absorb it through the digestive tract. This does not mean a sudden great increase of growth. The child is only one short stage further on its way toward development. While the newborn baby has power of digestion, that power is limited. All its digestive juices are weak and some of them have not appeared.

The fundamental needs of the infant for food are the same as those of the adult. The difference lies not in kind but in form and amount. Only those foods which are ready for absorption or require little change can at this period be utilized. It is beyond the feeble power of the baby's immature digestive tract to utilize foods which require marked changes before they are ready for absorption.

Protein is needed to supply the cornerstone for growth and development of all tissues, but it must be in a form adapted to a weak power of digestion. *Fats* and *carbohydrates* must be supplied to meet the demands for energy. But there is only one form of fat which is fitted to the infant and that is fat which occurs in a very finely emulsified form as in milk. *Starch* is a food stuff which requires marked changes before it is ready for digestion. The baby has practically no power for digesting starch. This power does not develop to any degree until after the end of the sixth or eighth month. *Sugar* requires little change, hence this is the form of carbohydrate suited to the infant. *Mineral matter* the baby must have to supply lime and phosphorus and iron and all the other elements which are concerned not only in building bones and forming red blood and stimulating growth but which are essential in many different ways. The mineral matter must be in a form best suited to the need for rapid development. *Water* must be present to hold food in solution, and to carry it to the cells and remove the waste products.

Best food for the baby.— Nature's answer to the question as to where all these demands are best supplied during this undeveloped period of the child's life is unfailingly " the mother's milk." In the *mother's milk* the *protein* is in a form which is very easily digested and yet gives the baby's digestive tract enough work to ensure its gradual development. The *fat* is unusually finely emulsified and is of a kind which requires little effort to digest. The *carbohydrate occurs as milk sugar*, almost ready for absorption, and is not so sweet as to vitiate the child's taste for bland food later on. *The mineral matter* present is very available to the human infant.

When we come later to a discussion of the composition of milk other than human milk and of the various patent baby foods on the market it will be readily seen that any form of food other than mother's milk must be regarded as abnormal for the very young baby, and as likely to involve it in serious difficulties. Hence every effort should be made by the mother to nurse her own child even if this method of feeding cannot be continued during the entire nine months or year.

The first meal.— During the first two or three days after the infant is born no milk is secreted by the mother's breast. A thin watery fluid called colostrum is secreted, which is believed to have a distinctly laxative property and which thus aids in cleansing the baby's intestinal canal of the mucous which has accumulated there before birth. The child should be put at the mother's breast as soon as the mother has recovered from the fatigue of labor, about six or eight hours after birth, and every two or three hours thereafter when the mother is awake. This helps to establish the flow of milk, it aids in closing the uterus, and probably gives the baby some water. It also establishes the ability of the child to suck. Nature seems to have intended to give this time to establishing a natural supply of food and it is dangerous to experiment unless under the advice of a physician who understands thoroughly the essentials of infant feeding. The old fashion of making a " sugar rag " or a " flour ball " and giving it to the newborn baby must be strongly condemned. It puts into the child's stomach some entirely foreign substance and is a fertile source of colic, and it diminishes the sucking activity and consequently withdraws this stimulus to milk secretion, thus causing delay in flow of milk.

If the milk is slow in coming, the following mixture may be given after the third day every four hours, alternating it with the breast: Whey, 2 teaspoonfuls; water, 2 teaspoonfuls; milk sugar, $\frac{1}{4}$ teaspoonful. This should be stopped as soon as the milk supply begins.

Water.— As soon as the child's eyes and nostrils have been cleansed it should be given a teaspoonful or two of warm sterilized water either from a spoon or a nursing bottle. A little warm water should be given at intervals during the day all during the nursing period. Babies frequently suffer grievously from thirst and are given an irregular meal to supply this demand. The child needs plenty of clean, sterile, warm water given between feedings to keep the kidneys active and the body in good condition. Yet many mothers never think of giving the baby so simple a remedy as a drink.

Regularity of meal hours.— From the day the baby is born it should be fed at regular hours and at regular intervals. Time should be given after each meal for the food to digest and the stomach to rest. It is a common sight to see little babies of a few weeks or a few months old, fed at all hours and at all times. The child cries and the mother has learned that feeding it will cause temporary relief. It is a very fatal mistake. The child is, as a rule, not crying because it is hungry, but because it is thirsty, or because irregular meal hours and constant feeding have upset its digestion and colic has resulted, or because it is sick or uncomfortable. First determine the cause of the irritation. Find out whether it is due to colic, to indigestion, to thirst, to uncomfortable clothing, chafing, pins, cold or heat, or the beginning of some illness. Do not make things worse by feeding the child. If the trouble is due to indigestion, the amount of food is to be decreased and not increased and a longer time must elapse between feedings. A drink of warm water will often relieve the irritation. If the trouble continues, a good physician should be consulted who will be able to judge whether or not medicines should be given.

Time for feeding.— For the first six weeks the baby should be put at the breast every two hours in the daytime from five a. m. until eleven p. m. It should then remain quiet until the following morning, allowing six hours of undisturbed rest for both mother and child. For the first few days another night feeding may be necessary until the child learns to rest quietly without the extra food, but this should be discontinued as soon as possible. Gradual lessening of the amount of food given at this extra feeding and a little patience will quickly accustom the child to adjust itself to this schedule. Common sense must always govern the planning of any schedule. In some cases where the child is robust and the mother's milk is rich, these intervals are too short and the number of feedings too many. The main point is absolute regularity whatever the schedule. The schedule will have to be adjusted to the child. If the child is asleep and its meal hour arrives it should be awakened for the first few days. If this is done, it will very soon become accustomed to awaken with a clock-work regularity.

From the sixth week to the third month the nursing intervals should be gradually increased to three hours, giving seven feedings between five a. m. and eleven p. m. inclusive. If it is possible to avoid it no night feedings should be given at this time. By the sixth month six feedings should be enough for the average child, and by the end of the year five.

Irregularity of feeding not only affects the child directly by interfering with its powers of digestion, but it affects the quality as well as the quantity of the mother's milk by overworking the milk-producing glands. One cause of failure in the mother's supply of milk is due to habitual irregularity in feeding the child.

Length of time of nursing.— About twenty minutes should be given to each nursing. If the time is shorter than this it usually means that the milk flows too freely and that the quick feeding may result in digestive disturbances. Under these circumstances the flow of milk should be controlled by pressure of the nipple between the fingers. If the child falls asleep while nursing it should be awakened and kept awake until it has finished the meal. The contents of one breast should be sufficient for a meal, especially with younger babies, and the breasts should be alternated. As the child grows older, or if the yield of milk is not large at any one time, it may be necessary to give both breasts at a meal. After the child has been fed it should be placed in its crib on the side which has been uppermost during the nursing. This rests tired muscles and ensures better sleep.

Care of the breast.— Indigestion in breast-fed babies is sometimes caused by a lack of care of the mother's breast and of the child's mouth. Before and after each nursing the nipples should be washed with a dilute boric acid solution and rinsed with fresh water. The baby's mouth should also be cleansed by wrapping a little soft cloth or cotton around the finger and swabbing out the mouth with clean water. Milk left on the nipples or in the mouth of the child may sour or become otherwise contaminated and cause as much trouble as unclean milk from any source. The milk which accumulates in the milk ducts is often contaminated and it is often best to withdraw a little of the milk before nursing the child.

The mother's food.— The general health and nutrition of the mother may affect the composition and quality of the milk.

The diet of the nursing mother should be much the same as it has been during the nine months previous to the birth of the child. It should be rich in milk, eggs, well-cooked cereals, vegetables and fruits. Meat should play an unimportant part, unless the mother has been accustomed to a large meat diet. Under these circumstances the withdrawal of this stimulating food may be unwise. Strong vegetables, as onions and turnips, which produce flavors in milk should be avoided. Liberal use may be made of such fruits as apples, which are often better cooked as they are more easily digested, oranges, prunes, ripe peaches and pears. The belief is a mistaken one that fruit in the mother's diet is a cause of colic to the baby. Constipation and the general bad condition resulting from a diet deficient in bulk and in the mineral salts provided in fruits and vegetables is much more to be feared. If there is any tendency toward constipation the diet should be a laxative one such as has been previously suggested.

Weaning.— The age at which a child should be weaned will have to be determined by a number of things, such as the vigor of the child, the richness and quality of the mother's milk, teething conditions, season of the year. Normally the child should be weaned at least within the year, for by this time the average milk has become insufficient to meet all the needs of the growing organism. It is not wise to wean a child just at the beginning of summer or during the hot weather. It should be accomplished earlier or should be held over until fall. Prolonging the period of breast-feeding beyond the normal time may be as bad for the child as any other wrong method of feeding. Weaning should be accomplished gradually unless the child refuses other food as long as it is kept at the breast. Two or three months may be allowed for it, beginning at first with only one modified milk meal a day and gradually increasing the number. The last nursing to be dropped should be the one at night. The change from the breast to cow's milk must be made carefully to avoid any disturbances which may arise from the difference between the two foods. Cow's milk is rarely given at this time without dilution and it must be more diluted than for a child of the same age who has been artificially fed from birth. The milk mixture to be substituted at this time will be considered in the second part of this bulletin under the head of artificial feeding.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post-Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME { MARTHA VAN RENSSELAER, *Supervisor*
MRS. IDA S. HARRINGTON, *Assistant Supervisor*

VOL 1. No. 1 | ITHACA, N. Y. OCTOBER 1, 1911 | FOOD SERIES No. 1

THE CARE AND FEEDING OF CHILDREN.—PART I

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist in your study of scientific home-making. We want your assistance as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the work of the State College in its efforts for rural progress.

Will you please send your opinions on the following points to the Supervisor of the Cornell Reading-Course for the Farm Home?

1. Discuss the results of the constant attention so often given to babies by their grown-up friends.

2. What responsibility have you for the right care of other people's children?

Name.................................

Address.............................

A GUIDE TO CLUB STUDY

The Care and Feeding of Children:

A. Care of the mother before the birth of the baby.

1. Effect of poor conditions for the mother on the child, as overwork, under-exercise, wrong feeding, etc.

2. How the mother may care for the baby at this time.

3. What is meant by prenatal influence and how it affects the child.

B. Care of the child after birth.

1. The newborn baby.

2. Care of the child.

Clothing.

Bathing.

Exercise.

Food.

3. Effects of poor care on the baby.

4. Training the child.

1. What effect the formation of good physical habits in babyhood, such as regular meal times and sleeping hours, may have in developing self-controlled, well-poised men and women.

2. The need of the child for quiet and freedom from the constant attention of grown persons.

3. Play, games, and toys as factors in the training of children.

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post-Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME { MARTHA VAN RENSSELAER, *Supervisor*
MRS. IDA S. HARRINGTON, *Assistant Supervisor* }

VOL. I. No. 3 — ITHACA, N. Y. NOVEMBER 1, 1911 — FOOD SERIES No. 2

THE CARE AND FEEDING OF CHILDREN.—PART II

FLORA ROSE

Alas for the baby deprived of its natural food supply! With all our accumulated knowledge of foods and our improved methods for making the artificial approach the real, we have not been able to find or manufacture a food that can supply the baby's needs in the same perfect way that they are supplied by the mother's milk. Experience has shown that even with skilful supervision the artificial feeding of a baby may be attended by results as serious to its health as a severe illness. If this is true, what disaster may follow when there is no knowledge of child feeding and the baby becomes the victim of untutored experimenting? This peril is impressed upon us when we read such statements as the following: (1) " The death rate among artificially fed babies is seven to ten times as great as among those fed from the breast"; (2) " breast-fed babies have a greater possibility of developing into healthy childhood than artificially-fed ones"; (3) " one third of the babies die before the end of the third year, and 85 per cent of these are bottle-fed."

In the face of this evidence it is our duty to become familiar with the conditions that will give the best possible chance to the unfortunate " bottle-fed " baby and to protect it with all the knowledge that science has brought to bear on the subject. This knowledge is now within the reach of all, as each year sees an increasing number of good books, simply written, on the care of the child.

ARTIFICIAL FEEDING

When the baby's natural food is denied it, the question of finding a substitute that will give good results becomes urgent. Too often the only guide to a choice is the advertisement that goes with a patent food. The worried mother tries first one brand, then another, in a frantic attempt to find something which will " agree " with the baby. Sometimes we hear of a successful result, but the failures are sadly marked. This is not the time to rely on the word of those having a commercial interest in selling a particular patent food. Now, only expert advice and the word of those physicians and scientists who have spent a lifetime in exploring this field should be considered. What is the opinion as expressed practically unanimously by these persons? *That the food which gives the best results when babies must be fed artificially is the milk of some other animal.*

Whatever the source, milk is a natural building material for such tissues as the baby's. When the mother's milk fails, or is not available, an intelligent effort should first be made to use the milk of some other animal. Undoubtedly there are serious difficulties to interfere in the use of cow's milk as a substitute for the baby's natural supply, but an understanding of these difficulties will enable us in most cases to overcome them. We must remember that the difficulties in using foods other than milk are greater than those in using milk.

Nature has adapted the milk of each animal to meet the particular needs of its young. The new-born calf is a relatively strong and well-developed animal. Its muscles are comparatively vigorous and its powers of digestion are fairly active. In a very few hours it must lead a semi-independent existence and in a very few weeks it must shift for itself. Cow's milk is a strong food that stimulates and develops but does not overtax the digestive powers of the sturdy calf.

But the new-born baby is more frail and helpless. Its muscles are weaker, its powers of digestion relatively feebler, its period of dependence longer. Human milk is a weak food, requiring comparatively little effort to digest, and it is perfectly suited under normal conditions to the lagging activities of the baby.

In using cow's milk to feed the baby, a part of the problem, therefore, is to adapt the food of a naturally vigorous animal to a naturally less vigorous one. To accomplish this, cow's milk must be modified or changed to make it more like human milk. Milk thus treated is known as modified milk, and it has become an important factor in the artificial feeding of infants.

CLEAN MILK

A very important factor in suiting cow's milk to the baby's needs is the question of cleanliness. Mother's milk is delivered directly from the " producer to the consumer." There is little time or opportunity for it to become contaminated in passing from the mother to the child. Cow's milk, on the other hand, is frequently produced under very unclean conditions and is liable to careless and dirty handling before it reaches the baby. Hours or even days may elapse before it is used as a food. During this time it may have become contaminated in one of a dozen ways and may finally be unfit for use. Many deaths among babies and little children may be traced directly to the use of unclean milk. Milk not quite fresh, and a little dirty, is a very common cause of a baby's trouble in using cow's milk.

MILK MODIFICATION

Cow's milk can be so diluted and modified as to make it resemble mother's milk very closely in composition, but no known process of modification can make the two alike in all respects. The two differ not only in composition, but also in other characteristics. The following table will serve to show the external differences between them:

COMPARISON OF HUMAN MILK AND COW'S MILK

	In 100 Parts of Milk				
	Water	Protein	Fat	Milk sugar	Mineral matter
Human milk. .	12–13	1.50	4.00	6.50	0.15
Cow's milk. . .	13–14	4.00	4.00	4.50	0.70

Cow's milk not only contains more than twice as much protein, but the protein is largely of a kind called casein, which may form a relatively firm curd when it reaches the stomach. This curd is a good developer for the calf's active stomach muscles but it is not so well adapted to the needs of the baby, whose natural food contains but little casein and demands no such effort to digest it. The fat in the cow's milk is in larger particles, or globules, than that in human milk, and it is therefore more difficult to digest. This difference in the two kinds of fat is now believed to be a frequent cause of the child's difficulty in digesting cow's milk. There are just as distinct, though less easily explained, differences in the mineral content of the two kinds of milk.

All of the foregoing factors, combined with the possibility of dirty milk, make more difficult the artificial feeding of the baby even with skilfully made modified milk mixtures. They are mentioned here to show that artificial feeding must ever be regarded as unnatural and that the baby thus fed must be treated with double care.

No matter what method is used in making modified milk mixtures, the underlying principle is the same: that is, to dilute cow's milk so as to reduce the amount of protein present until it is about the same as in mother's milk, and then to increase the food value of the diluted mixture to normal by adding sugar or sugar and cream. Which method is best, it is impossible to say, and there is not space here to include a description of all of them or to enter on a discussion of their respective merits. Every family in which there is a baby should own one or more good books that treat on the care and feeding of children. If the child must be bottle-fed, the choice of method may then be made intelligently.

Most methods of modifying milk are rather complicated and difficult to manage. The following is recommended for its simplicity and is given here by the courtesy of the Babies' Dispensary and Hospital of Cleveland, Ohio:

BOTTLE FEEDING

1. "The only good substitute for mother's milk is milk from healthy, consumption-free, clean-kept cows, milked in a clean stable by clean milkmen into sterilized cans, quickly cooled over sterile refrigerators and poured into sterile bottles, which are closed with sterile stoppers, *and kept cool till used for the baby. Such* milk need not be sterilized or boiled. Common store or milkman's milk is no food for the baby, even though it may taste and look good. The patent baby foods, condensed milk and the like, also harm the infants in most cases, and should therefore not be used. *Your doctor can tell you how to get the right kind of milk for your baby.*

2. "*If you cannot get the best milk*, see that you get as good milk as you can from a milkman whom you know to be clean; *use a clean dish*; unless it is certified milk or clean and pure beyond doubt *boil the milk from three to five minutes; during the hot summer boil for ten minutes; cool as quickly as possible* by placing the dish in another filled with the coldest water you can get; renew this water frequently and keep the dish covered in the coolest room of the house.

3. "*Clean the bottle* immediately after feeding by first rinsing it with clear water, then soak it in soda, borax, or soap water; clean well with clean brush and rinse with boiled water; *then set it upside down in a clean place*, or stand it upright filled with boiled water. (The bottles are to be boiled as directed below, before being used.—Author.)

4. "As soon as you have sufficiently cooled the milk, prepare your food as directed by the doctor, always using the *cleanest dishes*; then pour it with a clean pitcher, not through a dirty funnel, into as many bottles as the baby is to have meals, and stopper with clean cotton batting, which you may have baked in the oven. Before using the bottles, however, which you have already cleaned as directed under item No. 3, boil them for twenty minutes and then set them upside down in a clean place or dish to dry and cool.

"Use a nipple which is slipped over the neck of the bottle and which can be turned inside out; *nipples with tubes* are convenient for a lazy mother, but mean *death to the baby. Cleanse the nipple* thoroughly, outside and inside, after each feeding and keep it dry in a clean, covered cup or glass. Boil the nipple at least once daily.

5. "*Feed the baby:*

"*First Week.*— Seven meals in 24 hours; each meal from $1\frac{1}{2}$ to 2 ounces (45 to 60 grams), consisting of 1 part milk and 2 parts water or thin gruel, and 1 even teaspoonful of granulated sugar for each 2 ounces or 60 grams of the diluted mixture.

(Boil the water used in making milk mixtures.)

"*Second Week.*—Six meals in 24 hours; each meal from $2\frac{1}{2}$ to 3 ounces (75 to 90 grams), consisting of 1 part milk and 2 parts water or thin gruel, and 1 even teaspoonful of granulated sugar for each 2 ounces or 60 grams of diluted mixture.

"*Third and Fourth Weeks.*— Six meals in 24 hours; each meal of 4 ounces (120 grams), consisting of 1 part milk and 2 parts water or thin gruel, and 1 even teaspoonful of granulated sugar for each 2 ounces or 60 grams of diluted mixture.

"*Second Month.*— Six meals in 24 hours; each meal of 4 to 5 ounces (120 to 150 grams), consisting of 1 part milk and 1 part water or thin gruel, and 1 even teaspoonful of granulated sugar for each 2 ounces or 60 grams of diluted mixture.

"*Third Month.*— Six meals in 24 hours; each meal of 5 ounces (150 grams), consisting of 1 part milk and 1 part water or thin gruel, and $1\frac{1}{4}$ even teaspoonfuls of granulated sugar for each 2 ounces or 60 grams of diluted mixture.

"*Fourth to Sixth Month.*— Five meals in 24 hours; each meal of 6 to 7 ounces (180 to 210 grams), consisting of 2 parts milk and 1 part water or thin gruel, and $1\frac{1}{2}$ even teaspoonfuls granulated sugar* for each 2 ounces or 60 grams of diluted mixture.

"*Seventh Month.*— Straight milk may be given in five feedings of about 6 to 7 ounces each.

6. "Warm each feeding to about body-heat before giving it to the child, by placing the bottle in a dish of hot water; hold the baby in your arms while feeding; do not allow the baby to drink from the bottle any longer than 15 minutes at the most; *pour away any of the rest; do not save this for the next feeding.*

7. "*Do not coax the baby to take more food than he wants.* Too large quantities and too numerous feedings harm the stomach and lead to in-

*The use of milk sugar in place of granulated sugar is believed by some physicians to be advisable because, first, it is said to ferment less easily, and second, it is considered to have a slightly laxative effect. If milk sugar is used the amounts given above should be doubled. The disadvantage of its use is expense.

testinal disturbances. *That's what makes the baby cry so much; not, as mothers think, insufficient food. Do not overlook a serious illness because the child is teething; for teething very rarely makes the baby sick.*

8. "From the seventh month on, give one meal of broth daily. From the eighth month, give 2 to 3 tablespoonfuls of strained oatmeal, rice, tapioca, farina, flour soup, zwieback, daily. From the tenth month on, strained apple sauce, prune juice, orange juice.* *Never give the baby more than five meals a day all in all.*"

Modified milk mixtures must always be used with common sense. Directions are given to serve as guides and are not infallible rules. If a child digests its food well but shows too great symptoms of hunger between meals, increase the amount given at a meal. If the child is not hungry at meal times increase the intervals between meals. There will be many similar points of adjustment to be made, for no schedule can be absolutely perfect for all cases. Cleanliness, accuracy, and regularity can and always should be observed.

DILUENTS

The question is often asked, which is best to use in diluting milk mixtures, water or some kind of gruel. If the baby suffers habitually with constipation, a thoroughly cooked thin oatmeal gruel should be used in place of water to dilute the milk. Barley gruel is also somewhat laxative, though less so than oatmeal. Rice water may be used when there is a tendency to looseness of the bowels. The use of barley or oatmeal is advisable in cases in which the milk seems to cause slight indigestion. Many physicians believe that it is always better to use a thin gruel instead of water as a diluent, because the thickened starch aids in breaking up the curd which cow's milk forms when it reaches the stomach, and thus helps the baby to digest the milk. If gruels are used they should be carefully made, very thoroughly cooked and strained, and should be rather dilute.

Barley water or gruel.— To 1 quart water add 1 tablespoonful well-washed barley. Boil very slowly for several hours or until reduced to 1 pint. Strain and use. If too thick, dilute with a little water that has been boiled.

Oatmeal water.— To ½ cup rolled oats add 1 quart water. Boil slowly two hours. Strain and use. If too thick, dilute with a little water that has been boiled.

Rolled-oat jelly.— To 1 cup rolled oats add 3 cups water. Cook two hours or longer in a double boiler. Rub through a strainer. The coarser part may be reserved for use by the adult members of the family.

* If the baby is fed with boiled milk, a teaspoonful of strained orange juice diluted with 2 to 4 times its amount of water should be given between feedings several times a day.—Author.

INDIGESTION

If the baby suffers from indigestion, for a day or two give it a milk mixture suited to a younger child and then increase the strength gradually meal by meal.

PREMATURE WEANING

If the baby is prematurely weaned, begin by feeding it with a milk mixture suited to a younger child, and increase the strength of the mixture meal by meal and day by day as fast as the baby can bear it without showing symptoms of distress. One of the essentials to success is that the child's intestinal tract should come gradually to adjust itself to digesting cow's milk.

WEANING

When a baby is weaned at the normal time, the milk mixture used to replace mother's milk should at first be much more dilute than the usual mixture required for that age in artificial feeding. The strength of the mixture to full cow's milk should then be increased as rapidly as the baby can bear it. Gruels should be used to dilute the milk at this time, for the baby will have established its power to digest starch and the gruels will have an actual food value as well as being of use to break up the curd.

PEPTONIZED MILK

Sometimes even the most careful efforts to feed a baby with modified milk fail. It may then be necessary partly or completely to predigest the milk with pepsin. This is a very simple process. A given amount of the digestive substance, pepsin, is added to milk and the milk is kept at about body temperature for five to thirty minutes, according to the completeness of digestion desired. It is then chilled as soon as possible to stop further digestion. Predigestion of milk must be carefully considered. It means carrying on outside the body a process which normally should occur within the body. If it is kept up too long the child's powers of digestion may become weakened by having too little work to do. Therefore the milk should be slightly less completely digested day by day until the child learns to do its own work. Directions for peptonizing milk are given with the powders or pepsin purchased for that purpose.

STERILIZED MILK

If the milk supply is at all doubtful, milk should be either boiled or pasteurized. Pasteurization is the name applied to a process of heating milk for a given length of time at a temperature below the boiling point of water. Milk is less changed by the action of this lower temperature than by boiling, and generally pasteurization is sufficient to make the milk clean and wholesome. If milk is to be pasteurized, the easiest way is to mix the milk, water, and sugar for the entire day's feedings previous to heating the milk, fill the bottles which have been sterilized by being boiled, stopper with clean absorbent cotton, and set on a rack in a boiler or deep kettle with sufficient water to come to the level of the milk in the bottles. The water should be kept at a temperature of 145°–155° F. for forty-five minutes. A dairy thermometer may be used for regulating the temperature. At the end of this time the bottles should be removed, cooled quickly, and put away in a cold place until ready for use.

It is a much discussed question as to the effects which cooking has upon milk, but the consensus of opinion is that milk thus treated loses some of its desirable properties. While this may not be of great importance when milk is only a part of the dietary, as with older children and grown persons, it is of considerable importance to the baby living entirely on milk. When sterilized milk must be fed, it is believed to give better results if a teaspoonful of strained and diluted orange juice is given between feedings several times a day. The freshness of the orange juice is believed to counteract in part the harm done by sterilization. An effort should be made to procure milk produced under such clean conditions as to make sterilization or pasteurization unnecessary.

PATENT FOODS

Little has been said so far concerning the use of the various patent foods on the market, save that they cannot compete successfully with carefully made milk mixtures in substitute or artificial feeding.

The baby should have its carbohydrate in a soluble form like sugar, for it has little power to digest starch until about the sixth month or later. Some of the patent foods contain as their chief food-stuff unchanged starch, and as this is not available to the baby the child may actually suffer from tissue hunger although the stomach and intestine are full. To give best results, the baby's food should contain fat in a finely divided, easily digested form. Many of the patent foods contain little or no fat. Perhaps the strongest case against the patent foods is their lack of the food-stuff known as mineral matter or salts, which is so essential to healthy growth and development. Many cases of malnutrition result directly from the use of such of these foods as are deficient in fat and mineral matter. A common ailment among babies thus fed is rickets, an ailment that is serious and may be lasting in its effects.

When a patent food is made with milk, its bad effects are minimized and it may serve a useful purpose. As has already been pointed out, barley and oatmeal are much used in place of water to dilute milk mixtures. They help to break up the curd formed from the casein of the milk during the process of digestion. Some of the patent foods act in the same way and this is one of the secrets of their success. Occasionally a patent food used without milk is of value to tide the baby over a period of indigestion, to help when a trip is to be taken and fresh, clean milk is not available, or to take the place of the mother's milk during a brief temporary illness of the mother. On the whole, however, canned milk and patent foods used without milk should be last resorts. They may make a fat baby, but fatness does not mean development of muscles, bones, and nerves, or assurance of vigor and endurance.

USE OF SOLID FOODS

If a child has been bottle-fed, the use of semi-solid or solid foods begins somewhat earlier than with the breast-fed baby. Wise care should underlie this use of solid foods and the baby should not participate in the family dietary, as so frequently happens, just because milk is no longer its sole maintenance.

CARE IN PREPARING FOODS

The cereals given to the baby should be very thoroughly cooked. Many times failure to make children like cereals is due to improper cooking. The half-raw cereal has an unpleasant taste and causes indigestion. Package directions should not be depended on; they are given to tempt us to save time. Even partially prepared cereals, as rolled oats, when served to very small children should be cooked 1½ to 2 hours. A fireless cooker will make this both easy and cheap to accomplish and every family can afford at least a home-made cooker. Vegetables should be carefully prepared so as to keep them mild and delicate in flavor. At first they should be strained or rubbed through a sieve to remove all lumps or hard pieces.

FOOD AND CARE FOR OLDER CHILDREN

To realize the significance of an understanding of the right way to feed children, it is necessary simply to turn to some of the recent bulletins on the feeding of animals. The writer has in mind one bulletin that gives the results of experiments in feeding growing swine. The kind of food given to them during their growth period was found to affect greatly the size and strength of the bones, the vigor and amount of muscular tissue, the size and activity of the lungs, kidneys, and liver, total growth and weight, and ultimately the ability to produce healthy offspring. So, after all, Providence is not altogether responsible for our physical defects.

The feeding of the baby during the first nine months or year of its life is so important to its future that under normal conditions nature is not willing to let us experiment with it, but cares for it herself by providing mother's milk. This first year is the time when the baby's digestive powers are being made ready for use. Toward the end of the year the healthy, human digestive apparatus is ready to begin its more exacting education. It now needs training by carefully chosen exercises. It would be absurd and unwise for us to try to hamper the year-old baby in his attempts to crawl or walk or otherwise use his strengthening muscles. It is equally foolish to limit the diet of the normal year-old child to milk only. He is instinctively ready to begin the active use of his muscles, whether of locomotion or digestion. On the other hand, these are functions which are by no means fully developed. Are we going to demand greater feats of the muscles of digestion than of the arm and leg muscles? The underlying principal of child feeding should be to *develop* the child's powers of digestion, and neither to retard nor to overtax them. If child labor is to be discouraged it must be discouraged in the less apparent but equally real way of making a child's immature digestive apparatus do grown-up service.

The two mistakes most often made in feeding children are:

(1) Giving foods unsuited to the stage and age of development.

(2) Permitting children to eat between meals and at irregular hours.

The baby just weaned is not immediately ready for a very varied diet of solid foods, although it has established its ability to digest starch and has increased its ability to digest the other food-stuffs. These powers should be tested a little at a time and the burdens imposed on them should be gradually increased. The first starchy food given to a baby is cereal gruel mixed with its milk, later cereal jelly and unstrained cereal, and then bread crumbs and bits of crust or zwieback or tough educator crackers to develop its powers of mastication. Strained fruit-juices are given first, then fruit pulp and cooked mashed fruit, and finally the fruit itself. Meat broth and meat juice precede the use of scraped meat, and this precedes meat which is finely cut. Vegetables are mashed, bread is crisped, cereals strained, meat scraped or cut fine, until the child has some grinding teeth and is old enough to obey the command to "chew." The child should be trained to digest fat by giving it, first, rich milk, then thin cream, then butter, and lastly other solid fats.

This idea of gradually increasing the strength of the food to be digested as the child grows and develops should be carried out all through childhood. If more thought were given to this there would be little need in later life to discuss the digestibility and indigestibility of various foods. A sound, well-educated stomach would be able to stand the wear and tear of the every-day diet. Certainly we should learn to digest foods that require real work on the part of the digestive organs, but this should come gradually. It is all very well to say that Jane or John is a perfectly vigorous child and already at two or three years of age shares the family dietary in all particulars. Do the grown-up Janes and Johns exhibit such sound health as to justify us in our belief that the vigor has endured?

Much of the trouble that is laid at the door of teething and most of the difficulties feared during the baby's second summer are due not to teeth and time, but to wrong feeding methods. The child's first summer is in point of fact more perilous than the second, but usually during the first year it is living on a carefully regulated diet and all the digestive processes are proceeding normally.

During the second year, when foods other than milk should of necessity appear in the child's diet, unwise choice of foods is made and digestion is disturbed. Cutting teeth adds to this disorder and the time becomes one to be feared by the mother and suffered by the child.

The following list of dietaries is given as a guide to aid in a wise choice of food for the child up through the seventh year. It is intended to be suggestive and to illustrate types of food for different ages, and does not pretend to cover all the foods which may appear in the child's dietary during these years. The actual dietary as prepared and served to the child must be a matter for individual adjustment and requires the practice of much sound common sense.

Dietary from 12th to 18th month

First meal. 6–7 A. M.

Warm milk mixed with a little thick cereal gruel or cereal jelly

or

A little lightly cooked egg mixed with stale crumbs, and a glass of warm milk.

Second meal. 9–10 A. M.

Glass warm milk.

Third meal. 1–2 P. M.

A lightly cooked egg mixed with stale crumbs, glass of warm milk

or

Tablespoonful of thoroughly mashed potato with meat juice, glass of warm milk.

Fourth meal. Midway between meals.

One or two tablespoonfuls orange juice or prune juice. (This meal may be given at nine o'clock in the morning instead of at this time.)

Fifth meal. 5–6 P. M.

Glass warm milk with cereal jelly.

Dietary from 18th to 24th month

First meal. 6–7 A. M.

Warm milk with lightly buttered bread

or

Cereal with thin cream, glass of warm milk

or

Lightly cooked egg, lightly buttered bread, glass of warm milk.

Second meal. 10 A. M.

Glass of milk with slice of bread.

Third meal. 1–2 P. M.

Mashed potato with dish gravy, bread and milk, very small serving baked apple or prune pulp

or

Lightly cooked egg, bread and milk, small serving baked apple or prune

or

Mashed spinach, carrots, or similar vegetable, bread and milk, small serving very simple junket or rice pudding or similar simple dessert.

Fourth meal. Midway between meals.

Tablespoonful orange juice or scraped apple.

Fifth meal. 5–6 P. M.

Bread and milk

or

Milk toast.

Although the child may be at the family table from about the third year, it should not be allowed the freedom of the family dietary. It is far better for the child to learn that certain foods are not for its consumption, and that they are actually as remote from its scheme of things as the moon. There is no better lesson in self-control or temperance than the one that may be taught in this simple way.

Dietary for third year

First meal. 7–8 A. M.

Cereal with cream, milk to drink

or

Lightly cooked egg with toast and milk.

Second meal. 10–11 A. M.

Bread and milk.

Third meal. 2 P. M.

Lightly cooked egg, buttered baked potato, bread, milk, stewed fruit

or

Broiled scraped beef, mashed vegetables as spinach, puree of peas, or carrots, bread, milk, light pudding, as rice or bread pudding or junket, or occasionally a simple ice cream

or

Bread and milk, baked potato and one other vegetable, small serving pudding.

Fourth meal. 6–7 P. M.

Bread and butter, milk

or

Cereal mush and milk

or

Bread and milk and stewed prunes or apple sauce.

Dietary for fifth year

Breakfast. 7–8 A. M.

Cereal with sprinkle of sugar and cream, bread and milk.

An egg may be added to this meal.

At 10 A. M.

Milk with thin slice of bread and butter.

Dinner. 12–1 P. M.

Lightly cooked egg or finely cut meat, spinach or peas or beans well mashed, baked potato or boiled rice, stewed fruit or light pudding.

Supper.

Well-cooked cereal with cream, milk to drink, stewed fruit

or

Lightly cooked egg, bread and butter, milk to drink, baked apple.

Dietary for seventh year

Breakfast.

Cereal with sprinkle of sugar and cream, eggs, poached, boiled, or scrambled, milk with bread and butter. Fruit may be eaten at this meal.

At 10 A. M.

Glass of milk and a cracker.

Dinner.

Small piece of steak or roast, potato, rightly cooked cabbage or other vegetable, bread and butter and milk, some simple dessert as custard, bread and jelly, or fruit.

Supper.

Eggs or cream soup or milk toast, bread and butter, milk, stewed fruit or bread and jelly.

The above dietaries may be greatly simplified, but should hardly be made more complex. Such simplification has been fully explained in a previous bulletin on Human Nutrition. During the early years of childhood, fried foods, pastries, hot breads, heavy puddings, strongly flavored vegetables, much meat, candies, and the like should find scant place in the diet. Tea and coffee or other stimulants should never be given to children.

All through childhood, milk should be a mainstay in the dietary. The complaint is often made by mothers that their children do not like milk and will not take it. Inquiry generally shows that the cause for this has been the use of quantities of very sweet or highly flavored foods. The distaste is generally a fancied one. The cases in which a child has some persistent disability to digest milk are very rare. If the child has been permitted to become notional in his food habits and he will not eat raw milk, some way should be found to include it in the dietary. This can be done through the use of milk soups, weak cocoa, custards, cereals cooked with milk, and simple puddings. All the milk needed by the child may be concealed in this way.

The child's sense of taste is very highly developed. It derives much more flavor and " taste satisfaction " from such bland foods as milk and cereals, and from simple bread and butter, than does the adult. The healthy child does not need highly flavored, stimulating foods, for nature has given it a keener relish for bland ones. If strongly flavored foods are constantly given to the child its keen sense of taste becomes dulled and the child soon loses its pleasure in simple fare.

The question is constantly asked, is not the child's natural fondness for " sweets " an indication of its need for candy or sugar? A certain amount of sugar in the child's dietary is certainly a very desirable way of supplying some of the child's energy. But this sugar may be supplied best in the form of milk, in sweet fruits and vegetables, in fruit jellies, and in well-sweetened simple puddings, with only occasional pieces of candy as a dessert at the close of the meal. All the sugar a child needs can be included with other foods at meal-time without the necessity of the too common between-meal indulgences. If a child is allowed to eat candy, cake, and quantities of sweet crackers between meals, the appetite constantly accustomed to the stimulus of the sweet food becomes vitiated. As a result, the meal-time becomes a farce. " Not hungry," is the complaint. Muscles, nerves, blood, and bones, which need all the things that only such foods as milk and eggs and cereals and fruit are able to supply, become badly nourished and the child is not the rosy, wholesome, sound-sleeping, rightly-developing mortal intended by nature.

If a child is very active it is a simple matter to increase the sugar in its dietary without giving candy between meals. Sugar may be allowed with cereal or in bread and milk. Sweet jellies may be given to the younger children at some meal and preserves to the older ones. Simple desserts and cooked fruits may be well sweetened. Then the child eats the other foods along with the sugar and the diet is not a one-sided affair. When we say that constant candy eating results in poor teeth we are describing a more deeply seated evil than we realize. If poor teeth are caused by too much candy, it is usually because the use of the sugar has so satisfied the child's appetite that the child has been unwilling to include the blander bone-building materials in its diet. If the teeth are affected as a result, what about the harmful effects on the more obscure tissues which are hidden from us? Concentrated sugar solutions are very irritating to the mucous membranes and may give rise to gastric disorders, hence the further desirability of having the sugar used in the dietary diluted with other foods.

Some of the men most learned in the conditions best for little children believe that the use of meat in the dietary of the child until after the fifth, sixth, or seventh years is not advisable. The main reasons given for this are: Meat is more subject to decay in the intestines than other protein foods. Clean, wholesome milk tends to prevent this decay. Meat contains stimulating substances which, though they may be of use in the older organism, are not needed by the younger one. The baby or child should be vigorous enough not to need any stimulant. These substances give rise to waste products in the tissues which, though they may not be directly harmful, are certainly not beneficial to the child. The kitten is often cited as an illustration of this principle. While cats live healthily and well on a rich meat diet, if kittens are fed largely on meat they become subject to convulsions. Meat is a highly flavored food. A diet rich in meat is likely to be a diet poor in milk, for the higher flavor tempts away from the milder one. Such a diet may be deficient in lime.

Some physicians believe that it is an unwise practice to eliminate meat from the child's diet because meat is a useful source of iron. An intelligent knowledge of foods soon shows how this disadvantage may be overcome by using eggs and certain vegetable foods relatively rich in a form of iron more available than that which occurs in meat. Meat has one decided advantage in that it necessitates the use of the powers of mastication.

ATTRACTIVE SERVING

It is impossible to overestimate the importance of serving food in an attractive manner. Food may be of the right kind, carefully prepared, may be clean and wholesome and good, but at the last it may be presented in such a way as to appeal neither to eye nor to appetite. If a child does not like food which the parent knows to be desirable, the dislike may generally be conquered by a modification in the way the food is served.

Two little girls of the author's acquaintance would not eat baked potato until its commonplaceness had been removed by having wonderful rills mounded up the side with the tines of a fork. The change in taste caused in this way was very real to them and they clamored for more and more. A little imagination on the part of the parent will do much to make John and Jane eat bread and milk and find therein the flavor of nectar and ambrosia. But the bread and milk must be as daintily served and as attractively presented as any more elaborate feast.

THE SCHOOL LUNCH

The school lunch is a problem. We all concede that it is better for the child to have his noon meal quietly at a well-ordered table and under close supervision of grown-ups. This is not always possible, however, and in many places it is necessary for the child to carry his lunch with him in pail or box. The question is, therefore, how may this best be done?

If food is ever to be attractively presented, here is the opportunity. The limited variety made necessary by the use of cold foods, the tendency toward messiness unless the packing is careful, may make the child scorn bread and butter and choose only sweet or highly flavored foods for this meal. The mainstay of the child's lunch box should be sandwiches. Not thick slices of bread, but bread cut thin, both slices buttered lightly and filled with something not too dry. If meat is used it should be sliced thin, or it may be ground fine and mixed with cream to form a paste. Slices of hard cooked egg seasoned with a very little oil or cream salad dressing, peanut butter softened with cream, jams and marmalades, all make good sandwiches. The crusts should be left on the bread, but the sandwiches should be carefully cut and wrapped singly or in pairs in the paraffin paper which is used for wrapping butter. A piece of simple cake or a cookie, and a liberal allowance of some juicy fruit, will be enough. It would be better, however, if occasionally, at least, some little unexpected treat is included, as a few shelled nuts, a piece of candy, a little jar of jelly, or some much-loved dainty.

The best lunch box is made of tin. This type of box may be kept perfectly clean; and at the same time it keeps the food moist and in good condition.

If milk can be kept cold and clean, a bottle of milk is an excellent adjunct to the child's lunch. The mothers in a rural community would do well to take this matter up for discussion and see whether it may not be possible to arrange for the keeping of the milk.

MASTICATION

It is important that a child should learn to masticate its food well, and to this end it should have something to chew as soon as the large back teeth begin to come. Tough bread, zwieback, educator crackers, and, later, some meat are useful for this purpose. All of these things develop the powers of mastication and give the exercise necessary to develop the jaw and make room for the second teeth.

EATING BETWEEN MEALS

Again let emphasis be laid on the bad habit of allowing children to eat between meals. It results in no good to the child and must be strongly condemned. If a child is habitually and really hungry between two definitely established meals, shorten the interval between the meals, or give more food at the meal, or establish a simple meal of bread and milk at a regular time between the two meals, or allow him to eat dry, unbuttered bread. If dry, unbuttered bread is given, it will be found that the between-meal habit exists frequently more because of a desire for something good to eat than from actual hunger. Learn to distinguish between habit and hunger. It is a duty which parents owe their children and if it is neglected the child may finally pay the price.

CARE OF THE TEETH

From the time they arrive until the time they depart, a trouble, and when they are gone most trouble of all, the teeth. The teeth begin to appear about the sixth month, although there is considerable variation in this, as well as in the order in which they come. The following table shows the usual order and time of eruption of the temporary milk teeth:

Lower central incisors	6th to 9th month
Upper incisors	8th to 10th month
Lower lateral incisors and first molars	15th to 21st month
Canines	16th to 20th month
Second molars	20th to 30th month

Early appearance of teeth is not uncommon and may not be indicative of any wrong condition. If the teeth are delayed the cause should at once be investigated, as this condition may indicate some serious defect in nutrition, resulting in retarded or interrupted bone formation. Teething is a normal process and should proceed fairly easily. Pain or sickness at this time should not be overlooked or set aside as being the natural result of teething. The cause may be indigestion or some deep-seated malnutrition, and it should be investigated.

The teeth should receive care from the first. Before the child is old enough to handle a toothbrush, the mouth should be washed out twice a day with absorbent cotton wet with dilute boric acid water. The importance of keeping the teeth clean is twofold: first, to prevent their decay, and second, to remove particles of food which, left in the mouth, decompose and later, when swallowed with the food, start decomposition in the intestine. Good digestion in later life depends so much on proper mastication that defective teeth often interfere seriously with nutrition.

It is poor economy to neglect the care of a child's teeth. Last year's hat and coat had better do double duty if it is a choice between new clothes and the services of a good dentist. In many of the large cities, dental inspection in the schools is being required, for it is now known that decayed teeth may so affect the child's general health as to make him dull and backward. It has been found to be cheaper for State and taxpayer to pay for medical inspection than to pay for teachers to go on teaching over and over again curably dull and backward children.

The child's dietary should be so regulated as to ensure right nourishment of all bony tissues. Any habits such as "thumb sucking" or the habitual use of that pernicious plaything, the "soother" or "comforter," should be discouraged. The pressure on the gums through constant sucking throws the whole arch of the mouth out of symmetry and later makes mastication difficult and thus impairs digestion. Adenoids are said to be caused by thumb sucking and the use of the comforter.

DRUGS

The belief that all ills may be cured with drugs is fortunately diminishing as the knowledge of nutrition and hygiene increases, but there is still too much "faith in the label on the bottle." Only a good physician should be allowed to determine what medicines shall be given to the child. The following quotations concerning soothing syrups are made from a recent government bulletin on habit-forming agents, and show what disastrous treatment is often innocently given to the baby:

"It has long been known to the medical profession that these products as a rule contain habit-forming agents, but the majority of mothers have been and still are ignorant of this fact."

"In some instances, in which the remedy is freely used and the child does not succumb, there is developed a case of infant drug addiction. As soon as the effects of one dose pass away, the child becomes irritable and fretful, with the result that another dose is administered, the craving is met, and the child is quieted, a condition which is analogous in every respect to drug addiction among adults. The chief active agents of soothing syrups are well known to be opium, morphin, heroin, codein, chloroform, and chloral hydrate in some combination. The following are representative of this class:

Children's Comfort (morphin sulfate).
Dr. Fahey's Pepsin Anodyne Compound (morphin sulfate).
Dr. Fahrney's Teething Syrup (morphin and chloroform).
Dr. Fowler's Strawberry and Peppermint Mixture (morphin).
Dr. Groves' Anodyne for Infants (morphin sulfate).
Hooper's Anodyne, the Infant's Friend (morphin hydrochlorid).
Jadway's Elixir for Infants (codein).
Dr. James' Soothing Syrup Cordial (heroin).
Kopp's Baby's Friend (morphin sulfate).
Dr. Miller's Anodyne for Babies (morphin sulfate and chloral hydrate).
Dr. Moffett's Teethina, Teething Powders (powdered opium).
Victor Infant Relief (chloroform and cannabis indica).
Mrs. Winslow's Soothing Syrup (morphin sulfate).

"Soothing syrups containing habit-forming agents, used without discrimination, undoubtedly leave their impression on the delicate organisms of infants and induce tendencies which under unfortunate circumstances in future life may be aroused to activity and develop an evil habit of one form or another. The question arises: How is this condition to be met? The signs of the times point to two ways, namely, education, and the withdrawal of the dangerous articles, both measures appearing to be necessary. At present there are on the market, intended to be used for children, several mixtures free from the customary habit-forming agents, but they apparently do not give satisfaction as formerly, as manufacturers are constantly receiving calls for the 'old kinds.'"

THE TRAINING OF PARENTS

Physicians, lawyers, engineers, teachers, must all receive definite technical training before they are adjudged ready to assume their professional duties. A plea must be made for training parents. Is there any profession which, to be successful, requires greater intelligence, resourcefulness, endurance, self-control, ability to lead and to govern, than being just a parent? The knowledge of children and their needs is but little more inborn than a knowledge of law or medicine. In every home, an effort should be made to learn through books, or directly through the experience of others, something of the needs, both physical and spiritual, of the children in the family. The best inheritance a child may have is the training and care given to it by thoughtful, intelligent parents.

A GUIDE TO CLUB STUDY

I. METHODS OF INFANT FEEDING.

A. Natural method or breast feeding.

1. Composition and characterstics of mother's milk as compared with the milk of other animals.
2. Relative feebleness of the baby and other young animals.
3. Reasons for better results obtained by using mother's milk.
4. Causes of the inability of the mother to nurse her baby and of the failure of the child to flourish.
5. How these causes may be remedied.
6. Has the State any responsibility in legislating so as to secure to the working woman the privilege of nursing her children?

B. Artificial feeding.

1. Milk of some other animal.
   a. Cow's milk.
      1. Characteristics as compared with human milk.
      2. Reasons for difficulties in using cow's milk for infant feeding.
      3. Underlying principles in modifying milk.
      4. Methods of adapting cow's milk to suit the baby.
      5. The use of various gruels in making modified milk mixtures.
      6. Causes of differences in results obtained by using milk from various breeds of cattle.
      7. Clean milk.
         a. Relative cleanness of cow's milk and human milk when it reaches the child.
         b. Possibilities of infecting cow's milk on its way to the child.
         c. Practical problems in producing clean milk.
         d. Sterilization and pasteurization.
         e. Sterilized milk, pasteurized milk, or milk produced under clean conditions,— which?
   b. Goat's milk, etc.
2. Patent or proprietary foods.
   a. Comparative composition of various patent foods and human milk.
   b. Reasons for the use of patent foods.
   c. Their use and abuse.
   d. Possible injury from ignorant use of patent foods.
   e. Reasons for advantages of cow's milk over other foods in artificial feeding.

II. FEEDING OF CHILDREN AFTER WEANING.

1. Underlying principle in feeding children.
2. Food for children of various ages.
3. Effects of wrong nutrition on children.
4. Disorders caused by malnutrition.
5. Comparative value of milk and eggs and meat as foods for the growing child.
6. The use of sugar in the child's dietary.
7. Fruits and vegetables for children.
8. Mineral matter in the diet of the growing child.
9. What is to be learned about feeding children from feeding experiments performed on animals?
10. The interrelation of right food, exercise, fresh air, and rest.
11. What about eating between meals?
12. Shall children share the family meal?
13. Plan a week's meals for your family, considering the needs of each member and arranging the meals as far as possible so that most of the food may be eaten by all.

REFERENCES

Abbott, E. H. On the Training of Parents. Houghton, Mifflin & Co., Boston, Mass.

Brown, D. R. The Baby, a Book for Mothers and Nurses. Whitcomb & Barrows, Boston, Mass.

Cotton, A. C. Care of Children. American School of Home Economics, Chicago, Ill.

Griffith, J. P. C. The Care of the Baby. W. B. Saunders & Co., New York.

Hall, G. S. Youth. D. Appleton & Co., New York.

Holt, E. L. The Care and Feeding of Children. D. Appleton & Co., New York.

Hunt, Caroline E. Daily Meals of School Children. United States Government Bulletin, Bureau of Publications, U. S. Department of Agriculture, Washington, D. C.

Kirkpatrick, E. A. Fundamentals of Child Study. The Macmillan Company, New York.

Latimer, C. W. Girl and Woman. D. Appleton & Co., New York.

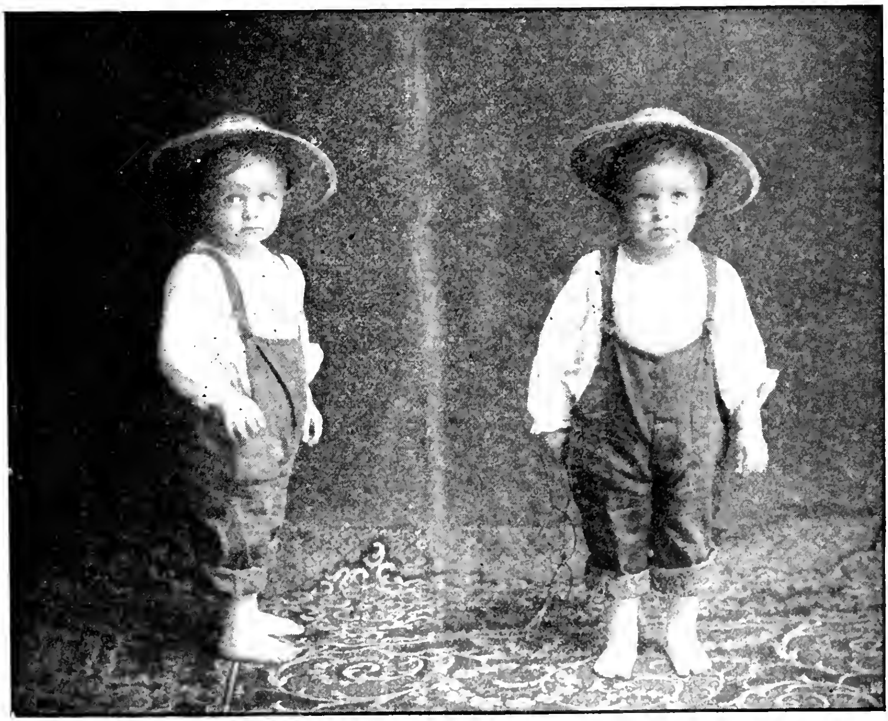
Mitchell, Margaret. Fireless Cooker Cook-Book. Doubleday, Page & Co., New York.

Morley, Margaret. Renewal of Life. A. C. McClurg & Co., New York.

Oppenheim, Nathan. Development of the Child. The Macmillan Company, New York.

Saleeby, C. W. Health, Strength and Happiness. Mitchell Kennerly, 2 East 29th St., New York.
Saleeby, C. W. Parenthood and Race Culture. Moffatt, Yard & Co., New York.
Shearer, W. J. The Management and Training of Children. The Macmillan Company, New York.
Starr, Louis. Diseases of Digestive Organs of Children. P. Blakiston's Sons, Philadelphia, Pa.
Starr, Louis. Hygiene of the Nursery. P. Blakiston's Sons, Philadelphia, Pa.
Washburne, M. F. Study of Child Life. American School of Home Economics, Chicago, Ill.
Yale, L. M., and Pollak, Gustav. The Century Book for Mothers. The Century Company, New York.
Bulletin on The Production of Sanitary Milk. State of New York, Department of Agriculture.
Bulletin 95. Experiments in Pig Feeding. Pennsylvania State College Agricultural Experiment Station.
Bulletin 213. Specific Effects of Rations on the Development of Swine. Ohio Agricultural Experiment Station, Wooster, Ohio.
Bulletin, October, 1909. Reduction of Infant Mortality. New York State Department of Health.
Farmers' Bulletins:
No. 363. The Use of Milk as a Food. R. D. Milner
42. Facts about Milk. R. A. Pearson.
74. Milk as Food.
63. Care of Milk on the Farm. R. A. Pearson.
413. The Care of Milk and Its Use in the Home. George M. Whittaker, L. A. Rogers, Caroline L. Hunt.
346. The Computation of Rations for Farm Animals by the Use of Energy Values. Henry Prentiss Armsby.
309. Bacteria in Cream.
348. Bacteria in Milk. L. A. Rogers.
Circular 117. A City Milk and Cream Contest as a Practical Method of Improving the Milk Supply. L. B. Lane, Ivan C. Weld, U. S. Department of Agriculture.
Abbott, Lyman. The Profession of Motherhood. The Outlook, April 10, 1910.
Addams, Geo. S. Children. The Survey, June, 1911.
Aikens, Charlotte A. Lunches for Travelers and School Children. Boston Cooking School Magazine, September, 1909.
Briscoe, Margaret Sutton. The Hospitalized Child. Good Housekeeping, November, 1910.

Brueie, Rob. W. Saving the Babies. The Survey, November 26, 1910.
B. S. B. The Training of Our Baby. Good Housekeeping, January, 1910.
Chambers, Mary D. Diet in Childhood, Sickness and Old Age. Boston Cooking School Magazine, January-April, 1908.
Greer, Edith. What Children Should Eat. Human Welfare Publication, Southwest Harbor, Me.
Stewart, Gwendolyn. Diet in Relation to Growth. Journal of Home Economics, February, 1911.
Taylor, John Madison. Children of Feeble Resistance. Home Science Magazine, February, 1904.
Washburn, Marion Foster. The Children's Diet. Good Housekeeping, September, 1908.
.... Weaning Bottle-Fed Babies. American Housekeeper, August, 1911.
Williams, Mrs. Mary E. Infant Feeding. Journal of Home Economics, April, 1911.



SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published Semi-monthly by the New York State College of Agriculture at Cornell University Throughout the Year. Application for Entry as Second-Class Matter at the Post-Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME { MARTHA VAN RENSSELAER, *Supervisor*; MRS. IDA S. HARRINGTON, *Assistant Supervisor* }

VOL. 1. No. 3 — ITHACA, N. Y. NOVEMBER 1, 1911 — FOOD SERIES No. 2

THE CARE AND FEEDING OF CHILDREN.—PART II

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist in your study of scientific home-making. We want your assistance as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the work of the State College in its efforts for rural progress.

Will you please send your opinions on the following points to the Supervisor of The Cornell Reading-Course for the Farm Home?

1. Discuss the ways for making simple foods attractive to children.

2. What causes a child to eat between meals and how may the habit be broken?

3 Plan a week's meals for your family, considering the needs of each member and arranging the meals as far as possible so that most of the food may be eaten by all.

Name ....

Address ....

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. Bailey, *Director*

Course for the Farm Home { Martha Van Rensselaer, *Supervisor*
Mrs. Ida S. Harrington, *Assistant Supervisor*

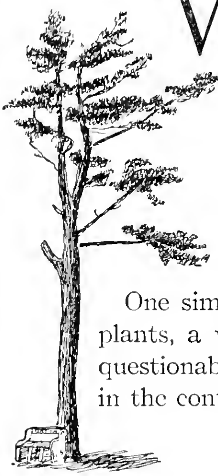
VOL. 1. No. 5 — ITHACA, N. Y. DECEMBER 1, 1911 — FARM HOUSE SERIES No. 1

HOUSEHOLD DECORATION

Introduction by

Martha Van Rensselaer

"*Come forth into the light of things, let nature be your teacher.*"—Wordsworth.
"*To make work happy and rest fruitful is the aim of art.*"—William Morris.



WE may not understand the principles of art and yet be possessed of artistic temperament or capable of artistic training. We may hold the erroneous idea that to be artistic one must express this quality by painting a picture. Every one may express an artistic temperament either in dress, in house furnishings, or even in the arrangement of flowers in a vase. This is the adaptation of the artistic sense to life itself, which is the best aim in education.

One simple and effective standard is nature itself. A pot of plants, a vase of flowers, effectively placed is worth all of the questionable ornament that can be supplied. Life has zest simply in the contemplation of these simple forms of art.

The following little anecdote carries a great meaning: "'Mary, come out, the violets are in bloom.' 'No, I cannot, I am housecleaning.' 'Dirt will keep, but violets won't.'

"She went."

Longfellow's advice to Mary Anderson, who became a great artist, was to study each day a beautiful picture, read a beautiful poem, hear a piece of fine music, or observe a bit of natural scenery. This is good advice to the worker in any field, for every day in which this is done is less spiritless and more worth while.

Every human being is responsible for making his own part of the world as beautiful as possible — by causing a flower to bloom where none had bloomed before, by ridding a doorway of unsightly weeds, by painting a weather-beaten surface of the house, by hanging a picture that will mean something in the life of the observer. This desire to beautify seems to be common to mankind; the person who has not this inclination may have become too absorbed in arduous duties to allow it to develop.

FIG. 1.— *Nature an effective standard in decoration*

It is not enough that houses be merely built; after they are built they should be made homelike by means of serviceable furniture and purposeful decoration. The taste and knack of the housewife may make even the commonest home attractive and restful. All women cannot be artists. They may never have used the brush and pencil, but every day they make a picture; they try to bring their rooms and their furnishings into one harmonious effect. It is a great study, bringing zest to the daily work and adding comfort and refinement to the home. There are principles in decoration that every one can learn, and good results will follow as the housewife studies nature in order to enable her to simplify and elevate her taste and ambitions.

Decoration is not mere ornament; it contributes to the making of a home picture. To produce a picture the artist places on canvas the forms and colors necessary to bring all things into beautiful harmony. In the art of decoration we are constantly producing pictures. The decorator makes use of materials to produce effects as truly as does the painter, but in a different way. The artist with brush works upon canvas not merely to show certain paints. The housewife who adorns her home works for general effects, although attention may be centered on some particular object that is emphasized by a pleasing relation to its surroundings.

Simplicity an important principle in decoration.— Comfort and good taste are excellent motives in decoration. The first law of good taste is simplicity. Two kinds of flowers do not grow on the same stem, although we are sometimes guilty of placing a conglomerate mixture of flowers in one vase.

The Japanese teach us lessons in simplicity of decoration. Their suggestions should do away with complex mingling of materials and arrangement. They do not display articles on their walls for mere ornament, but place them in cabinets to show to their friends as a matter of interest. Their homes are not over-decorated in order to show off bric-a-brac.

In seeking materials with which to decorate, combine utility and beauty if possible. This makes the most attractive decoration. " Be its beauty its sole duty " is not always sufficient.

HOUSEHOLD DECORATION

HELEN BINKERD YOUNG

The problem of home decoration is always with us. In the absence of such advice as good decorators might give on this subject, the average woman is thrown on her own resources, solving her problems by sentiment rather than by reason. This brings many failures and few successes; for preferences, to be safe and practicable, should be based on wise and reasonable principles. This bulletin aims to review these principles.

Unity of effect.— Broadly speaking, a simple, united effect is the first quality to be desired for interiors. This is true whether the interior be one room or several connecting rooms through which vistas are seen. All parts of the home picture should harmonize so as to produce one sustained impression. As we enter a room, we should seem to be infolded in an atmosphere of cheer, comfort, repose, and freedom. No single object nor surface should intrude itself on our immediate notice; later, when we have sunk contentedly into the spirit of the place, we may notice at leisure the various objects and ideas that have united to give us this pleasing impression. In a similar way persons impress us as being charming, cordial, earnest; later we notice that they have fine eyes, soft hair, and other attractive features.

This spirit of the interior of the house is as vital as the spirit of a person.

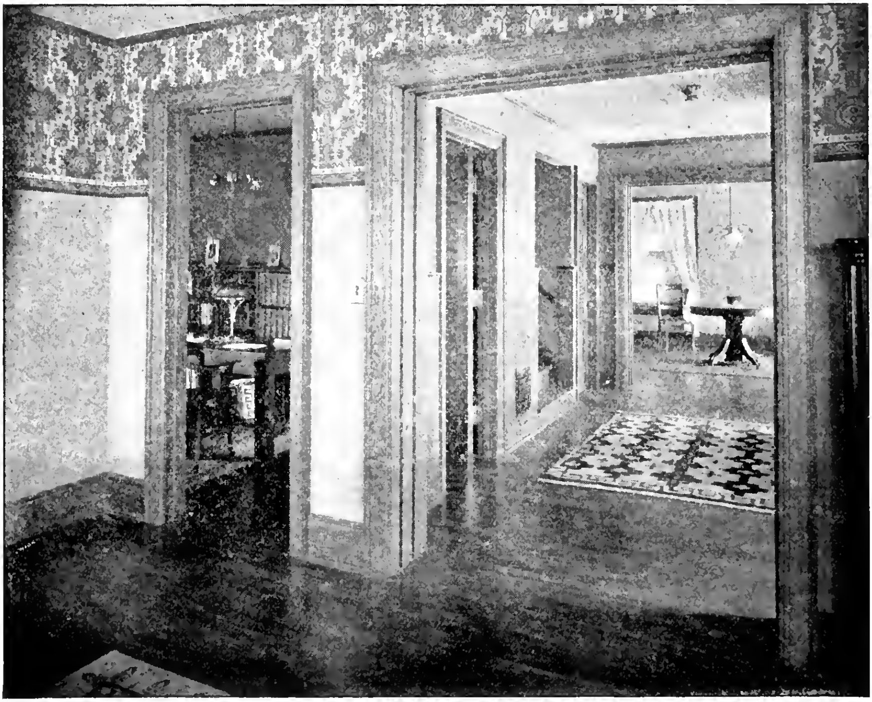


FIG. 2.—"*A simple united effect is the first quality to be desired for interiors*"

It must be a simple, sterling expression of the life within; otherwise it is a mere chaos of wood and textile. Says Lowell:

> " Roots, wood, bark and leaves, singly perfect may be,
> But clapt hodge-podge together, they don't make a tree."

THE WALLS

Since the walls, ceiling, and floor of a room present greater surface than any of the furnishings, they require first attention. It is chiefly on the walls that we must rely for uniting our whole interior scheme, for they serve as a common background for furnishings and persons. Moreover, they define the outermost limits of the interior and should be covered in such a way as to hold their place. For this reason we must avoid the use of bright colors and showy patterns; these have no place in the modest home. Bright or gayly papered walls have a way of crowding into a room and clamoring for notice. We must remember that it is never the intent of decoration to be conspicuous or exciting. The home should be a place of rest. There is small encouragement for relaxation in the sight of walls flaring with color, writhing with scrolls, or peering with spots. Discarding these two things, then, we have left for use all sorts of quiet colors and modest patterns. Let us discuss these subjects of color and pattern thoroughly in order that we may be armed with knowledge as well as with preferences.

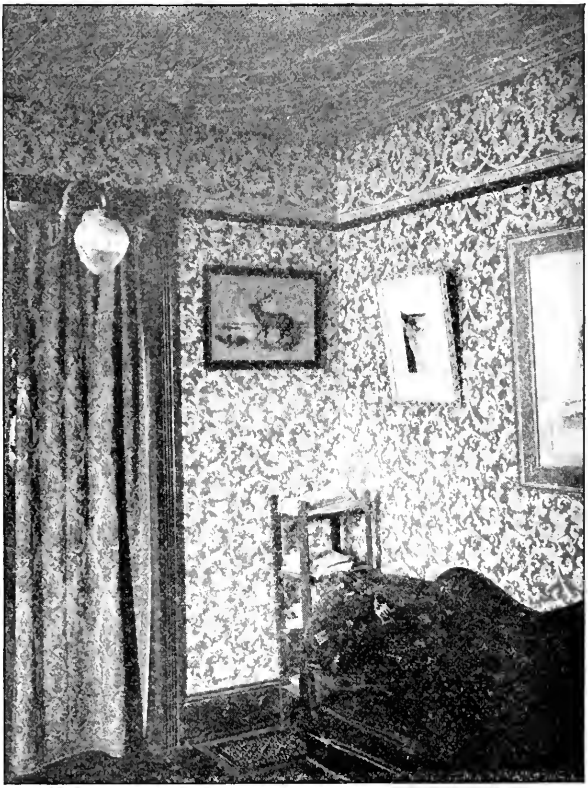


FIG. 3.—"*Gayly papered walls have a way of crowding into a room and clamoring for notice. There is small encouragement for relaxation in the sight of walls writhing with scrolls*"

Color.—For the purposes in hand, we may say that (with the exception of black and white) there exist only three colors that cannot be formed by combinations of other colors. These are red, yellow, and blue, and are commonly called the primary colors. Many color experiments have been tried on folks, sick and well; and while yellow proves merely cheering and sunny, colors that are strongly red have been found to be somewhat exciting, and those that are strongly blue to be somewhat depressing.

Therefore, if we are to have restful homes we must avoid using large quantities of colors that are strongly red or blue, for these demand of us too much nervous energy. Consciously or otherwise we react to their influence, and sensitive women have been known to pay the price of one headache a week for a red wall paper. We confess to this color influence ourselves in such expressions as "red with anger" and "having the blues."

Compare these mental states with the calm mood expressed by the words "in a brown study." Why is brown calm? Because it is a mixture of red, yellow, and blue, in which each color subdues the intensity of the others. It is by mixing these three bright colors that all our soft, livable colors are produced; if mixed in equal proportions we get a gray, which all agree is a color that "goes with everything." We now see why this is true: because gray contains all the colors that exist, it will harmonize with each in turn. If to this gray mixture an excess of red and yellow in varying proportions is added, all sorts of soft reds, tans, and browns are produced; if an excess of blue and yellow in varying proportions is added, soft gray-blues and greens are produced.

These soft colors are called "tones." By covering our walls with soft colors, or tones, we may unite into one harmonious effect the red of mahogany, the brown of walnut, the various shades of oak, and other motley colors present in mixed furnishings. This is an important problem in the average home.

The color influence of nature.— Natural surroundings greatly influence the color sense. In our climate nature moves in great shifting masses of greens and browns, according to leafy or leafless seasons. For this reason it will be found that interior color effects in various shades of green and brown are likely to be pleasing and restful to folks in general. Not that these are the only colors that may be successfully used; but it is a comfort to know that for almost any room in question some shade that will be safe and attractive may be found within the wide range of greens and browns.

Our reference to "warm colors" and "cool colors" also comes from our contact with nature. Warm colors we associate with blaze, heat, and sunlight; cool colors with leafy shadows, blue sky, ice, and distant hills. "Green as grass" is a frequent term of comparison; yet observe that grass is not so green when compared with a green wall paper. The trouble is that we are not keen enough observers: we imagine Nature cruder than she is. So if we attempt to outwit her by using paper that is greener than grass she responds by fading it until it is fit to live with. Depend upon it, all bright colors in inexpensive materials are likely to fade. One should reckon with this in mind, for fast dyes are expensive and are used chiefly for coloring expensive stuffs. Greens and blues are especially treacherous, because, roughly speaking, colors tend to fade toward the yellow. Hence buffs, tans, and browns are usually more permanent.

If we stand off and look at a summer landscape we notice that, broadly speaking, the great masses of leaves, grass, and grain, broken as they are by sunlight and shadow and softened by atmosphere, are only tones after all; and that brilliant colors are reserved for bits of accent or fleeting effects, as a bluebell, a yellow daisy, an orange sunset, or an autumn maple. These conditions in nature, if applied to our subject of home decoration, would suggest soft colors for all large surfaces as wall, ceiling, floor, and hangings, with accents of bright color in pictures, books, lamp-shades, and other small objects, as Nature uses her flowers. This furnishes a sparkling play of color over the interior and enlivens the scene.

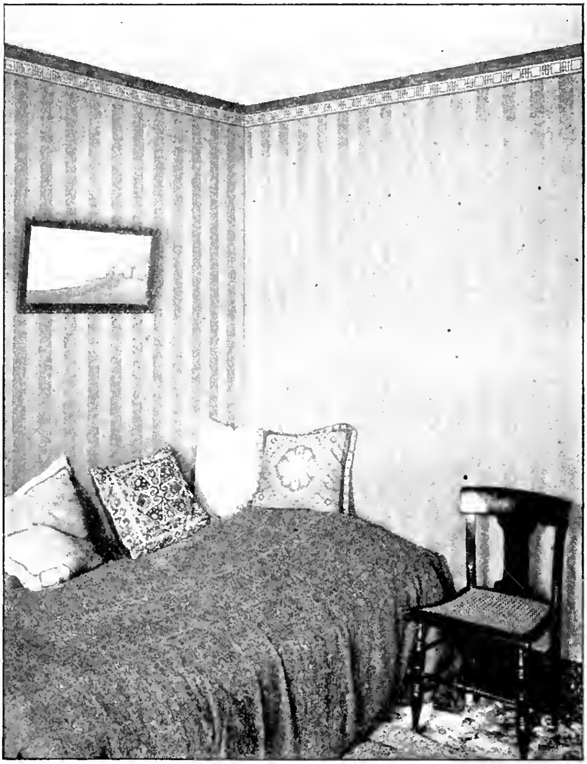


FIG. 4.—*An harmonious corner in a north room. Walls and furnishings in soft browns and tans, with bits of color furnished in pillows and picture*

Figures and patterns for walls.— Since a wall is a flat surface, designs should be flatly represented so as to lie tight to the wall. They should in general represent only two dimensions, length and breadth, not thickness. All shaded moldings or designs of any kind that imitate rounded forms are false in principle. A natural rose or an actual grape vine crawling through an actual trellis is not good decoration. A floral wall paper should suggest to us the idea of a rose or other growth adapted to use on a flat surface — not a confusion of lifelike flowers bulging from the wall.

Only in pictures and in statuary is actual representation good art. Even then it should not be so realistic in detail that we can see every wrinkle in a face or read the labels on all the books in the picture. Good art, in both pictures and decoration, must leave something to the imagination. Natural forms should be somewhat conventionalized before they are good decoration. "Conventionalized" means simplified in form or color and applied to some definite orderly arrangement. All geometric all-over patterns, or conventional flower designs in two or three tones of the same color or two harmonious colors, are likely to be good. An all-over pattern that connects or interlaces is more pleasing than one composed of separate spots.

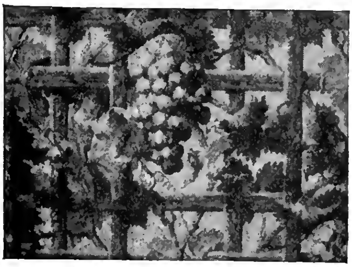


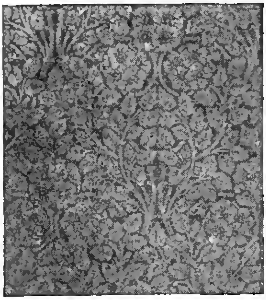
FIG. 5.—*A natural rose or actual grape vine with actual trellis is not good decoration*

Most scroll patterns are frivolous and meaningless and are likely to be bad. Large medallion or shield-shaped spots with scrolly outline are a very common type of distressing pattern. Figures of a pattern should be not too far apart, else we are continually surprised at each repetition and never get used to the idea. About seventy-five per cent of figured wall papers are on the wrong principle; therefore, when in doubt about a pattern, choose a plain one. Avoid selecting patterns that, viewed from a distance, suggest queer faces, human shapes, or other absurdities. If a pattern suggests an odd resemblance once it is likely to do so again, and one cannot consider it a dignified wall covering.

These principles of pattern apply also to rugs, upholstery, curtains, and other flat surface designs.

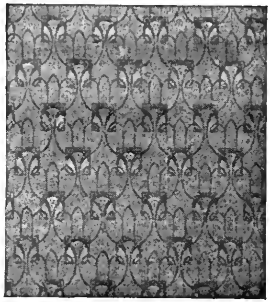
HOW TO PROCEED WITH DECORATING THE WALLS

Before deciding on the decoration for any particular room, one must first size up the situation. The paper hanger is not the person who can best decide whether your walls shall be this color or that, light or dark, plain or figured, for these things depend upon home conditions that he knows nothing about. The home-maker knows, as the decorator cannot know, for what the room is used, whether it is naturally light or dark, sunny or sunless, high or low, large or small, and what colors are present in woodwork, floor, and furnishings. These are the considerations that should influence interior decoration, for obviously if a room has any nat-



Two shades of green

Dull blue and gray

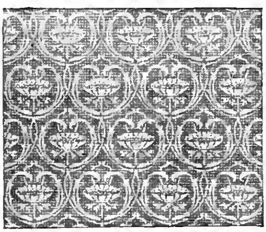


Two shades of greenish gray

FIG. 6.—*Three good all-over patterns in two or three harmonious tones*

ural deficiencies in proportion, light, or harmony of furnishing, such faults should be overcome if possible in the decoration. It is the same principle that influences personal dressing: the tall woman chooses such styles of clothing as make her appear shorter, the short woman tries to look a little taller, the stout woman to look a little thinner, and the thin woman to look a little stouter. A ready-made suit will fit tolerably well a woman of average height and weight, but will not exactly fit any of the four above-mentioned types.

This is precisely the weak point of fads and novelties in decoration: they are ideas for the average case that cannot in the very nature of things take account of differing conditions. Common sense and reliance on a few sound principles are surer guides than "the latest thing." Growing tired of a wall covering is nearly always an admission that it is designed on a wrong principle. Moreover, if we wish really to be economic we should use wall coverings that will stand the test of satisfaction for a long period of time. Except for the sake of cleanliness, there is hardly more sense in changing the wall paper every year than there would be in remov-



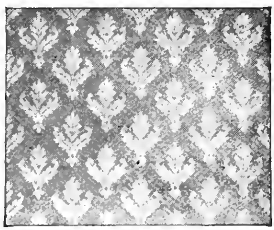


FIG. 7.—*An all-over pattern that connects is more pleasing than one composed of separate spots*

ing the woodwork or changing the floors. Wall decoration would be undertaken more cautiously if viewed in the light of a fixed part or element of the house.

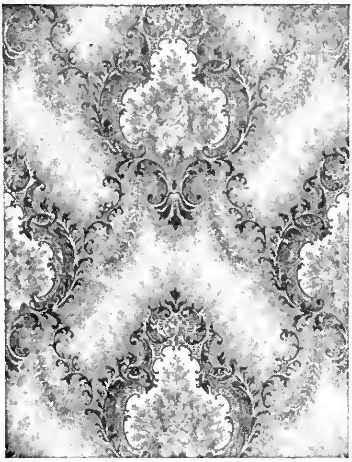


FIG. 8.—*"Large medallion or shield-shaped spots with scrolly outline are a common type of distressing pattern"*

The use of the room.—In all family living-rooms of whatever sort we are likely to have various tastes, ages, and moods to satisfy. Only an unobtrusive wall covering is appropriate here; for a paper the color and pattern of which strike our fancy when we are fresh and rested may oppress us when we are tired. If one intends to cover walls with paper, it is a good plan to bring home rolls of several selections and look at them in their proper setting and in various moods. One may thus test their effect before buying. The color schemes of adjoining rooms through which vistas are seen need not be identical, but must harmonize in order to produce an effect of spaciousness. It is very jarring to look from a yellow room into a blue room on the one hand and a green one on the other. The color scheme is thus broken into several small divisions and unity of effect is destroyed.

FIG. 9.—*A fussy bedroom paper that would become tiresome*

The passing whims of fashion or of the paper hanger should not be inflicted on all the members of the family. Decided color preferences and a taste for novelty effects should be reserved for one's own bedroom, where they need offend no one.

Light or dark walls.—Outdoors a flood of light from all directions permeates everywhere. Indoors we have artificial conditions of light, due to the fact that light enters a room from the side only, and usually from but one or two directions; also, because a room is box-shaped, we have reflected light as well as direct light. The ceiling especially acts as a reflector of light. For this reason it usually should be kept light colored, unless the interior already has too many windows, when by making the ceiling darker we may absorb some of the glare. The walls also reflect one upon another, thus using the light twice. Because of this reflection, light-colored walls will look lighter and bright-colored walls will look brighter than the actual color applied. No room nor interior need appear dark if the daylight that enters it is utilized to its fullest capacity; cream or yellowish walls with white woodwork and ceiling and a moderately light floor covering will, by reflection, illuminate the darkest interior. Just how light or dark the walls of a given room should be depends on the quantity of daylight that enters. Avoid dark color schemes unless the room already has too much daylight. Dark colors, especially blues and greens, absorb much light, both by day and by night. This makes the evening lights inefficient and expensive. Rooms with gloomy corners present veritable wells of darkness unless a color scheme is used that will reflect light into the dark spots.

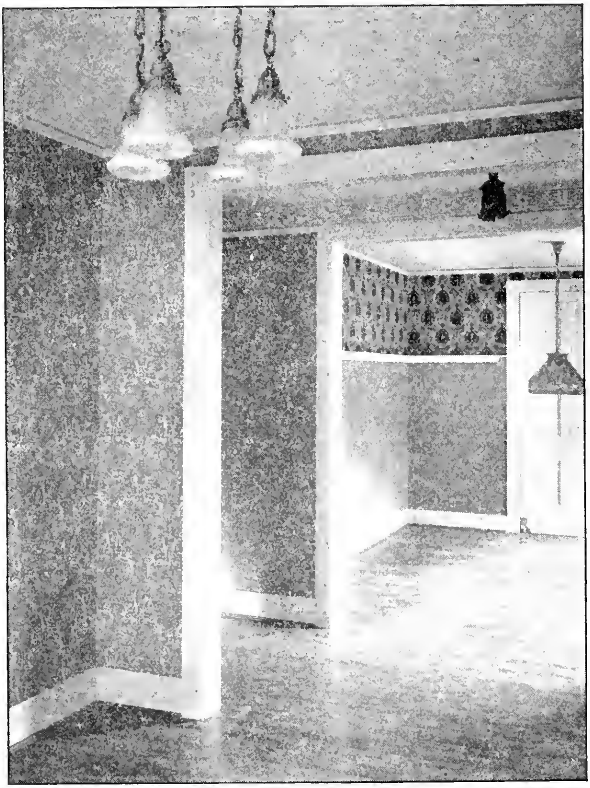


FIG. 10.—"*Color schemes of adjoining rooms through which vistas are seen must harmonize so as to produce an effect of spaciousness.*"
The above interior has natural oak brown floors, buff and greenish pattern paper in foreground, with plain buff beyond, except for the staring upper third in farther room, which shows a badly designed paper

The present tendency, perhaps, is too much toward dark interiors. Modern building and the laws of health now provide more windows than formerly; then the decorator turns around and appropriates all the light we have purposely admitted. Dark interiors prevent the easy discovery of dust and dirt, and thus harbor germs and disease. A moderately light interior looks cleaner than a dark one and encourages better care.

How to decide color of walls for a particular room.— As before mentioned, a room usually receives light from only one or two directions. This affects greatly the color scheme for that room. A north room lacks sunlight, and therefore needs yellow or some other warm color in order to produce a balanced impression of light. A south room is filled with yellow light and therefore needs to be tempered by cool or moderately dark colors. Hence it is safe to say that all rooms, whether living-rooms or bedrooms, which are northerly (north, northeast, or northwest) look their best when the walls are of some warm color, as yellow, tan, buff, golden brown, reddish brown, old rose, or terra cotta, provided the furnishings harmonize with these suggestions. Beware of blue and green for northerly rooms.

FIG 11.—*Corner of a bedroom which was naturally gloomy. Decorated with grayish green "Sanitas" on walls, cream-white ceiling and cream-white painted woodwork. Floors of wide boards, painted golden brown, with hard floor finish; old furniture painted apple green; cream scrim curtains at window*

Rooms that are southerly (south, southwest, southeast) look their best in cool tones, such as cool tans or buffs, dull browns and greens, grays and gray blues, and lavender (with gray or white for bedroom), provided the furnishings harmonize with these suggestions. Beware of colors containing much red or yellow for southerly rooms, unless there is but one window.

Rooms that are east or west allow of a wide choice of color, as they are both sunny and sunless according to the different times of the day.

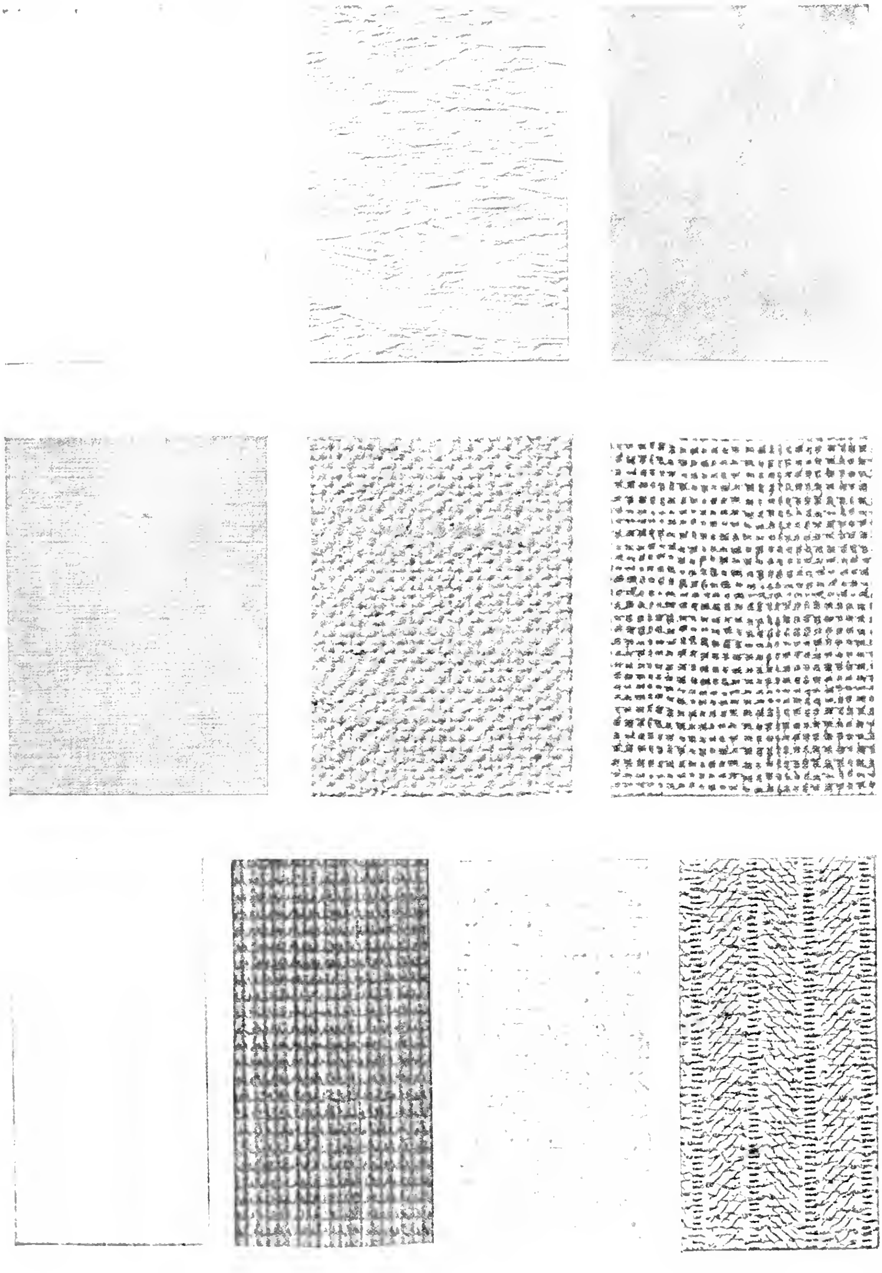


FIG. 12.—*A few good tones that may safely be used as wall coverings either in calcimine, paint, paper, or textile.*

Three samples showing difference in texture. These greens would be almost sure to fade.

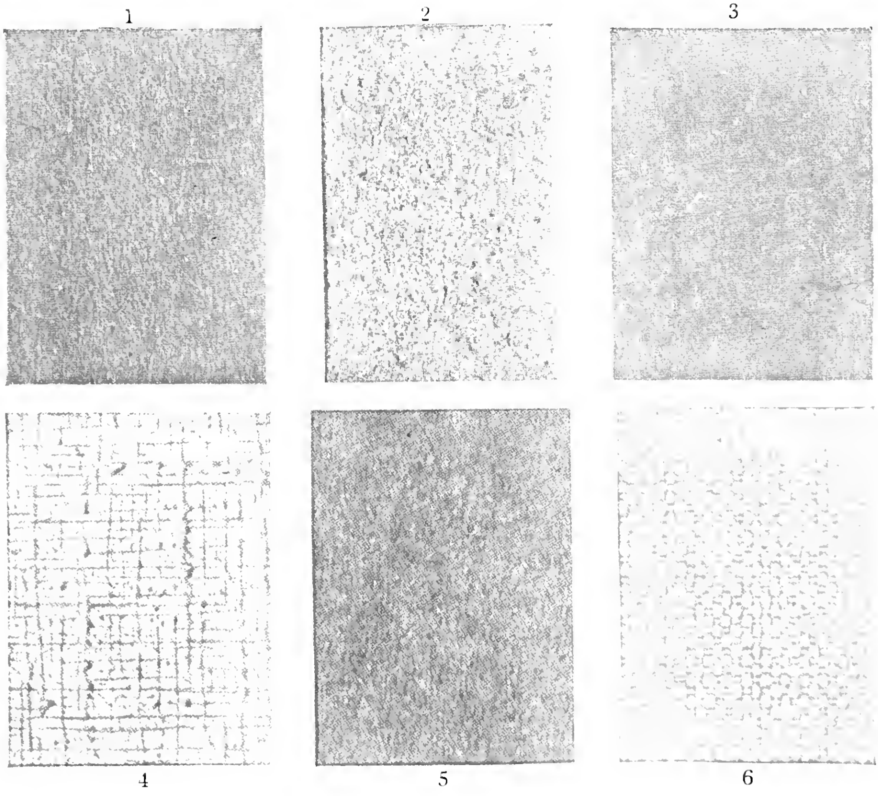


FIG. 13.—*A few colors that should not be used for wall covering. Nos. 1, 2 and 3 are too bright and would fade; No. 4 is raw; No. 5 is too dark; No. 6 is a "nerve-racker."*

The amount of daylight, the amount of sunlight, and the furnishings and woodwork in the room should guide aright our selection of color.

Plain or figured paper.— To most persons plain walls are less tiring than even a good figured paper. They also make the best background for pictures, as they do not compete with them in interest. Pictures may be used, however, with most modest, quiet patterns, but in the case of a fine large design they should be omitted. This would occur only in a large room, when the design may be beautified by using it in panels with

Fig. 14.—*For living-rooms, plain walls furnish the best background*

plain colored border. A small room looks its largest with plain, light-colored walls.

Striped papers are good in principle, since they repeat and emphasize the vertical dimension of the wall. For this reason they can be relied on to give height to a low room. The contrast between the stripes should not be pronounced, and in the case of large rooms alone may broad stripes be used. A quiet striped paper adds a charming dignity to a room.

The majority of persons prefer plain walls for the rooms that are used the most, yet still have a hankering for a figured paper somewhere. The hall is usually a safe place for indulgence, since in the absence of furniture and pictures a well-selected pattern seems to furnish the place without getting in anybody's way.

Borders, friezes, picture moldings, etc.— The joint between ceiling color and side wall is usually covered by a molding, and may be further accented by a decorative band or border, which greatly relieves otherwise plain walls. The reason for the frequent omission of borders in decoration lately is not because the principle is wrong, but because most borders are so poor in design. A simple stenciled border, or a band of color cut from striped or plain paper and used as a border on plain tinted or papered walls, makes them more interesting and gives a more finished appearance. In a low room this border would be merely a narrow band placed against the picture molding that is fastened in the angle between ceiling and wall, in order to avoid breaking up the height of the room.

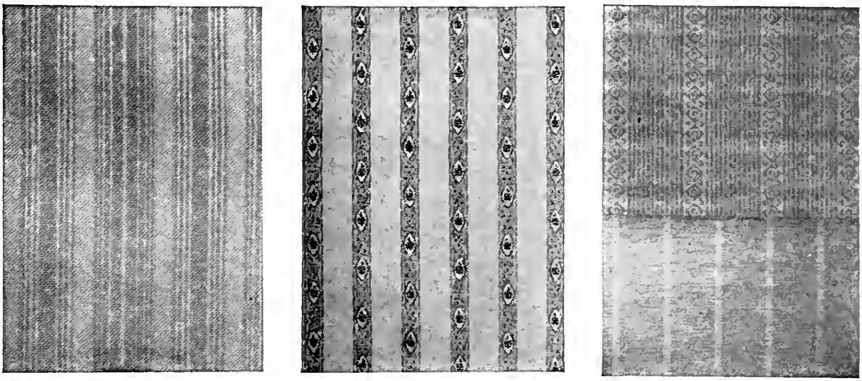


FIG. 15.—*Good striped papers*

Borders representing a continuous scene are often good if not too realistic. Combinations of plain wall in the lower two thirds or three fourths of the room and figured wall above are good, if the room is high enough to be thus divided. The plain wall thus answers as a background for pictures and furnishings, while the figured paper is in reality a very deep border or frieze and occurs high in the room where it does not conflict with the furnishings. Foliage papers, soft in color and indefinite in design, are excellent used in this way or used with wood paneling below.

Ceiling color carried down on to the side walls and finished with molding and border makes a high room look lower. Picture moldings in this case should line with tops of doors or windows.

What to use for plain walls.— In old houses in which the plaster is uneven, plain walls are often impracticable as they show up all imperfections. Loose places in an otherwise good wall may often be kept intact by applying unbleached muslin or a canvas with prepared back, or a manufactured oilcloth that has a dull plain surface, or even a tough grade of ingrain paper. Ingrain or cartridge papers come in many soft colors and possess a nice texture, due to what seem to be little hairy flecks of color. It is this quality of texture that gives burlap, linen, grass cloth, and matting their charm, although the dust-catching qualities of these uneven surfaces are a great drawback to the practical and cleanly housewife. Unbleached muslin on walls may be finished by painting with either water or oil paints. Muslin or canvas applied to a loose ceiling, under wood strips that are screwed on, can be relied on as a good-looking and permanent "fix," and for homes this is much to be preferred to the crudity of a metal ceiling.

Water color paints, tints, or calcimines of whatever brand should be a great blessing to the farmer's wife, for they are inexpensive and readily applied by members of the family. They are especially good for bedrooms, being clean, soft colored, and easily freshened by a new coat. Darker tones than were used formerly are made now, so that water paints are also suitable for living-rooms. Any desired shade may be obtained by mixing two colors of the same brand. Try a sample first and let the paint dry. When the right shade is obtained, mix bulk enough to complete the job in hand. Keep a note of the exact proportion of each color used in the mixture, for reference in case you or a friend ever desire to match that particular shade.

One can sometimes apply calcimine over an old wall paper if it is in good condition, plain colored, or of an inconspicuous pattern. Red spots or stripes in paper cannot be obliterated, but will strike through the paint. One cannot safely apply paper over calcimine, however, since calcimine, or water paint called by whatever name, is a mixture of plaster of paris and ground color, which when applied in liquid condition leaves a thin

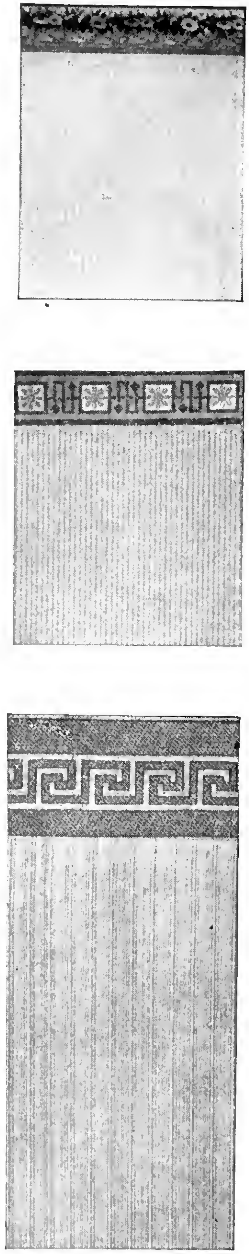


FIG. 16.—*A decorative band or border greatly relieves plain walls*

FIG. 17.—*Foliage papers, soft in color and indefinite in design*

coat of plaster on the wall. Paper applied to such a wall adheres merely to this skim of plaster and soon the whole thing is likely to strip off. It is well to remember, then, that after using calcimine the unpleasant process of washing down the walls must precede papering. New walls should be sized before tinting or papering.

FIG. 18.—*Light tan design on brownish background. Suitable for a hall*

In the case of kitchens, pantries, and bathrooms the chief considerations are cleanliness and ease of care. For this reason, a smooth, hard surface that can be washed over is best for walls, ceiling, woodwork, and floors. Clean, light-colored paint, with varnish in the last coat, is first class for walls, ceiling, and woodwork. Wooden wainscoting, even at its best objectionable in kitchens, pantries, and bathrooms, should be painted a light color rather than varnished over the natural wood, which when splashed or scratched shows white marks. A dark pantry will be improved in looks and ease of care by painting cream, yellow, or white. Include the shelves in the painting process, and afterward omit shelf paper.

Instead of paint, the walls may be covered with a kind of oilcloth or varnished tile paper, either of which is clean and lasting.

Oil paint with dull finish is equally excellent for bedrooms and other parts of the house, but is more expensive than either calcimine or medium grade wall paper.

FLOORS

The adoption of rugs in place of carpets is often delayed by lack of knowledge as to how to treat the old floors. If an old floor is good, heavy, and not too uneven by warping or otherwise, it may be made presentable. Fill the cracks between the boards, the nail holes, and other open spaces with some good brand of crack filler; then when completely hardened, paint the floor with two coats of oil paint, allowing it to dry thoroughly between coats. Then apply a coat of a good brand of "hard floor finish." This is a special form of varnish adapted to use on floors; it does not heel-mark, can be wiped with a damp cloth, and lasts longer between applications than either wax or ordinary varnish finish. Keep the floor moderately light in color. A golden brown is excellent (provided it harmonizes with the furnishings), as it does not show dust or footprints readily. For this color use yellow ochre paint and a natural or medium dark oak floor finish. This light brown floor goes well with painted woodwork.

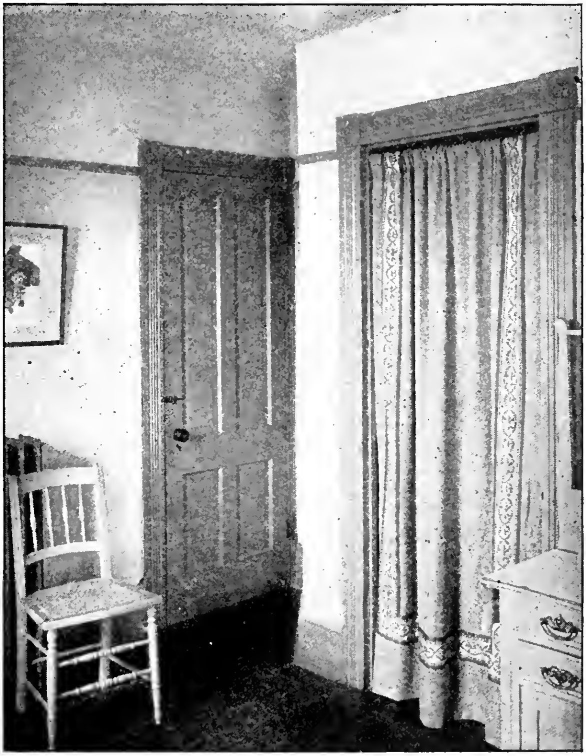


FIG. 19.—*Plain walls for restfulness. A home-made room. Woodwork painted gray-green, furniture painted lighter shade of same, walls finished with grayish green Alabastine over old cartridge paper*

If when the carpet is removed an old floor is found to be badly warped, uneven, and with wide cracks, it is better to cover it again until a new floor can be afforded to take its place. Japanese straw matting in the natural buff color laid over a paper lining is excellent for this purpose. It is finely woven, inexpensive, smooth in surface, and easy to care for. A carpet sweeper or a soft cloth on a broom keeps it in good condition; but of course like carpet this must be taken up occasionally, as some dirt sifts through. Matting should be sewed together and the reversible kind should be used. Chinese mattings that are cheaper, but less durable, are not so artistic in effect. Many persons object to the odor of straw matting on damp days. There seems to be no remedy for this. Perhaps we are overnice, for a hayfield or wet sod we call fragrant. The odor is clean and temporary; sun, air, or an open fire will remove it.

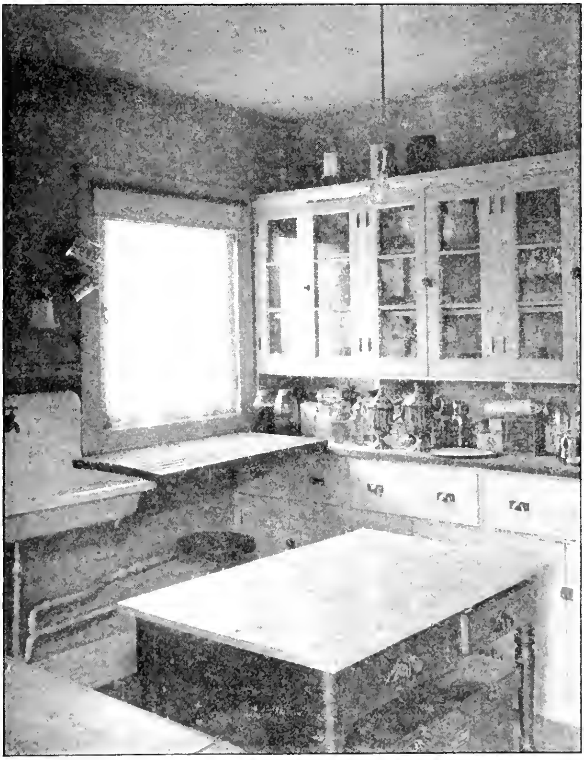


FIG. 20.—*A sanitary kitchen. Ceiling, walls, cabinet, and woodwork all painted deep cream color with varnish in last coat. All surfaces can be easily washed. Notice absence of grooves and moldings in woodwork*

When one can afford it a new hard floor can be laid over the old floor, the uneven surfaces having been previously subdued by planing. Flooring strips one half inch or less in thickness are available for covering over old floors, or wood carpeting may be used over a fairly smooth floor. The latter is sometimes cheaper. Yellow pine is the cheapest of the usual floorings; plain oak and maple are more expensive, being denser woods. These floorings should be filled and either waxed or finished with a hard floor finish. The color may also be regulated by adding a little stain to the filler. However, care should be taken not to get the color too dark, as is commonly done. Most "mission" or dark finishes are too dark, preventing the grain of the wood from being luminous and clearly seen, and rubbing off in light spots where the wear is greatest.

For kitchen and bathroom floors. — If an uncovered wood floor is desired, maple will be found to give the best results, since it is very dense. This should be finished by saturating with linseed oil, then wiped thoroughly. This treatment will protect the wood and keep it from absorbing grease spots or from raising the grain when wiped with a wet cloth.

Granite or inlaid linoleum of a quiet geometric pattern is a good floor covering for kitchen and bathroom. The surface may be varnished or painted with hard floor finish to prevent absorbing dirt and grease, and may then be washed.

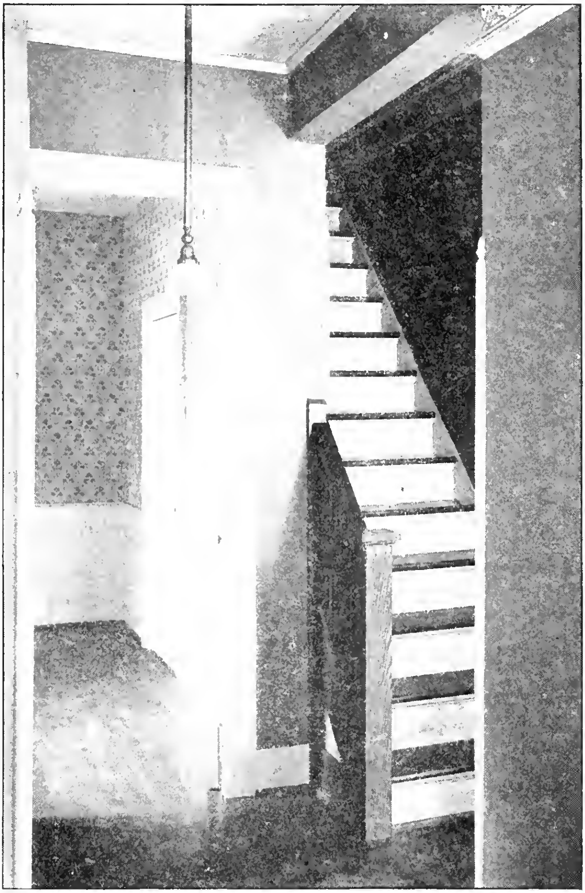


FIG. 21.—*An old interior remodeled. Woodwork painted white. New oak floors laid over old pine ones. Farther room was formerly an old kitchen, now a bedroom, with white wainscot and a quaint wall paper in green tones*

WOODWORK

In most houses that have been built for a number of years, the woodwork is painted white, or rather cream. This is excellent, and one never tires of it if the walls are kept light enough in color scheme. In many of the newest and best-designed houses the woodwork is white throughout. Occasionally pearl gray or soft apple green or some other light color makes a pleasing change for one or two rooms, usually bedrooms. Any sort of painting is to be preferred to "graining," which is a sham, since it pretends to be oak or some other wood that it is not. We should express in things only such qualities as we admire in persons: simplicity, honesty, modesty, self-control, and common sense are virtues in both.

Unless woodwork has a grain worth showing, it should be painted rather than stained. Stain is a transparent finish intended for use on woods that are beautifully grained by nature. Woods with grain are usually finished in three steps: filling, staining, and surface finishing. Filler and stain may often be mixed and applied in one coat. Firms that manufacture wood finishes of various kinds show that cypress and ordinary yellow pine may be made very beautiful by using on them the same grayish, greenish, and brownish stains that are ordinarily applied to oak and chestnut. After wood is filled and stained, the surface may be finished with either varnish or wax. The latter is preferable if it is to be applied by members of the family, since it does not require skilled labor.

Both wax and varnish require much rubbing to secure a good result. Wax is rubbed up to a finish, varnish is rubbed down to a finish, with powdered pumice stone and oil. Shiny varnished surfaces are cheap and inartistic, as wood when finished should glow, not shine. There is no short cut to securing a good finish on woodwork; whether painted or stained, waxed or varnished, it takes time, labor, and patience. When well done, however, a good wood finish is very lasting.

The greatest menace to good taste in American homes to-day is the desire to get results quickly. Tawdriness has been the result with us all. Let us no longer decorate in haste only to repent at leisure. The artistic problems of home life must be dreamed over for weeks and months before our decisions are assured. Yet one such result will bring more satisfaction than all previous snap-judgments put together.

Ruskin says in the "Seven Lamps of Architecture:"

"I am no advocate for meanness of private habitation. I would fain introduce into it all magnificence, care, and beauty, where they are possible; but I would not have that useless expense in unnoticed fineries or formalities; cornicing of ceilings and graining of doors, and fringing of curtains, and thousands such; things which have become foolishly and apathetically habitual — things on whose common appliance hang whole trades, to which there never yet belonged the blessing of giving one ray of real pleasure, or becoming of the remotest or most contemptible use — things which cause half the expense of life, and destroy more than half its comfort, manliness, respectability, freshness and facility. I speak from experience: I know what it is to live in a cottage with a deal floor and roof, and a hearth of mica slate; and I know it to be in many respects healthier and happier than living between a Turkey carpet and gilded ceiling, beside a steel grate and polished fender. I do not say that such things have not their place and propriety; but I say this, emphatically, that the tenth part of the expense which is sacrificed in domestic vanities, if not absolutely and meaninglessly lost in domestic discomforts and incumbrances, would, if collectively offered and wisely employed, build a marble church for every town in England; such a church as it should be a joy and a blessing even to pass near in our daily ways and walks, and as it would bring the light into the eyes to see from afar, lifting its fair height above the purple crowd of humble roofs."

A GUIDE TO CLUB STUDY

A. The principles of home decoration.
    1. Unity of effect.
    2. Atmosphere.
    3. Harmony.
    4. Simplicity.

B. How to carry out principles.
    1. Walls.
        Their importance in the scheme of decoration.
        They define limits and act as background.
        Should be quiet and restful.
        Colors.
            Primary colors: red, blue, yellow.
            Their differing effect on people as shown by experiments.
            Nervous strain from being surrounded by glaring colors.
            Soothing influence of softened and subdued colors, called tones.
            How tones made up of several colors unite and harmonize mixed furnishings.
            The color influence of nature.
                Shifting masses of brown and green that nature uses, a good suggestion for interior color scheme.
            Warm and cool colors.
            Crude colors, when used in home decoration, are faded or "toned" by nature.
            Bright colors used in nature only to accent effects.
            This hint as applied to home decoration.
        Figures and patterns for walls.
            Walls, as a flat surface, should represent only length and breadth, not thickness.

- Designs should not bulge.
- Simplified, or conventionalized, designs.
- Good and bad patterns.
- Safety in choosing plain paper.
- Principles of patterns apply to rugs, upholstery, curtains, and other flat surface designs.

What to consider in planning decoration.

- Purpose of a room.
- Whether it is light or dark, sunny or sunless, high or low, large or small.
- What are the colors of woodwork, floor, and furnishings.
- The danger of "the latest thing."
- Permanence in decoration.

Use of room.

- Living rooms should be planned to suit various tastes, ages, and moods.
- Adjoining rooms must harmonize in color.

Light walls or dark?

- Room has artificial conditions of light.
- Reflection from walls and ceiling.
- Exact tone to be used depends on amount of daylight that enters.
- Dark colors to be avoided unless room has too much daylight.
- Expense of artificial light in dark room.
- Dark interiors harbor disease.
- Proper colors for different exposures.

Plain walls or figured?

- Plain wall best for small room, or as a background for pictures.
- Striped papers give height to low room.

Borders, friezes, moldings.

- Simple borders add interest to plain tinted or papered walls.
- Width of border and location of picture molding should depend on height of room.

What to use for plain walls.

- Treatment where plaster is uneven.
- Advantages and disadvantages of burlap, linen, grass cloth, etc.
- Good effects possible with water-color paints, tints, or calcimines.

Kitchens, pantries, bathrooms.

- Necessity of smooth, hard, washable surface and light color.

Paint a better treatment for shelves than shelf paper.
Oilcloth or varnished tile paper as wall coverings.

2. Floors and woodwork.
   Treatment of old floors.
      a. If slightly cracked.
      b. If badly cracked.
   Mattings.
   Flooring strips.
   Wood carpeting.
   Colors and finishes.
   Kitchen and bathroom floors.
   How to make nonabsorbent.
   Treatment of linoleum for best service.
   Woodwork.
   Proper finish depends on grain.
   Time, labor, and patience necessary to achieve lasting effect.

BIBLIOGRAPHY

Bailey, L. H.	The Outlook to nature
Burrage and Bailey	School sanitation and decoration
Crane, Lucy	Art and the formation of taste
Daniels, Fred Hamilton	The furnishing of a modest home
Kellogg, Alice M.	Home furnishing, practical and artistic
Priestman, Mabel Tuke	Art and economy in home decoration
Ruskin, John	Seven lamps of Architecture
Wheeler, Candace	Principles of home decoration

Periodicals

The Craftsman
The House Beautiful
House and Garden

I TEACH

I teach
The earth and soil
To them that toil,
The hill and fen
To common men
That live just here;

The plants that grow,
The winds that blow,
The streams that run
In rain and sun
Throughout the year;

The shop and mart,
The craft and art,
The men to-day,
The part they play
In humble sphere;

And then I lead
Thro' wood and mead
By bench and rod
Out unto God
With love and cheer.
I teach.

L. H. Bailey in the Outlook to Nature

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME { MARTHA VAN RENSSELAER, *Supervisor*
MRS. IDA S. HARRINGTON, *Assistant Supervisor*

VOL I. No. 5 | ITHACA, N. Y. DECEMBER 1, 1911 | FARM HOUSE SERIES No. 1

HOUSEHOLD DECORATION

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist you in your study of scientific home-making. We want your assistance in our work as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the work of the State College in its effort for rural progress.

1. About how much would you feel justified in spending to fix over the walls and repaint the woodwork of a room 14 x 16 feet? Does your estimate include labor as well as material?

2. In how far have you attempted to replace carpets with rugs? How did you succeed in making the old floor sightly; or did you use new flooring?

3. Does your experience lead you to favor papered or painted walls? Why?

4. Tell us any personal experience you may have had with plain or figured walls, or with color, which agrees with or differs from the discussion in this bulletin.

5. How are the walls and floor of your kitchen finished at the present time? Are they satisfactory, or could they be improved in some way that would make your kitchen-work easier and more enjoyable?

Name..

Address..

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME { MARTHA VAN RENSSELAER, *Supervisor* / MRS. IDA S. HARRINGTON, *Assistant Supervisor*

VOL. 1. No. 7 | ITHACA, N. Y. JANUARY 1, 1912 | FARM HOUSE SERIES No. 2

HOUSEHOLD FURNISHING

HELEN BINKERD YOUNG

"*How much there is in this world that I do not want.*"—Socrates.

With most persons, furnishing the home is a threefold study. It consists, first, in arranging one's present belongings to the best possible advantage; second, in discarding all useless and ugly objects; third, in selecting new articles that shall fit appropriately into the already established home. The ability to do any one of these things comes only through patience, experiment, and a clear conception of the final effect desired. It is of no use to begin moving things about and buying new material until one knows what result she is after. Almost any phase of furnishing can be analyzed, pondered over, and to some extent decided on before the first move is made. And this conception of the complete home picture must be spiritual as well as material. Many a house containing correct furniture and decoration fails to become a home because of its coldness, and many a home exists in spite of atrocious furnishings. For home consists not merely of a roof over one's head and of external trappings about us; it is a place where dwell peace and harmony.

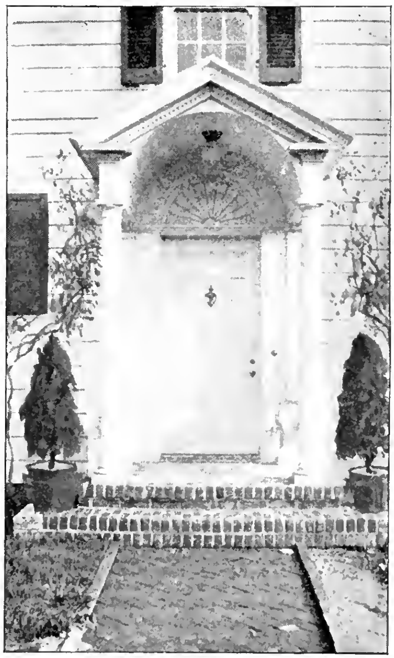


FIG. 22.—*A colonial doorway. Simple structural form with appropriate ornament*

A POINT OF VIEW

It is of vital importance that the home shall have personality and individuality. The influence of an indifferent interior is as negative as the influence of an indifferent person. The home should have positive qualities of goodness; it should express comfort, orderliness, harmony, cleanliness, simplicity, and honesty—surely very human qualities! If we demand these virtues of ourselves, why should we not demand them of our possessions as well? Why not insist that every object within our jurisdiction shall ring true, in purpose, in material, in workmanship?

" Have nothing in your houses which you do not know to be useful and believe to be beautiful." So said William Morris some forty years ago. So say we to-day, but we do not apply it. Suppose each one of us should go on a tour of inspection throughout the house, challenging every article in every room with such questions as these:

In what way is this article useful?

Does it serve its purpose in a simple and direct manner?

Is it durable?

Is it made of appropriate material?

Is it pleasing in form and color?

If it is decorated, does the decoration improve it, or would it look better if left plain?

If all articles that fail to measure up to this standard were banished from sight, our attics would be fuller but our rooms would be simpler, more genuine, and more spacious. For we have indeed become hardened to the presence of useless objects and have endured about us many things that in no way serve us, either physically or spiritually. So long as picture or vase is giving forth its quota of pleasure or usefulness it may be retained; when it becomes negative in value it would better be passed on or destroyed. It is true that we cling to many objects through sentiment, a tendency that should not be lightly disregarded. Years of association cannot be brushed aside in a moment, and so long as one feels devoted to an object, however unlovely it may be, that object should not be ruthlessly expelled from its accustomed place. Each individual must decide these personal matters for himself.

The gifts of friends whose tastes differ greatly from our own also create a problem, but if we keep kindness in our hearts and frankness in our friendships the right solution in each instance will be found. Only let us first make sure that the sentiment is fine and sincere. The friend whom we would forget without a visible reminder surely has little hold on our affections.

Habit is strong with every one. We grow so accustomed to the presence and position of chairs, pictures, and other familiar objects that we no longer notice them. In other words, the appearance of our rooms ceases to make an impression on us. This is unfortunate and usually implies that

FIG. 23.—*View of living-room. Showing right relation between plain and decorated surfaces. Conventionalized tulip design applied to upper wall and screen (which has been moved forward) adds interest to an otherwise plain room*

the rooms lack personality, for an interior arranged in an orderly manner and with harmonious contents, however humble in themselves such contents may be, should continually appeal to the observer without effort on his part. It would be an excellent plan if we would mentally step outside of ourselves once in a while and view our homes with an impersonal eye. This would suggest certain shifting of the furniture, which would be as refreshing to the occupants as going on a visit. Such a series of experiments would finally reveal the perfect arrangement for any given room, bringing it to the point where it would give permanent satisfaction and a continual feeling of enjoyment.

Many times it happens that certain pieces of furniture, which from their harmony of color and design would make a room distinctive, are scattered broadcast throughout the house, no one of them showing to its best advantage because of the lack of relation between it and the neighboring pieces. The old-fashioned method of buying furniture in sets resulted in stiff and uncompromising effects; yet such furniture had two desirable qualities, namely, dignity and harmony of design. At present we have gone to the other extreme, so that in every room of the house may be found, side by side, mahogany, walnut, light oak, mission, burnt wood, and wicker. Sometimes, if the pieces are simple and well-selected, the result is pleasing; more often it is hodgepodge. On the other hand, while light varnished oak pieces are in themselves not beautiful, being usually poor in design and cheap in finish, still if we accept this yellow-brown color as a basis for arranging an entire room a charming result may be obtained. For example, a north room will create a glowing atmosphere of harmony if fitted up with bed, dresser, washstand, and chairs of varnished oak, cream-white woodwork, a mixed rug of tans and browns, or japanese matting with a rug, pale yellow, tan, or golden brown ingrain paper on the walls, cream-white ceiling, and cream scrim or crossbar muslin curtains at the windows. Furthermore, the room will radiate this definite impression every day of the year. The keynote of all successful furnishing, like the keynote of family life, depends on harmony among its members.

The principles discussed in the previous bulletin on household decoration should help the home-maker solve any problems that might arise concerning the finish of walls, ceiling, woodwork, and floors.

Having secured an harmonious setting for the home picture, let us consider the various objects that compose it.

FLOOR COVERINGS

The substitution of bare floors and rugs for carpets will go farther in easing general housework than any other one item. Next to bare floors, japanese matting will probably be found most satisfactory to care for. Rugs may be used with matting, the same as with bare floors.

In general, rugs should be heavy enough to lie flat by their own weight without tacking. A light-weight rug that wrinkles or that curls up on the edges is an aggravation. For a room that is used continually or by a number of persons, such as a sitting-room, one large rug is better than several small ones. A generous central rug makes a room appear larger and is more effective and more satisfactory to the occupants than a number of small rugs, no matter how beautiful the latter may be in themselves. If the room is large or long, the main rug may be supplemented by one or two smaller ones in alcoves, between wide doorways, or in irregularly shaped parts of the room. Small rugs are suitable for bedrooms, fitted conveniently into the open spaces left by furniture. A rug should not extend under the bed, as this arrangement complicates cleaning. Rugs or mats placed before the bureau, the washstand, and the bed are comforting and necessary. A washable cotton mat is the most practicable kind for use before the washstand.

Bare treads on the stairs are easy to clean, but they are noisy and for this reason are not advisable if in frequent use. It must not be supposed that bare floors are intended to walk on. The areas of travel for the most part should be covered, so that persons can move noiselessly about the house. We should be much fresher at the end of the day's task if we were spared all unnecessary noise. The nervous system pays toll alike for jarring sights and sounds.

As in the case of wall papers, large, vigorous flowery or scrolly patterns should be avoided in selecting floor coverings. The floor should lie modestly in place and not seem to dart up to meet one. Fortunately, flowered carpets are for the most part relegated to the past. The advent of rugs with their rectangular outlines has brought about more appropriate designs for floor coverings. The body of the rug is usually covered with some sort of geometric pattern introducing several colors or shades and finished with a border of similar design. Many plain rugs with dark border and lighter center are also made. These are very attractive, but they are impracticable for general use since the care that a plain rug requires is often out of proportion to the effect secured.

The various mottled textures to be found in rugs of domestic weave are more practicable than and almost as beautiful as plain rugs. Among the richest of these mixed effects are rugs made by the carpet weaver from old ingrain or body brussels carpets. Such rugs stand high in favor with housekeepers who have tested their worth, being at once inexpensive, durable, and artistic. They are reversible, deep-napped, and heavy enough to lie in place. A plain band of lighter or darker shade is usually woven near each end, thus adding to the general impression. Old velvet or axminster carpets cannot be used in this way but they may be sewed into rugs of convenient size.

Rag rugs are excellent in many places. A widespread admiration for this old-fashioned floor covering has led to its commercial manufacture. It must be admitted that the rag rugs on the market, while perhaps not so substantial in weight as the homemade hit-and-miss variety, are better in design because attention has been paid to assorting the rags for color value. This should be a suggestion to all women who love to experiment with carpet rags. The usual hit-and-miss pattern will be much improved by omitting the white rags from the body of the rug and using them with some other light or bright color for the border. It may be said, in general, that dark rugs of any kind containing patches of white in the pattern tend to give the floor a disorderly appearance. If the rug is light in color value

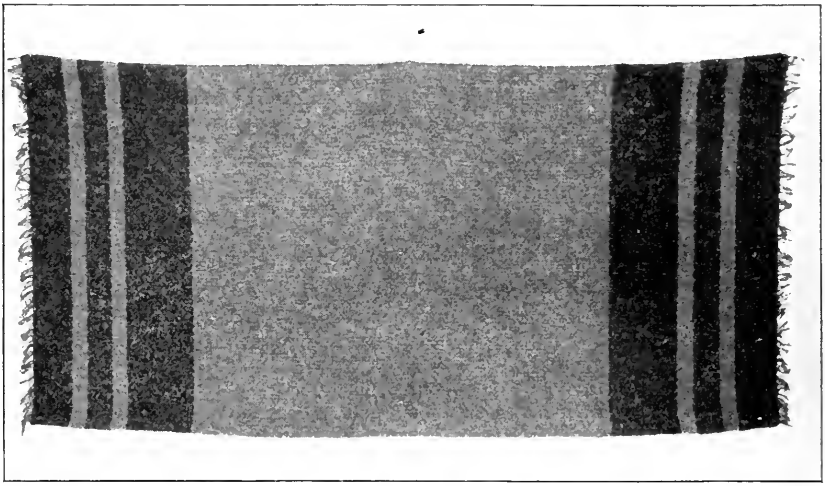


FIG 24.—*A good style of design for any kind of rug*

the white is not so noticeable. A rag rug with a moderately dark flecked body and a broad contrasting border becomes an artistic product in contrast with the usual hit-and-miss carpet, which is merely a practicable product. Very original results may be obtained by sorting into balls the various shades and colors that blend well, keeping all harmonious colors for the same rug. Thus, blues and greens woven with a white warp and a broad light band near the ends give one effect, while if these colors are woven on black warp with a dark band across the ends the effect is distinctly different. Dull reds and browns woven on a tan warp with a lighter or brighter border make an appropriate rug to spread before the fire. Old blue-jeans make a bedroom rug of good weight; usually, if cotton rags alone are used, the rug is too thin. The old-fashioned round or oval braided rugs are quaint and all too scarce. It is well to scan all available material before investing in new floor coverings.

Rugs of ingrain weave, called by various names, may be bought in good colors and patterns. They are inexpensive and durable, but they wrinkle because they are thin. Perhaps no rug purchased could be more satisfactory than a good body brussels showing an all-over pattern in a mixture of such colors as will harmonize with a variety of furnishings. Rugs containing mixed patterns in tans, browns, greens, dull reds, and black unite pleasantly with any usual color scheme. One should never invest in tapestry brussels, which is cheap but short-lived, as the pattern, being merely hooked into the surface threads, soon wears off in spots. Wilton velvet rugs are rich and durable, and are preferable to axminster since the latter mats down and loses nap at every sweeping.

Straw mats are less expensive than almost any other floor covering of a given size. They are an artistic product, but are not very durable on floors that receive hard usage. The warp threads that hold the straw intact soon wear through and leave grassy, whiskery ends projecting upward. To keep them wearing evenly, straw mats should be constantly shifted and turned over.

If one contemplates purchasing an oriental rug, he should become informed on the subject and should buy only from a reliable source. The beauty of oriental rugs lies in their richness of texture and in their exquisite coloring. Many commercial tricks, such as burying in the earth, are resorted to in order to make new rugs look ancient and only an expert can detect the real from the false.

FURNITURE, ITS CONSTRUCTION AND DESIGN

Every piece of furniture should serve some useful purpose. The construction should be strong and honest, and the shape of each piece should be a frank statement of its use. The material of which any given piece is made is of secondary importance to the straightforwardness of the design. Thus, through all combinations of oak, mahogany, walnut, or pine with leather tapestry or cane, a chair should immediately proclaim that it is made for the purpose of receiving human weight in a sitting posture with comfort and with stability. Most furniture, as bookshelves, chairs, tables, or beds, must bear up under weight or pressure of some kind; therefore, the upright structural members should be approximately straight, since force, unless interfered with, tends to move in straight lines. A piece of furniture showing an elaborately bowed and curved structure should be viewed with suspicion; its fancy shape is often obtained at the expense of strength. The cost of constructing curved and molded members is greater than that of making plain ones; yet the cheapest furniture is often of the former fashion, indicating either that the workmanship has

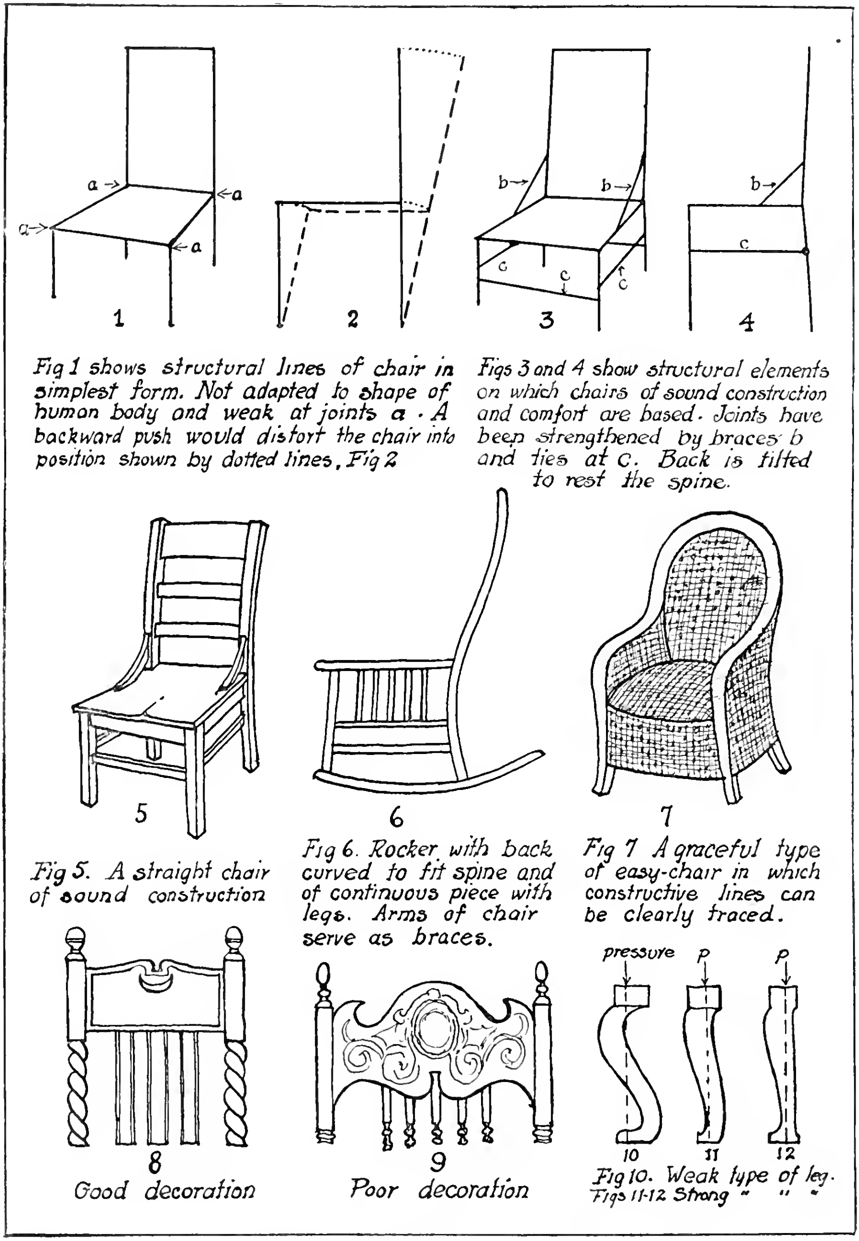


FIG. 25.—*Chairs. A study in construction and ornament*

been slighted or that the material is inferior to what might have been used in a plain shape at the same price.

No piece of furniture is stronger than its weakest joint. A chair may have legs that are thick enough to be used as porch posts, but if the seat and the legs are not united by sound joints the chair is inefficient and gives the lie to its seeming strength. If one tries the experiment of joining a horizontal and a vertical strip of wood securely at a single point he will discover that this is well-nigh impossible. Bracing of some kind must therefore be used. Drawer, slides, the arms and rungs of chairs, the apron on a table, are in reality braces.

Any variation in outline, or any decoration, should follow or fit the structural shape. Gentle, restrained curves may be introduced to soften the outline, and angular corners may be rounded, without impairing the strength of the members.

The structural shape of a chair takes its cue from the human body. The back should tilt slightly backward and it is sometimes curved to fit the spine. Low arms where the elbows naturally fall in place may be curved or varied in shape to conform to the body. The general lines of a chair should be less angular than those of other pieces of furniture. The seat is usually made of some elastic material, such as rush, cane, leather, or tapestry, unless, as in the case of dining-room chairs, the use is for only a short period.

Any well-constructed piece of furniture containing drawers is expensive as compared with a piece having none. This is reasonable, as every drawer is made up of at least five pieces of wood and requires a considerable amount of work. An attempt to economize on such a piece of furniture, whether desk, bureau, or chiffonier, will prove unwise, as the drawers in cheap furniture sag when opened and are likely to stick and to slide in and out unevenly at the corners.

Successive styles of furniture.— No one knew better than the colonial folk the relation between structure and form. It is not because colonial furniture is old that it is valuable, but because it is sound in workmanship, normal in form, and made of a kind of mahogany that is not on the market to-day. The decoration applied by the colonial makers to their furniture, whether carving, inlay, moldings, turnings, or decorative grain, with few exceptions enhanced the effect and in no way distorted the natural shape. Cherry and birch were used for legs and for uprights requiring strength, mahogany being too brittle for this purpose. The fronts of bureau drawers, the backs of davenports, and other parts showing beautiful grain were merely veneered with a thin layer of mahogany glued to a backing of soft wood. Wood veneer should not be looked on as a sham, since it is used for the purpose of preventing large panels of wood from warping; table tops, door panels, and the like would warp out of all usefulness unless they were built up of two or more layers of wood running in different directions and glued together, so that the tendency of one large layer of wood to shrink in one direction is overcome by the tendency of another layer to remain firm in that direction and to shrink in the opposite direction.

A large number of the New England chairs and chests of drawers were made of soft wood and were painted for preservation. These pieces may

Boston rocker Windsor chair

FIG. 26.—*Two painted colonial chairs*

be sandpapered down and repainted, making appropriate bedroom furniture with woodwork painted to match or to harmonize.

Many old treasures have been pushed aside for newer and less worthy furniture. Mahogany bureaus and tables have often become so deadened by generations of varnish that the grain cannot be seen. This varnish may be removed by applying wood alcohol or some good brand of varnish remover, and using a putty knife. Every home-maker should make sure that all worthy heirlooms are given an opportunity to remain useful and beautiful as long as they can.

Walnut furniture will never be valuable as a style for the reason that it represents a period of poor design. Walnut is in itself a beautiful

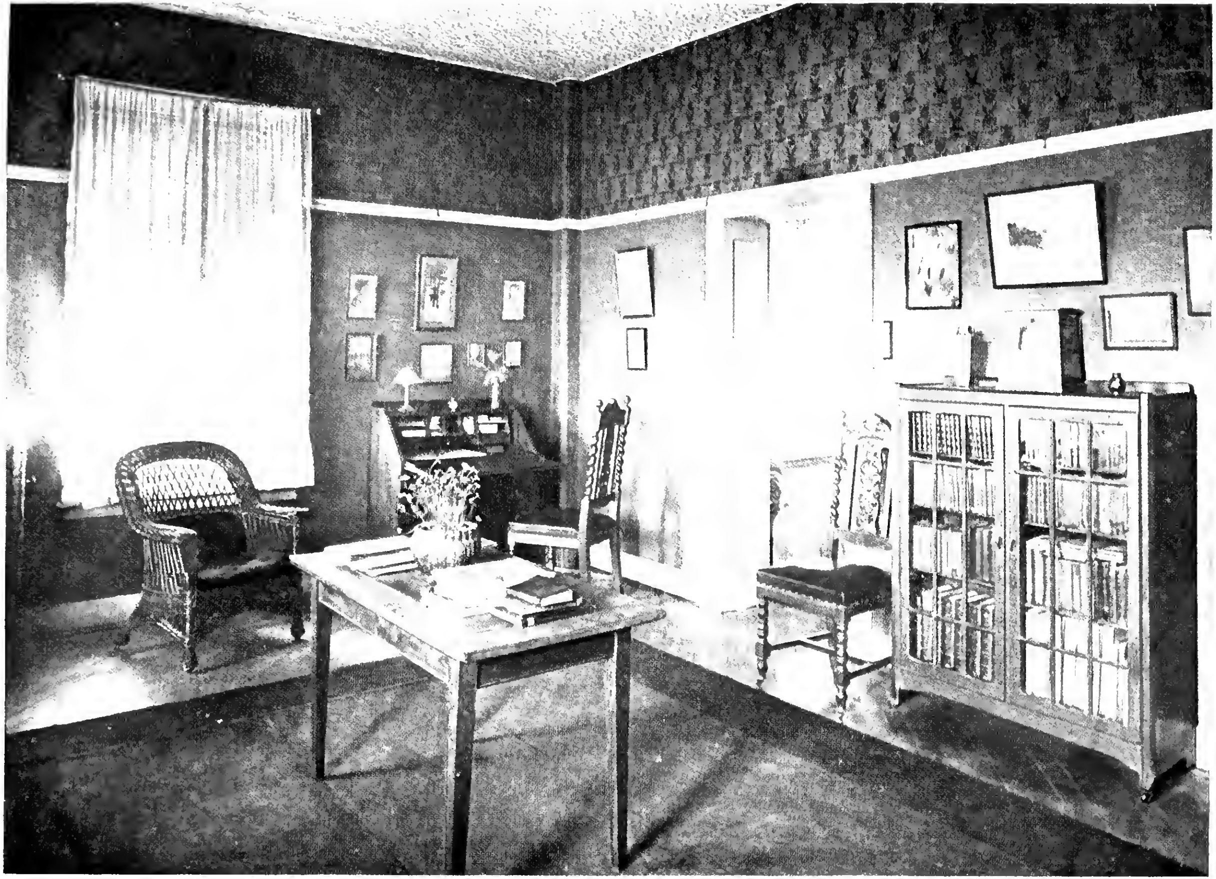


FIG. 27.—*Atmosphere of room is a rich warm brown, with accents of bright color in pictures, books, candle shades, vases, and plants. Dignity, orderliness, harmony, and comfort are apparent. The parts of the room not shown in the picture contain more bookcases, a Morris chair, two comfortable rockers, and a carved wedding chest*

wood, glowing in color and fine in grain, but the sort of grooving, piercing, carving, and molding to which it was subjected largely robbed it of its natural charm. Many pieces were too ponderous to be easily moved about. Simple designs in walnut, similar to colonial pieces, would be beautiful and valuable, but even mahogany worked into ornate designs as was walnut would be artistically valueless. A few of the plainer pieces of walnut are good in design and are therefore permanent in worth. Walnut sets of chairs and sofa may be given a very good appearance by removing the black horsehair and using a lighter-colored upholstery in browns, greens, old gold, or old blue.

Oak, as well as walnut, has been greatly abused in the manufacture of furniture. Oak pieces are usually heavier in structure than are mahogany pieces, because of the bold, vigorous grain of the wood. Of all styles of furniture, the golden oak, or varnished natural oak, of fifteen or twenty years ago, was probably the tawdriest and the most insincere ever manufactured. There were several reasons for this, chief among which was the perfection of machinery that could produce with great ease all sorts of mechanical curves, carvings, and so-called decorations. In this way furniture-makers became childishly involved in producing monstrosities, instead of using the machinery as a tool for the larger production of normal, durable furniture at less cost than was required for handmade products.

Stamped decoration of poor pattern, machine carving glued to panels, scroll-work brackets, and bended arms ending in animal heads, all these distortions have been applied to furniture in the name of decoration. But all in vain is the name, for decoration means enhancement. A chair or table of plain structure, with straight edges, has at least the dignity of being genuine. If the general form is to be softened or refined, a human being, not a machine, must have the upper hand. The attempt to beautify must be an inspiration, not a nightmare. We must ponder over our national sins in furnishing before our homes are purged of the trash that represents false ideals. We have wandered far from the goal, we have confused the means with the end. As an instance of this, take the morris chair. Who could have foreseen that the attempt of William Morris to make a plainly-shaped chair comfortable by adding cushions and adjustable back would have been misconstrued into meaning that the cushions and back might be placed on any sort of hideous framework?

The burnt-wood fad created another epoch of avoidable ugliness. Because it was discovered that by means of burning grooves in wood with a hot tool designs could be made on furniture, a hunt was immediately begun for things that could be burned. The process involved neither skill nor art on the part of the performer, who became literally intoxicated with the decorative idea and proceeded to damage everything in sight.

Not one piece in one hundred should be left in this half-burned condition, but nearly all should be consigned to the flames for finishing.

The idea giving rise to mission furniture was a more serious one. Weary of sham, shine, and ignoble forms, the public was ready to accept any sort of furniture that appeared plain and genuine. Many of the mission pieces are clumsy, crude, uncomfortable, and weak in the joints in spite of their solid appearance, and the wood has in many cases been stained so dark as to kill the grain; yet this wave of mission design has given modern furniture a trend in the right direction. As a result, there may now be found on the market durable and appropriate furniture that compares favorably with colonial work in the solidity of its construction and in the refinement of its form and finish.

Let us now apply these rational ideas to the different parts of the house.

THE HALL

The hall is primarily a place of entrance and of passage. It should radiate cheer and yet be kept free from unnecessary furnishings. Above all, dignity and order must prevail. The smaller the hall, the more difficult is the task; hence, it sometimes happens that a small hall appears more like an enlarged coat closet than like anything else. Garments hanging limply from hooks destroy all attempts at neatness. For this reason, the family apparel, at least, should be hung out of sight, either in a coat closet or on a row of substantial hooks behind a curtain or a screen, which may be supplemented by a few exposed hooks in a convenient place for the temporary use of visitors.

The atmosphere of a hall with a limited amount of daylight will prove most cheerful if some yellow, tan, or golden brown color is used for the walls, provided this harmonizes with the adjoining rooms. Either a plain or a two-toned figured paper will be appropriate, the pattern being kept small and neat unless the hall is fairly spacious. A stripe may be relied on for dignity of appearance, provided the effect is not too elongated as one looks up the stairway. The use of pictures and ornaments in halls should be avoided, as they tend to give the place a trivial aspect and, except in rare instances, are out of place in a passage.

Some provision must be made at the threshold for wiping muddy feet, and a well-ventilated umbrella jar with drain pan will be needed beside the outer door. The main part of the floor should be covered with a large heavy-weight rug of mixed weave or of a pattern in grays, browns, or some other color that will not show footprints readily. A plainly framed mirror of clear, perfect glass should be hung in such a position that it will reflect a person standing in a well-lighted spot. A chair, settle, or small table may be added, according to the usable space. A piece of furniture pretending to combine hatrack, mirror, seat, and umbrella rack, but performing no function well, should be avoided. Since the hooks are placed one above another on each side of the mirror, the garments of different persons interfere with one another and hang against the umbrellas, which, when removed, bring down a coat or two; while the seat, in turn, is usually occupied by hats and gloves.

THE LIVING-ROOM

The appearance of the family living-room, or sitting-room, influences more persons than does any other part of the house. Not only is it constantly used by members of the family, but it touches the lives of neighbors and of friends. Here is the proper place to begin the process of readjustment. All other parts of the house should await their turn until this room is fitted out in the best taste the house can afford. Let there be this one room, at least, in which no object violates any one of the principles of harmony, comfort, and convenience. Let us set ourselves the problem of proving that utility, beauty, and common sense are all compatible in home-making. It may be necessary that every part of the house shall contribute to this revised living-room, but at all costs let us have it.

It would be a good plan to think this problem out during the winter months when one is house-bound of necessity, and to go searchingly from room to room with freshened ideas as to the qualities that constitute worth in furnishings, selecting such chairs, tables, pictures, curtains, and other objects as have in common the qualities of simplicity or plainness in form, softness in color, and absence of conspicuous ornament. When the spring house-cleaning begins, a " clean sweep " may be made of everything in the living-room; the floors and woodwork may be freshened and the walls finished in a soft, plain tone or in a neat, modest pattern that will make a good background. Since most furniture is reddish or brownish, some warm brownish or tan color scheme will probably be the easiest and most satisfactory to arrange, unless the room is too sunny to stand a warm coloring.

In general, the furniture should be placed so as to outline the room, leaving the central space free and open for the use of the occupants. A substantial table for the necessary books, magazines, and lamp should be the only piece of furniture centrally placed; the remainder of the room should be so arranged that persons may move about without dodging the furniture. Desks, bookshelves, couches, or other pieces that belong against the wall should be fitted into convenient spaces between doors and windows, and the chairs should be placed where the light is good for reading or where they command a view from the windows.

The largest and most comfortable chairs should occupy the best and most permanent positions. These may be supplemented by chairs of lighter weight that may be shifted from place to place. One or two wicker or willow chairs are excellent in a living-room, as they are light to handle, comfortable to sit in, and may be stained to harmonize with any color scheme. The value of willow furniture lies in its elasticity. It is especially appropriate for chairs, since it yields easily to the shape of the body.

1 2

FIG. 28.—*Two good modern chairs. 1, Willow chair, stained brown with monk's cloth cushions to match. 2, Rocker of fumed oak. Plain shape, with leather seat*

Willow tables, bookshelves, or desks, are absurdities, since smooth, flat surfaces and unyielding uprights form the chief requirements of these pieces. Wicker furniture with knobs and with fancy ornamentation should be avoided.

One need not hesitate to use mixed furnishings in the living-room. If each piece of furniture is in itself genuine and plain it will harmonize with others of like nature, although they may be made of different woods. It is true that if we were furnishing entirely with new things, we should not mix up all sorts of designs and woods; neither should we have all the new pieces identical in pattern, as a certain amount of variety adds interest. But in either case, violent contrasts are to be avoided. An old mahogany desk or high-boy would clash with yellow oak, but it might harmonize with dark brownish oak or with walnut. A little experimenting will yield satisfactory results.

As soon as possible we should get rid of tufted and tasseled upholstered pieces, whether chairs or couches, having them recovered with strong material stretched tightly over the framework. The couch should be

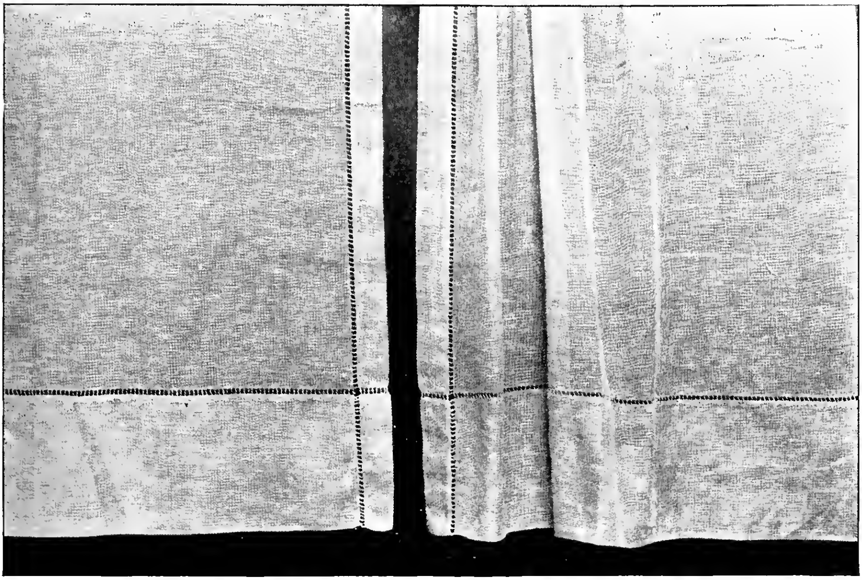


FIG. 29.—*An appropriate curtain for general use. Cream-colored scrim with hemstitched border, two inches wide on edge and seven inches wide on bottom. These should be hung to the window sill and pushed apart if view permits*

provided with enough pillows to make one comfortable but not so many as to preclude use. These pillows may be covered with denim, burlap, linen, cretonne, or some other figured material, but not with hand-painted satin, embroidered violets, heads of ladies or of Indians, or outlines of pipes, books, steins, horses, or scenery. All of these ideas are trivial, for a cushion is a pillow and not a picture. Such decoration is false and inappropriate for the use intended. The dignity of use should always be borne in mind.

The space in front of the windows should be kept free from such obstructions as taborets and gilt stands displaying groups of statuary. Aside from ventilation, the object of having the windows at all is to allow the light to look in and persons to look out. Whatever we can do to induce ourselves to look out to nature more constantly will be for the good of our souls and of our nervous systems. A room appears larger if it includes some of the view. Curtains should be pushed aside with this in mind, and not drawn across the window except for reasons of privacy or because of an unsightly outlook. Long lace curtains drawn across the windows and hanging to the floor, muffling both light and view with their showy patterns, are gradually disappearing because our point of view concerning the use of curtains has changed. The object of curtains is to soften the structural shape of the window. In the living-room this is appropriately done by plain or neatly figured scrim or net curtains, having a hemstitched border and hanging to the sill.

Every picture that finds its way into the living-room should have some dignified and permanent meaning. The fact that poorly drawn charcoal pictures or weakly painted water-color scenes have been executed by members of the family or by near friends is not sufficient recommendation for using them as decoration. Such pictures can impart neither a serious nor an inspiring message. If original paintings are used, they must be better than most amateurs can produce or than most of us can afford to own. Fancy heads are also usually insipid and meaningless. Better a few neatly framed magazine pictures showing the work of good artists than a bushel of poor homemade productions. The magazine pictures may be either in color or in monotone and may represent the work of old or of new masters.

Amateur photography furnishes one good source for personal, homemade pictures; these should consist, not of set groups of individuals wearing clothes that will soon look out of date, but of views and bits of scenery that are always in fashion. Sepia prints with tan-colored mats and neat brown frames, recording familiar scenes or the memories of pleasant trips, will prove a constant source of pleasure to the family. A mere snapshot having high artistic value in composition, showing sunlight and shadows, for instance, may be enlarged and become really a work of fine art.

Family portraits should not be used in the living-room unless they have real artistic value. Photographs of persons are kept in better condition in a desk drawer, where they are at hand when wanted. If a few of these are to be kept in sight, they should be put under glass and arranged in an orderly way over the desk or in some personal corner of the room. They are more appropriate in a study, office, den, or rest room, if there be such a place.

The use of white mats on pictures should be avoided when possible. In general, white is very conspicuous in a room furnished in tones. Pictures in browns, grays, and colors, with tinted mats and brown, gray, or gilt frames, will give as much variety as is desirable in one room. Pictures should not be hung diagonally in steps, but should be arranged horizontally or vertically according to the wall space in question. The final effect of pictures should be one of orderly, dignified arrangement showing harmony of color between the wall and the pictures.

A clock will also be needed in the living-room. This should consist of a plain, durable case with a clearly marked dial. An ordinary schoolroom or alarm clock is superior in worth and usefulness to an "art nouveau" affair in gilt, showing a great deal of ornament and a very small clock face. Candlesticks of brass are always beautiful and may on occasion be useful as well. Bowl-shaped or tall vases of earthenware in various colors will prove an adornment either with or without flowers. The outline of all such ornaments should consist of simple flowing curves and should not be full of knobs, handles, and rippled tops.

THE DINING-ROOM

The real needs of the dining-room are few. A rag rug, or one of body brussels or of some other material not having a deep pile, a plain, substantial extension table, comfortable, straight chairs, a serving table or a sideboard, and cupboard space for dishes comprise everything required. A built-in dish closet with glass doors is preferable to a movable china closet. If the latter is needed, however, it should be a modest affair of rectangular shape and not a bowed-front, beveled-glass piece like a shop window, which suggests display — always a questionable motive in the home. Plate rails catch dust and are reasonable only when one possesses rare or historic china, pewter, or other ornaments. As our standards of domestic art progress, we shall know that in reality much of the so-called fine china is very poor art, and is not worthy to be displayed for its beauty. At best, orderliness is difficult to preserve in the dining-room because of the medley of small objects used in serving meals. Would it not be better then, to let the decoration of the walls suffice without using pictures, plate rails, and other ornaments to add to the confusion? Instead of indoor pictures, we may make the most of outdoor views through all available windows with a good outlook. Dining-room curtains similar to those in the living-room will be appropriate.

All practical housekeepers should realize the value of a waxed top over that of a varnished top for a dining-room table. A waxed top is not easily damaged by water spots or by hot dishes; it remains in good condition for a long period of time and shows no white rings nor scars as does varnish. A wax finish should be insisted on when buying a new table. The finish of a table top may be changed from varnish to wax by the following process:

Wood alcohol or varnish remover is used, together with a putty knife, for removing the varnish; the top is then cleaned evenly and thoroughly and sandpapered, after which it is treated as a piece of new wood, being stained to match the legs, waxed, and rubbed down long and arduously. A library table may be refinished in the same way.

FIG. 30.—*A dining-room. What comments have you to make?*

THE BEDROOM

The bedroom should be pure, airy, clean, light-colored, and orderly. The bed should be placed in such a position that good ventilation without draughts is assured and that the early morning light does not shine in the face of the sleeper. Bureau and chiffonier should be placed where the light is good by day and by night; and, if possible, the washstand

FIG. 31.—*Walls covered with grey-green cartridge paper; ceiling white, carried down to tops of windows to make the room appear lower. Woodwork painted white, yellow pine flooring. Iron bed (of poor design, however) fitted with firm felt mattress and rather low pillows. White lawn curtains finished with hem and insertion border, hung on rings, so that they may be readily drawn across the window or pushed aside. No pictures*

should be provided with a screen for the sake of privacy. After the furniture is in place, the clear area in the room should be rectangular, leaving plenty of space for dressing.

All articles of wearing apparel should be kept in places where they will be out of sight. A closet or a wardrobe will be needed for every bedroom. If a room is not provided with this convenience, a wardrobe may be built of matched boarding and finished to correspond with the woodwork of the room; or it may be made of burlap or of denim stretched tightly over a wooden framework, with a curtain at the opening. An ingenious home-made device can always be fitted up for a closet, care being taken to make it as dustproof as possible. A closet should be at least two feet deep and should be provided with a rod supplied with coat and skirt hangers for the various garments. Clothing may thus be kept in shape and free from wrinkles, and more articles can be hung in a given space than by any other arrangement. A long, narrow closet prepared in this way will furnish more hanging space than will a square closet of greater size. A shelf above for hats and another below for shoes will complete the outfit. A closet that one reaches rather than steps into may be provided with a strip at the threshold to keep out the dust. The closet should be finished white or very light inside, so that garments may be easily seen and selected and moths may be detected. Closet space may be supplemented with boxes of any desired size, covered with cretonne or matting, fitted with hinged lids and made the height of a seat, thus answering two purposes.

Metal beds are to be preferred to those of wood. Of course, when a home is stocked with wooden beds these must be retained; but it is safe to say that wood will never again be largely used in the manufacture of beds, as the fact that vermin will not hatch on metal has given the latter material an indisputable advantage. For the average home, nothing can be more sanitary and more inviting in appearance than a plain white iron bed with or without brass cappings. The most recent designs in metal beds show plain, square posts and railings of low or moderate height at head and foot, with only as much framework as is necessary for security and strength. Brass beds are more showy than are painted iron ones, and for this reason they do not appeal strongly to persons of modest taste. Springs should be built on an iron framework. Beds should be provided with somewhat low pillows and firm, rather than soft, mattresses. This arrangement promotes more complete rest for the body.

If a bedroom is used merely for dressing and for sleeping, it will be found most restful without pictures or ornaments; but if it is used also as a sitting-room or a sewing-room and is one's special sanctum, photographs of friends and other personal decorations, if not used to excess, will have their place and meaning. These ornaments should be arranged as neatly as possible in positions where they will be undisturbed by draughts and by other movements about the room. Favorite quotations, or a calendar of daily texts, may be kept in sight for constant inspiration, for these silent sermons have a way of keeping us up to the mark, physically, mentally, and morally.

In order to live efficiently, we must keep ourselves physically freshened and mentally poised. The struggle for mere possession of objects should not master completely our time and strength. The daily routine of work may be our immediate interest, but it is not the goal, for all work, play, rest, and hospitality should combine to make of the home a suitable fortress of strength to the community, standing for wholesome living, clean ideals, and unselfish public service.

Listen to Mr. William L. Price in "The house of the democrat":

"I once built a house for a Democrat — a man who left a money-making partnership when he believed he had as much money as he could employ profitably to his fellowmen — and his one concern for this house was not that it should cost too much, but that it should in no wise embarrass his friends; ample enough to contain them; simple enough to leave them unoppressed; yet with artistry to please and to lead them, if they would, to do likewise. Some of his friends were not well enough off to afford such a house, some of them were rich enough to build palaces; yet his house was not to make the one envious or the other contemptuous.

"When at last we build the house of the democrat * * * it shall be set in a place of greenery, for the world is a large place and its loveliness mostly a wilderness; it shall be far enough away from its next for privacy and not too far for neighborliness; it shall have a little space knit within a garden wall; flowers shall creep up to its warmth, and flow, guided, but unrebuked, over wall and low-drooped eaves. It shall neither be built in poverty and haste, nor abandoned in prosperity; it shall grow as the family grows; it shall have rooms enough for the privacy of each and the fellowship of all. * * * *

"The rooms of his house shall be ample, and low, wide-windowed, deep-seated, spacious, cool by reason of shadows in summer, warm by the ruddy glow of firesides in winter, open to wistful summer airs, tight closed against the wintry blasts; a house, a home, a shrine; a little democracy unjealous of the greater world, fenced in, but pouring forth the spirit of its own sure justness for the commonwealth.

"Its walls shall be the quiet background for the loveliness of life, hung over with the few records of our own and others' growth made in the playtime of art; its furnishings the product of that art's more serious hours; its implements from kitchen-ware to dressing table touched by the sane and hallowing hand of purpose and taste."

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME { MARTHA VAN RENSSELAER, *Supervisor*
MRS. IDA S. HARRINGTON, *Assistant Supervisor*

VOL. I. No. 7 | ITHACA, N. Y. JANUARY 1, 1912 | FARM HOUSE SERIES No. 2

HOUSEHOLD FURNISHING

DISCUSSION PAPER

Every woman enjoys the effort to improve her home, to have a home of taste—her taste, to be sure, but always improving—a home in which to live and to enjoy living. Emerson refers to such homes as those of virtue, sense, and taste. These homes may have snow drifting in at the windows and may be without expensive furnishings; but they require an ideal that is based on simplicity and refinement. They are based as well on a study of principle. Will you discuss with us the making of such a home?

Ruskin says: " If you have sense, and feeling, determine what sort of a house will be fit for you;—determine to work for it—to get it—and to die in it, if the Lord will. I mean, one that you can entirely enjoy and manage; but which you will not be proud of, except as you make it charming in its modesty."

1. Describe the simple house-furnishings among which you would like to live.

2. What are the essentials of a good piece of furniture?

3. If you had one hundred dollars with which to improve the house, how would you spend it?

4. *a*) How shall we drape a window so as to make it an effective frame for the view outside?

b) What can we do to make the view more beautiful?

5. To what extent should we spend money in the reupholstering of furniture?

6. Dust is one of the friends of disease. Modern sanitary home-making avoids dust lines. What can we leave out of the household furniture for the sake of health and of labor-saving, and still have an artistic effect?

7. If you were furnishing a living-room, what should determine the taste?

Name..

Address...

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. Bailey, *Director*

Course for the Farm Home { Martha Van Rensselaer, *Supervisor*
Mrs. Ida S. Harrington, *Assistant Supervisor*

VOL. 1. No 9 — ITHACA, N. Y. FEBRUARY 1, 1912 — RURAL LIFE SERIES No. 1

READING IN THE FARM HOME

Martha Van Rensselaer

"Oh for a booke and a shadie nooke,
Eyther in doore or out;
With the grene leaves whispering overhead
Or the streete cryes all about.
Where I maie reade all at my ease,
Both of the newe and old;
For a jollie goode booke whereon to looke,
Is better to me than golde."

THE character of the farm home depends in great measure on the woman who keeps it; and the character of the woman depends in good measure on the amount and the character of her reading. A love of the best books gives one a new point of view, and strengthens one's hold on life.

The mother's literary sense needs the most food while the children are growing, so that she may be an example and a stimulus to her family. He is a happy boy whose mother will sit up and read "Arabian nights" with him, even though his jacket must be mended at a later hour. Better to let the jacket go than to lose altogether the companionship afforded by reading together.

Books are better than bric-a-brac. A bookless house has a homeless appearance. A few choice books have lent a charm to a home with furnishings both scant and plain. These books have an element of life in them. The long, quiet evenings in the farm home spent with friends in books have built up many delightful associations. History, biography, and poetry may be enjoyed in the farm home much more than in the village and the city, where there are interruptions to regular consecutive reading.

Reasons why the reading habit is lost.—A common testimony of housekeepers is that the demands of the home are so great that even if they find a little time they are too tired to read or to study. Reading has been pursued in a perfunctory way, perhaps, and has ceased to be a recreation, or the habit has become lost in the too close attention to the practical. Perhaps in the effort to provide the home with the comforts of life, books have become a luxury. Or it may be that the books composing the library are only those once enjoyed and not in line with present tastes and demands; they may be volumes that the urgency of the subscription

FIG. 32.—*A boy's corner*

agent has induced the homekeeper to buy, only to be locked behind glass doors: books of information, but not of inspiration.

On the shelves there are books that we often resolve to read, but we await an opportunity when we may be able to read for an hour or two at a time. Hence the book remains perhaps for years, and it is always a pleasure or a task ahead of us, rather than one accomplished or a present enjoyment. We should first choose our book, read a chapter or a few pages, and leave it at a point where there is interest enough to make the desire to know what is coming next irresistible. It is a pleasure to place a book on the shelf with the feeling that it is a part of our own life and experience, a new and treasured friend.

CHILDREN AND BOOKS

Read something that the children will like.— Do not try to elevate the children to your point of view; if you do, the reading will be "dry" and the children will not stay to hear it unless they are obliged to do so. If you find that your boy is reading trashy stuff, do not upbraid him, for his taste may be partly your own fault. Read him a good story, and one that is full of the real, living, jumping, hilarious boy. If you have no such story or do not know of one, ask your neighbor or the teacher or the minister, or go to the village library. The boy's or the girl's taste for reading is likely to be determined or directed by the mother. Is it not possible to inculcate in the children such a taste for good things to read that they will not care for dime novels or for hairbreadth escapades?

Usually the reason why young persons read trashy books is because no older person is taking a real live interest in pointing the way to the good things in fiction. In order that the children may acquire the habit of reading, it is worth while to arouse interest in a subject. It is not enough that the children look at the titles of books that mean nothing to them; it remains for an older person to interest them in a subject, and perhaps to read aloud until a sufficient desire is gained for more.

That is not an ideal picture which shows the father of the family sitting throughout the entire evening reading the newspaper, the mother silent, darning and mending, and the children playing games. This is a time when the members of the family may be united in one enterprise. Older people are pleased with history, biography, and stories that carry with them real value and strength, and the children have a lively interest in that for which their elders care. It is a mistake to "read down" to children. It is a mistake to ask always whether all parts of a book are within the comprehension of the child. He may not understand all of "Marmion," but he catches the fire and the spirit of the poem, and he enjoys it much more than when, as an older person, he reads from the standpoint of a critic. It is surprising how much children will absorb from mature books that are read to them. Children enjoy that which is strong. Their intellectual tastes will be vitiated by literature that has not in it the element to make it alive.

An education is desired for children, and too often, in the crowded days and nights of striving for their children's welfare, the parents feel compelled to lay aside the books. There is danger here of pushing the boys and the girls to the front, while the parents go into the background and fall behind the times. It is exceedingly wholesome for the boys and girls to feel that their parents are in advance of them; they not only enjoy their intellectual comradeship, but are benefited by looking to the parents for literary and intellectual leadership. There is a larger amount of sympathy between the mother and the daughter who wash the dishes and read "The lady of the lake" together, than between the mother who washes the dishes and the daughter who reads "The lady of the lake" alone. The boys and the father will both enjoy "Snow bound" more if the father and the son have shoveled snow together. The mother may fear to neglect the physical needs of the child in this attention to books, but "the learned eye is still the loving eye."

Establish the habit of reading aloud.— By means of the reading habit, all members of the family are interested for a time in the same thing, and good fellowship, copartnership, and sympathy are aroused at the same time that the reading habit is being established. Perhaps you think you are not a good reader, but that only shows that you have not had practice and that your need is so much the greater; one cannot sing nor skate without practice. Most persons make too hard work of reading aloud. Only read simply and easily, with the least effort possible.

Read what will make a lasting impression on your hearers, things that they will think about afterward. Many of the most entertaining stories and poems have this merit. Beside entertaining for the time being, they make one feel better, they inspire one, help him over hard places, give him information that is desired, make him determined to do and to be something. Set aside one evening in the week for the family reading. Take turns reading aloud. Let your neighbors know that you keep open house that evening, if they wish to drop in. Do not try to make an "entertainment," but spend a quiet, restful evening.

Just as soon as the boy or the girl expresses a desire for a book on any practical or rural subject, provide it. If one of the children likes poultry, buy a poultry book. You may need one on birds or gardening or trees or horses or pets. Remember that a good book well read is a good investment. The child that steals away to read in secret should be looked after.

The desire for good things.— If a boy appreciates good things to eat, it is largely because he has had such things at home; if he likes good things to look at, it is because he has seen good pictures and flowers at home; if he likes good things to read, it is because some one has led him to read such matter. May not exercise in reading be as much a part of the home as exercise in singing or in school-going or in good manners?

CHOICE OF BOOKS AND METHOD OF READING

Shall we have fiction in the home reading?— Men and women are most interested in human nature, in its fortunes, its misfortunes, and its possibilities. Hence the enormous sale of fiction. There is, however, a large amount of fiction bought and read, which, while it may not be pernicious, fails to inspire one with a nobler ambition; it does not strengthen the mind; it does not add culture. It excites, it entertains, it wears very smooth the avenues of the brain through which it travels, but it leaves no thought-pegs on which to hang ideas. A novel which has led a person to think, which creates an appetite for the best literature, and which incites to higher and nobler living, is well worth while. Regret is often expressed that the book of the day, referring particularly to the novel, does not oftener come into the farm home. Perhaps there are compensations for this deprivation. Dickens, Scott, and Thackeray have

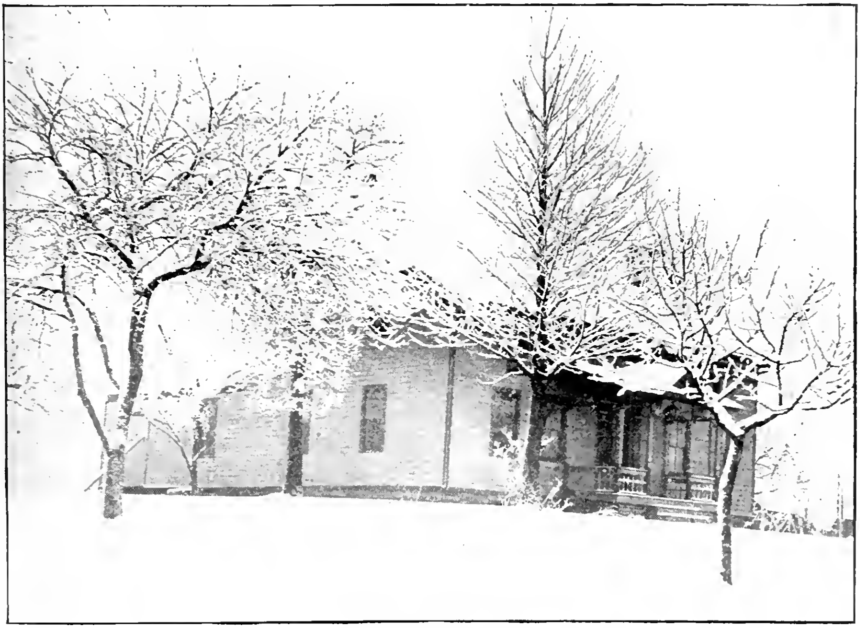


FIG. 33.—*Now is the time for the farmer to read*

not wholly given place to the modern novel. Many modern novels that have attracted wide attention are not reread, nor are they known for many months; their authors must make a new sensation if they would live. Other recent books will always hold their place because they are sincere and they ring true.

Too much reading may be a source of harm.— The mind needs very careful management. It rebels against overcrowding, as the body rebels against overeating. Sometimes we do not read because we do not feel equal to the task before us; our energy has been spent in other directions. Still, there are books that are a recreation and are well worth reading.

One of our great teachers has said: "A man is worth to himself what he is capable of enjoying." We cannot always enjoy books of equal depth. Because we cannot on some occasions read a learned book, difficult to understand, we need not refuse at such times to read a good book of fiction, a bit of biography, or a poem. There are suggestions of the working of a sieve when the newspapers, the short magazine article, the scrappy reading often indulged in, are the sole occupation of the reader. When books were fewer, men and women read them more slowly and more often, and thought more about them. Their minds were not satiated and they had capacity for enjoyment and for reflection. It is true that this flood of reading may be made a blessing in that it furnishes a large opportunity for a wise selection, but it is a blessing only when the literary taste is sufficiently cultivated to be able to choose wisely. The reading of a book may be accompanied by a notebook, but one should read carefully and should become thoroughly saturated with the subject before putting anything into the notebook.

Memorize good selections.— Our fathers and mothers cultivated this habit more than their children have. In earlier days there was less reading matter. More time was spent on standard works, and attention was not dissipated by a large amount of scattered reading. Poetry was read and committed to memory. Time was given to allow a thought to enter the mind and to become absorbed before the reader rushed to the next subject. The habit of memorizing may be easy or it may be very laborious to acquire. It may be lasting or only transitory. Words should never be committed to memory before the thought has been absorbed. Read a selection or a paragraph two or three times in order to form the mental pictures. Close the book and recall them in their order; never mind the exact wording. If the pictures cannot be recalled easily, take a paragraph or a verse at a time. Reread it until the entire picture is before you. Then see how easily the words come in their order. This method is not mechanical and it is delightful occupation. Think of the pleasure to the aged person who, after eyesight has failed, can recall incidents and sentiments that have been a pleasure in the original reading.

This cultivation of the memory for literature is aided by recalling events and objects seen at a glance. All this helps one to be accurate in his observations and in his routine of details. One great cause of inefficiency in practical life is a lack of power to remember. A boy that forgets to bring in the wood or to put up the bars, a girl that forgets to salt the potatoes or to sew a button on her father's coat, needs to train the memory.

By practice in memorizing, power may be gained for much enjoyment. The day's churning or a walk to the pasture will be much pleasanter if one lives over the scenes that were visited in last night's reading. Pleasant thoughts are good companions.

Efficiency in the grange, in the institute, in the lyceum, in the literary club, is gained by the increase of power to stand before the company and speak. It is true that he who ventures may be overcome by fright; but let him persevere, take five full breaths, say he does not care what anybody thinks as long as he does his best, get on his feet and say something, and he has contributed to the success of the meeting, has gained power for himself, and is ready for a greater effort next time. Or, in a more retiring way, when he is one to be heard because of his gray hairs or because he has associated with the writers of the day, has read their thoughts and has lived in them, he may recite choice passages of good literature, and the young are the happier for his being with them.

The life of hurry and rush precludes sufficient meditation and reflection. Books are not thoroughly digested. It is not the number of books one has skimmed that cultivates the mind; one's power is lessened by reading books or articles that do not require thought. Language and thought are so closely related that we cannot express ourselves well unless we have thought as we have read. It is a good habit to write out, now and then, what you have read, repeating in your own words, if need be, the thought of the author. Improve on it, if possible; make it clear, simple, forceful. Too many words hide the thought. Nearly every one is called on nowadays to speak in public, to write a notice for the paper or for a meeting of some kind, and he needs to read clear, concise, simple statements in order to learn to think and to express himself clearly and concisely. Literature to be simple need not be devoid of strength and of thought. The ablest works are the easiest to read because they are clearly expressed, showing that the author was a clear thinker. Striking examples are Caesar's three words, "Veni, vidi, vici" ("I came, I saw, I conquered"), or Lincoln's Gettysburg address, also "And God said, Let there be light, and there was light."

VALUE OF THE READING HABIT IN LATER LIFE

Favorable surroundings increase the habit of reading.— A good light, properly shaded, an easy-chair, books and magazines convenient to pick up, a room comfortable to sit in, a plate of apples at one's elbow, all contribute to real literary enjoyment. Everything possible should be provided to increase the literary atmosphere in the home. It is a sad picture to see members of the family growing old without the desire to read. With the advance of years and the lessening of activity, a person may find great comfort in books, while one with folded hands, not interested in books, may simply sit by the fireside, waiting, unemployed in body and mind, just rusting out.

A final word on books.—Old age and the enjoyment of books go well together. With hands folded, simply waiting for the end is a sad termination to life; while to be in touch with the story of human life and of nature and of history is to live out one's life fully and happily.

"If," says Sir John Herschel, "I were to pray for a taste which should stand me in stead under every variety of circumstances, and be a source of happiness and cheerfulness to me through life, and a shield against its ills, however things might go amiss and the world frown upon me, it would be a taste for reading. Give a man this taste, and the means of gratifying it, and you can hardly fail of making a happy man, unless, indeed, you put into his hands a most perverse selection of books."

BOOK LISTS ON SPECIAL TOPICS

The old prejudice against "book farming" is fast dying out. In the new order of things the farmer needs his reading matter on farm subjects, the same as the lawyer needs his law books. He will have some farm journals, and in addition he will have books of reference on agricultural subjects.

List of Agricultural Reference Books

Poultry

Brigham	Progressive poultry culture. The Torch Press, Cedar Rapids, Ia.	$1.50
H. P. J.	Ducks and geese.	
H. P. J.	Poultry houses and fixtures.	
H. P. J.	Turkeys.	
Kains	Profitable poultry production. Orange Judd Company, New York.	$1.50
Lillie	Development of the chick. Henry Holt & Co.	$4.00
McGraw and Howard	Perfected poultry of America. Howard Publishing Company, Washington.	$2.50
Powell	Making poultry pay. Orange Judd Company.	$1.00
Purvis	Poultry breeding. Saunders Publishing Company.	$1.50
Rice, William, and Cox	Squabs for profit. Orange Judd Company.	$.50
Robinson	Poultry-craft. Farm Poultry Publishing Company, Boston.	$1.50
Watson	Farm poultry. The Macmillan Company.	$1.25
Webber Brothers	How we make ducks pay.	

Weir, H. W.	Poultry book. Doubleday, Page & Co.	$5.00
———	American standards of perfection. American Poultry Association, Buffalo.	$1.50

Dairy

Conn, H. W.	Practical dairy bacteriology. Orange Judd Company.	$.80
Conn, H. W.	Agricultural bacteriology. P. Blakiston & Son, Philadelphia.	$2.00
Decker, John	Cheese making. Mendota Book Company, Madison, Wis.	$1.75
Farrington and Woll	Testing milk and its products. Mendota Book Co.	$1.25
Lipman	Bacteria in relation to country life. The Macmillan Company.	$1.00
McKay and Larson	Principles and practice of butter. John Wiley & Sons, New York.	$1.50
Russell and Hastings	Dairy bacteriology. Russell, Madison, Wis.	$1.00
Van Slyke	Modern methods of testing milk and its products. Orange Judd Company.	$.75
Van Slyke and Publow	Science and practice of cheese making. Orange Judd Company.	$1.75
Ward, A. R.	Pure milk and public health. Carpenter & Co., Ithaca, N. Y.	$2.00
Wing, H. H.	Milk and its products. The Macmillan Company	$.80
Winslow	Production and handling of clean milk. W. R. Jenkins, New York.	$3.25

Horticulture

Bailey	Nursery book. The Macmillan Company.	$.80
Bailey	Principles of fruit growing. The Macmillan Company.	$1.50
Bailey	Pruning book. The Macmillan Company.	$1.50
Bailey	Cyclopedia of horticulture. The Macmillan Company.	$20.00
Bailey	Garden making. The Macmillan Company.	$1.50
Bailey	Horticulturist's rule book. The Macmillan Company.	$.80
Bailey	Principles of vegetable gardening. The Macmillan Company.	$1.20
Budd and Hansen	American horticulturist's manual. John Wiley & Sons.	$1.50

Card	Bush fruits.	The Macmillan Company.	$1.50
Chittenden	Insects injurious to vegetables.	Orange Judd Company.	$2.00
Duggar	Fungous diseases of plants.	Ginn & Co.	$2.00
Green	Popular fruit growing.	Webb Publishing Company, St. Paul, Minn.	$1.00
Lodeman	Spraying of plants.	The Macmillan Company.	$.80
Paddock and Whipple	Fruit growing in arid regions.	The Macmillan Company.	$1.50
Saunders	Insects injurious to fruits.	J. B. Lippincott Company, Philadelphia.	$2.00
Waugh	American apple orchard.	Orange Judd Company.	$1.00

General Agriculture

Bailey	Cyclopedia of agriculture.	The Macmillan Company.	$20.00
Bailey	Principles of agriculture.	Orange Judd Company.	$1.25
Coburn	Book of alfalfa.	Orange Judd Company.	$.50
Davidson and Chase	Farm machinery and farm motors.	Orange Judd Company.	$2.00
Elliott, C. S.	Practical farm drainage.	Orange Judd Company.	$1.50
Fairchild, G. T.	Rural wealth and welfare.	The Macmillan Company.	$1.25
Fletcher	Soils.	Orange Judd Company.	$2.00
Fraser	Potato.	Orange Judd Company.	$.75
Hopkins	Soil fertility and permanent agriculture.	Orange Judd Company.	$2.25
Hunt	Cereals in America.	Orange Judd Company.	$1.75
Hunt	Forage and fibre crops.	Orange Judd Company.	$1.75
King	Physics of agriculture.	King, Madison, Wis.	$1.75
King	The soil.	The Macmillan Company.	$.60
Lynde, C. J.	Home water works.	Sturgis and Walton, New York.	$.75
Ogden	Rural hygiene.	The Macmillan Company.	$1.50
Roberts	Fertility of the land.	The Macmillan Company.	$1.50
Roberts	Farmstead.	The Macmillan Company	$1.00
Sanderson	Insects injurious to staple crops.	The Macmillan Company.	$1.20
Seavey	Bean culture.	Orange Judd Company.	$.40
Shaw	Clovers and how to grow them.	Orange Judd Company.	$1.00
Shaw	Soiling crops and the silo.	Orange Judd Company.	$1.50

Smith	Economic entomology.	J. B. Lippincott Company.
Spillman	Grasses.	Orange Judd Company. $1.00
Stevens and Hall	Diseases of economic plants.	The Macmillan Company. $2.50
Vivian	First principles of soil fertility.	Orange Judd Company. $1.00
Voorhees	Fertilizers.	The Macmillan Company. $1.50
Voorhees	Forage crops.	The Macmillan Company. $1.50
Warren	Elements of agriculture.	The Macmillan Company. $1.10
Wing	Alfalfa in America.	Saunders Publishing Company. $2.00

Mrs. Anna Botsford Comstock, in the "Handbook of nature-study," says: "Luckily, thumb-rule agriculture is being pushed to the wall in these enlightened days. Thumb rules would work much better if nature did not vary her performances in such a confusing way. Government experiment stations were established because thumb rules for farming were unreliable and disappointing; and all the work of all the experiment stations has been simply advanced nature-study and its application to the practice of agriculture. Both nature-study and agriculture are based upon the study of life and the physical conditions which encourage or limit life; this is known to the world as the study of the natural sciences; and if we see clearly the relation of nature-study to science, we may understand better the relation of nature-study to agriculture, which is based upon the sciences."

The value of nature-study books in the home is expressed in the following words by Mrs. Anna Botsford Comstock in the "Handbook of nature-study":

"Nature-study cultivates the child's imagination since there are so many wonderful and true stories that he may read with his own eyes, which affect his imagination as much as does fairy lore; at the same time nature-study cultivates in him a perception and a regard for what *is* true, and the power to express it. All things seem possible in nature; yet this seeming is always guarded by the eager quest of what is true. Perhaps, half the falsehood in the world is due to lack of power to detect the truth and to express it. Nature-study aids both in discernment and expression of things as they are.

"Nature-study cultivates in the child a love of the beautiful; it brings to him early a perception of color, form and music. He sees whatever there is in his environment, whether it be the thunder-head piled up in the western sky, or the golden flash of the oriole in the elm; whether it be the purple of the shadows on the snow, or the azure glint on the wing of the little butterfly. Also, what there is of sound, he hears; he reads the music score of the bird orchestra, separating each part and knowing which bird sings it. And the patter of the rain, the gurgle of the brook, the sighing of the wind in the pine, he notes and loves and becomes enriched thereby.

"But, more than all, nature-study gives the child a sense of companionship with life out of doors and an abiding love of nature. Let this latter be the teacher's criterion for judging his or her work. If nature-study as taught does not make the child love nature and the out-of-doors, then it should cease. Let us not inflict permanent injury on the child by turning him away from nature instead of toward it. However, if the love of nature is in the teacher's heart, there is no danger; such a teacher, no matter by what method, takes the child gently by the hand and walks with him in paths that lead to the seeing and comprehending of what he may find beneath his feet or above his head. And these paths whether they lead among the lowliest plants, or whether to the stars, finally converge and bring the wanderer to that serene peace and hopeful faith that is the sure inheritance of all those who realize fully that they are working units of this wonderful universe."

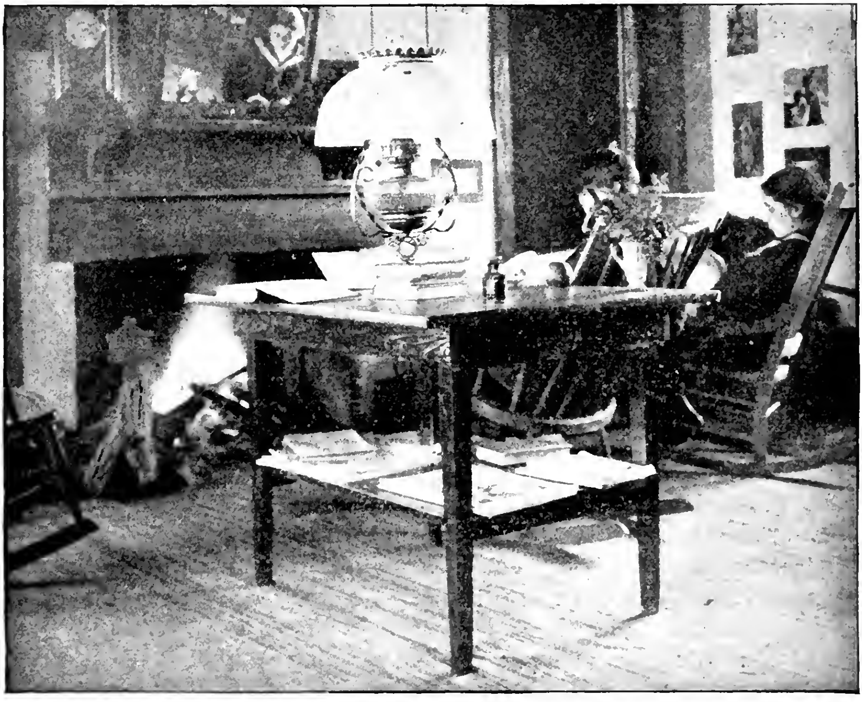


Fig. 34.—*A winter afternoon at the farm fireside. It was snowing when this picture was taken*

"And he wandered away and away, with Nature the dear old nurse,
Who sang to him night and day, the rhymes of the universe.
And when the way seemed long, and his heart began to fail,
She sang a more wonderful song, or told a more wonderful tale."
Longfellow's poem to Agassiz.

A Suggested List of Nature Books

Atkinson	First studies of plant life. Ginn & Co., New York.	$.70
Bailey	The nature study idea. The Macmillan Company, New York.	$1.25
Bailey	The outlook to nature. The Macmillan Company.	$1.25
Bailey	The manual of gardening. The Macmillan Company.	$1.50
Ball	Starland. Ginn & Co., New York.	$1.00
Blanchan	Bird neighbors. Doubleday, Page & Co., New York.	$2.00
Chapman	Handbook of birds of eastern North America. D. Appleton & Co., New York.	$3.00
Comstock, J. H.	Insect life. D. Appleton & Co.	$1.75
Comstock, J. H.	Manual for the study of insects. Comstock Publishing Company.	$3.75
Comstock, A. B.	Handbook of nature study. Comstock Publishing Company.	$3.25
Forbush, Edw. H.	Useful birds and their protection.	
Gaye, Selina	The great world's farm. The Macmillan Company.	$1.00
Gibson	Blossom pests and insect guests. Newson & Co., New York.	$1.00
Gilbert and Brigham	Introduction to physical geography. D. Appleton & Co.	$1.25
Hodge	Nature study and life. Ginn & Co., New York.	$1.65
Holts	Nature study. Charles Scribner's Sons.	$1.50
Ingersoll	Life of animals. The Macmillan Company.	$2.00
Ingersoll	Wild life in orchard and field. Harper & Brothers.	$1.50
Keeler	Our native trees. Charles Scribner's Sons.	$2.00
Keeler	Our garden flowers. Charles Scribner's Sons.	$2.00
Kellogg	Insect stories. Henry Holt & Co.	$1.50
Martin	The friendly stars. Harper & Brothers.	$1.25
Matthews	Fieldbook of American wild flowers. G. P. Putnam's Sons.	$1.75
Merriam	Birds of village and field. Houghton Mifflin Company.	$2.00

Parsons	How to know the ferns.	Charles Scribner's Sons.	$1.50
Roth	First book of forestry.	Ginn & Co.	$.75
Shaler, N. S.	Aspects of the earth.	Charles Scribner's Sons.	$2.00
Stone and Cram	American animals.	Doubleday, Page & Co.	$4.00
Stone and Cram	Animal life.	Doubleday, Page & Co.	$4.00
Von Arnim, Countess.	Elizabeth and her German garden.		

The bulletins named in the following list may be obtained free by writing to the Secretary of Agriculture, Washington, D. C.:

34. Meats: composition and cooking
42. Facts about milk
52. The sugar beet
63. Care of milk on the farm
74. Milk as food
85. Fish as food
93. Sugar as food
112. Bread and bread-making
121. Beans, peas, and other legumes as food
125. Protection of food products from injurious temperatures
126. Practical suggestions for farm buildings
128. Eggs and their uses as food
131. Household tests for detection of oleomargarine and renovated butter
135. Sorghum syrup manufacture
142. Principles of nutrition and nutritive value of food
166. Cheese-making on the farm
167. Cassava
175. Home manufacture of unfermented grape juice
182. Poultry as food
183. Meat on the farm: butchering, curing, and keeping
185. Beautifying the home grounds
203. Canned fruits, preserves, and jellies
232. Okra: its use and culture
234. The guinea fowl
241. Butter-making on the farm
249. Cereal breakfast foods
252. Maple sugar and syrup
255. The home vegetable garden
256. The preparation of vegetables for the table
270. Modern conveniences for the farm home

285. Iron in food and its function in nutrition
293. Use of fruit as food
295. Potatoes and other root crops as food
298. The food value of corn and corn products
332. Nuts and their uses as food
346. The computation of rations for farm animals by the use of energy values
348. Bacteria in milk
350. Peanuts
359. Canning vegetables in the home
363. Use of milk as food
377. Harmfulness of headache mixtures
393. Habit-forming agents
426. Canning peaches on the farm
432. How a city family managed a farm

The Ohio Agricultural Experiment Station, Wooster, Ohio, has available the two following bulletins:

201. The mineral elements in animal nutrition
213. Specific effect of rations on the development of swine

Pamphlets on the subjects named below may be obtained by addressing the publishers as designated:

The feeding of children. By Mary Schwartz Rose. Columbia University, New York. Price 10 cents.

The principles of jelly making. By N. E. Goldthwaite. University of Illinois, Urbana, Ill.

The home canning of fruits and vegetables. North Carolina Department of Agriculture, Vol. XXXI, No. 5, May, 1910.

Practical directions for preserving native fruits and vegetables. University of Wisconsin, No. 136, April, 1906.

Study of the methods of canning meats. Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

The perfect art of canning and preserving. The Butterick Publishing Company, New York. Price 15 cents.

Cornell reading-course for farmers' wives:

Old Series:

No. 2. Decoration in the farm home
3. Practical housekeeping
4. The kitchen garden
5. Flowers and the flower-garden
6. The rural school and the farm home
7. Boys and girls on the farm

21. Suggestions to readers
27. A month of education discussion
28. Another study in household equipment

New Series:

No. 2. Insect pests of house and garden
4. Household bacteriology
6. Human nutrition, Part I
7. Human nutrition, Part II

Cornell reading-course for the farm home:

No. 1. The care and feeding of children, Part I
2. The care and feeding of children, Part II
3. Household decoration
4. Household furnishing
Other lessons in preparation for the year

A Suggested List of Books on Home Economics

Library of Home Economics, American School of Home Economics, Chicago, Illinois. $12.00 a set

Barrows, Anna	Principles of cookery
Bevier, Isabel	The house: its plan, decoration and care
Cotton, Dr. A. C.	Care of children
Dodd, Margaret E.	Chemistry of the household
Elliott, S. Maria	Household hygiene
Elliott, S. Maria	Household bacteriology
Le Bosquet, M.	Personal hygiene
Norton, Alice P.	Food and dietetics
Pope, Amy E.	Home care of the sick
Terrill, Bertha M.	Household management
Washburne, Marion F.	Study of child life
Watson, Kate H.	Textiles and clothing

Abbott, E. H. On the training of parents. Houghton Mifflin Company. $1.00

Addams, Jane The spirit of youth in the city streets — The newer ideals of peace. The Macmillan Company. $1.25 each

Allen, W. H. Civics and health. Ginn & Co., New York

Balderston, L. Rae Laundry manual. Avil Printing Company, Pittsburgh, Pa.

Burbank, Luther H. The human plant. The Century Company, New York. $.60

Call, Annie Payson Power through repose. Little, Brown & Co., Boston. $1.00

Chittenden, R. H.	The nutrition of man.	Frederick A. Stokes Company.	$3.00
Conn, H. W.	Bacteria, yeasts and molds.	Ginn & Co.	$1.00
Daniels, Fred H.	Furnishing of the modest home.	Davis Press, Worcester, Mass.	$1.00
Dodd, Helen	The healthful farmhouse.	Whitcomb & Barrows, Boston.	$.60
Gulick, Luther H.	The efficient life.	Doubleday, Page & Co.	$1.20
Holt, L. E.	Care and feeding of children.	D. Appleton & Co.	$.75
Lipman, Jacob G.	Bacteria in relation to country life.	The Macmillan Company.	$1.50
Mitchell, Margaret J.	The fireless cook book.	Doubleday, Page & Co.	$1.25
Ogden, H. N.	Rural hygiene.	The Macmillan Company.	$1.50
Parloa, Maria	Home economics.	The Century Company.	$1.50
Pattee, Alida F.	Diet in disease.	A. F. Pattee, Mt. Vernon, N. Y.	$1.50
Richards, Ellen H.	The cost of living.	John Wiley & Sons.	$1.00
Rowe, S. H.	The physical nature of the child.	The Macmillan Company.	$.90
Saleeby, C. W.	Health, strength, and happiness.	Mitchell Kennerly, New York.	$1.50
Sedgwick, W. T.	Principles of sanitary science and the public health.	The Macmillan Company.	$3.00
Snyder, Harry	Human foods.	The Macmillan Company.	$1.25
Spargo, John	The common sense of the milk question.	The Macmillan Company.	$1.50
Wheeler, Candace	Principles of home decoration.	Doubleday, Page & Co.	$1.80
Whipple, George C.	Typhoid fever.	John Wiley & Sons.	$3.00
Wilbur, Mary A.	Everyday business for women.	Houghton Mifflin Company.	$1.25

READING IN THE FARM HOME

CAROLINE WEBSTER
Library Organizer, New York State Library

The city dweller, in this age of rush and strain, envies the men and the women on the farm their long winter evenings, free from interruption, for developing the joy that comes from reading. These leisure hours give a much-coveted opportunity for them to become better acquainted with the friends they already have in books, to meet new friends, to associate

FIG. 35.—*Snow without; reading within takes one to all quarters of the earth*

with the greatest men and women of all ages, and to catch a glimpse of "the light that never was on sea or land, the consecration and the poet's dream."

Reading aloud.— Whether the family be large or small, the ideal way of spending an evening is to have one member of the circle read aloud. The difficulty often is to find some book in which all will be interested; nevertheless, there are many stories that are especially adapted for reading aloud, many biographies that read like fiction, and many poems that must be read aloud in order to be enjoyed. Kipling always makes a strong appeal to the ear. Eugene Field and James Whitcomb Riley are delightful, too. The pathos and humor of their poetry, the drawing of things "here at home, jes' as they air," explain, if any explanation is needed, why they are loved in so many American homes.

In our reading circle we must not forget the children. It is not always necessary to read what are known as children's stories, for children will often enjoy the "grown-up" books quite as much as the books that are written for them. This is especially true of poetry. And "grown-ups" usually enjoy the stories written for children. The man or the woman who can no longer read a fairy tale with zest, or who is bored or horrified at the pranks of Huck Finn, or who experiences no thrill at the doings of Robin Hood or of the Knights of King Arthur, and who has a dry eye when he reads Field's "Little Boy Blue," is indeed to be pitied. It is well for the older members of the family to bear in mind the child's point of view, and the best children's stories usually present this point of view in a most pleasing way.

A short list of books that are good for reading aloud is given below. The list includes a collection of poetry rather than a volume of poems by one author, since this plan gives an opportunity for each member of the family to choose his or her favorite poem and also to make new friends. There are other collections of poetry as good as the one included in this list.

Bryant's "New library of poetry and song" and the "Oxford book of verse" both can be highly commended.

*a	Andrews	Perfect tribute
	Dana	Household book of poetry
	Edwards	In the Yukon
*b	Graham	The golden age
b	Graham	Dream days
a	Grenfell	Afloat on an ice pan
a	Hale, E. E.	Did he take the prince to ride?
b	Hale, L. P.	Peterkin papers
b	Harris	Uncle Remus
	James	International episode
	Jones	Life of Edison
a	Kipling	Incarnation of Krishna Mulvaney
a	Muir	Stickeen
a	Opseud, Henry	Handbook of Hymen (In his "Heart of the West")
b	Pyle	Men of iron
	Stuart	Sonny
	Wister	Seven ages of Washington
a	Wister	Ulysses Grant

*"a" May be read in an evening.
"b" Juvenile.

Out-of-door books.— Those of us who live in the country have the opportunity of knowing intimately the world that lies all about us, the world of the great out-of-doors. In gaining this knowledge books are our most helpful and sympathetic friends. They show us where to go and what to see and to hear. They express for us the joy that we feel but do not know how to put into words. They comfort us when illness shuts us in, by carrying us back in imagination to our favorite haunts. Nature herself is of course our best teacher:

> " Many runes the cold has taught me,
> Many lays the rain has brought me,
> Other songs the winds have sung me;
> Many birds from many forests
> Oft have sung me lays in concord."

The library in the farm home should include a few books that will help us to know the trees, the wild flowers, the birds, and the stars. Every woman who is fond of wild flowers will take real pleasure in owning Mrs. Dana's " How to know the wild flowers"; and Mrs. Ely's " Woman's hardy garden " will be the greatest help to any one who desires something more than annuals in her garden. Bailey's " Garden-making " includes suggestions for raising both vegetables and flowers, and gives plans for laying out grounds. Keeler's "Our native trees and how to identify them" will be useful to the lover of trees.

There is such a number of books about birds that it is hard to select just one. No one, however, would make a mistake in buying Chapman's " Bird life " or Merriam's " Birds of village and field." For a simple book on the habits of birds, a book, perhaps, that the children would enjoy, Olive Thorne Miller's " Second book of birds" is very good.

Martin's " Friendly stars " is a popular, entertaining description of the twenty brightest stars and the principal constellations, and renders easy their identification with the naked eye.

Books of inspiration.— It is more or less the fashion at present to cavil at fiction. When we do this we forget that Shakespeare was a writer of fiction, that Aesop wrote fiction, that it was a novel (" Uncle Tom's cabin ") which contributed more toward freeing the slave in this country than did any other thing. " But," you say, " it is the novel of the day to which we object." True, many of these are poor and many are more than poor — they are weak and bad; but one does not need to read that kind unless he is guided entirely by advertisements in his choice of books. It is unfortunate to condemn all fiction simply because some is bad. It would be a misfortune to have missed knowing " Bob, son of battle " and not to have thrilled at the " Call of the wild " because one had crossed modern novels off the list of books worth reading. And one would feel defrauded of two delightful companions if he did not know "Rebecca of Sunnybrook Farm" and "Anne of Green Gables." Never to have felt the charm of Colonel Carter's manners or of Babbie's bewitching ways would be a real loss to any lover of womankind. The question of fiction reading is a question of selection. We must have fiction in our farm library, but it must be carefully selected.

Poetry, of course, we shall need. "A single poem that warms the affections, elevates the soul, excites the imagination, kindles the emotions and arouses noble aspirations may be worth more to myriads of readers than a whole library of fact, argument, exhortation and edification."

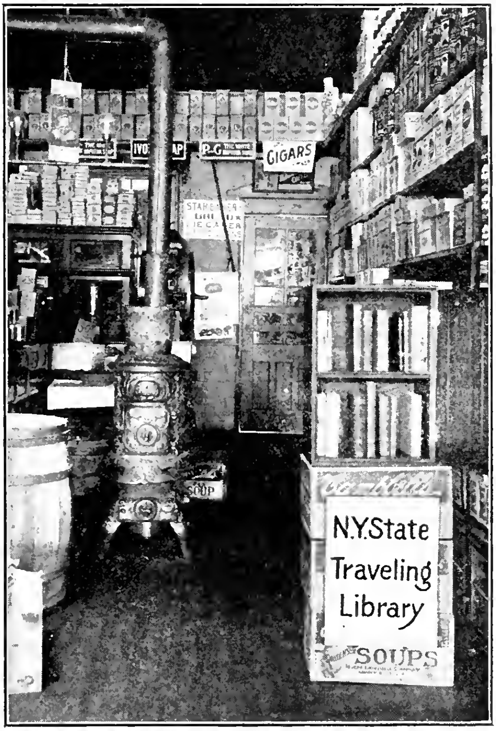


Fig. 36.—*One of our stations*

Among our inspirational books, biography also should have a conspicuous place. Could any one find better food for thought than in Franklin's "Autobiography," Booker Washington's "Up from slavery," Alice Freeman Palmer's "Life," or "The story of Helen Keller"? John Graham Brooks' "A story of an American citizen: a life of William Henry Baldwin, Jr.," published last year, is a book in which many young men cannot fail to take a vital interest. It is the story of a young man with a "straight and honest life record," a young man who succeeded in business and still maintained his high moral integrity: a splendid contrast to the type of man that is now figuring so largely in the muckraking articles appearing in the magazines. It is the story of a man who amassed wealth honestly and who has been described as the "Galahad of the market place"—just the sort of person for young men to know.

Children's books.— There is such a wealth of literature now published for children that one is almost bewildered in trying to select for them according to their special tastes and needs. We have made out and included in this lesson a list of interesting books for boys and girls. This is a tested list; it has been tested by boys and girls who have found the books interesting and by mothers and teachers who agree that the stories are good and wholesome. The books are as follows:

Aldrich — Story of a bad boy. Houghton Mifflin Company. $1.25
A story of a mischievous, but truly good, natural New England boy.

Barbour — For the honor of the school. D. Appleton & Co. $1.50
A story of school life.

Beard — American boys' handy book. Charles Scribner's Sons. $2.00
A practical description of sports, games, and amusements suitable for boys of all ages.

Beard — American girls' handy book. Charles Scribner's Sons. $2.00
Filled with practical directions for work and play of every kind.

Bennett — Barnaby Lee. The Century Company. $1.50
A private's story. Scene, New Amsterdam, time of English capture, 1664.

Bostock — Training of wild animals. The Century Company. $1.00
Accounts of traits of animals in captivity and of hazardous lives of trainers.

Crichton — Peep-in-the-world. Longmans, Green & Co. $1.25
Story of a delightful little English girl who spends a winter in Germany. This is sure to be a favorite with the girls.

Famous adventures and prison escapes of the Civil War. The Century Company. $1.50
True and exciting stories collected from the Century Magazine.

Greene — Legends of King Arthur. Ginn & Co. $.50
Perhaps the best version from which to read aloud to children.

Grinnell — Jack, the young ranchman. Frederick A. Stokes Company. $1.25
A New York boy's six months on a ranch in the Rockies. His adventures continued, and much information about Indians given in two succeeding stories of the same series: "Jack among the Indians" and "Jack in the Rockies."

Hale — Peterkin papers. Houghton Mifflin Company. $1.50
The doings of a delightfully topsy-turvy family who are rescued from all difficulties by "the lady from Philadelphia." This book is good for reading aloud.

Kipling — Jungle book. The Century Company. $1.50

Short stories about the secrets of animal life in the jungle. " Rikki-tikki-tavi " and " The white seal " seem to be especially adapted for reading aloud.

Lear — Nonsense books. Little, Brown & Co. $2.00

" A little nonsense now and then is relished by the best of men."

Lodge and Roosevelt — Hero tales from American history. The Century Company. $1.50

Sketches of famous men and descriptions of dramatic events in American history.

Lorenzino — Pinnochio. Ginn & Co. $.50

Story of a marionette. An ideal story for reading aloud to a group of children six to nine years of age.

Moffat — Careers of danger and daring. The Century Company. $1.50

Vivid accounts of the courage and achievements of steeple climbers, deep-sea divers, balloonists, ocean and river pilots, engineers, and the men that handle dynamite.

Montgomery — Anne of Green Gables. Doubleday, Page & Co. $1.50

Otis — Toby Tyler; or, Ten weeks with the circus. Harper & Brothers. $.60

This story and its sequel, " Mr. Stubbs' brother," will interest the boy who is not especially fond of reading.

Pyle — Some merry adventures of Robin Hood. Charles Scribner's Sons. $3.00. Abridged edition, Charles Scribner's Sons. $.50

Episodes in the life of the famous outlaw.

Rankin — Dandelion Cottage. Henry Holt & Co. $1.50

Concerning four little girls that are real housekeepers in a real little house.

Scudder, editor — Children's book; a collection of the best and most famous stories and poems in the English language. New edition. Houghton Mifflin Company. $2.50

Sewell — Black Beauty. Grosset and Dunlap. $.50

Stevenson — Treasure Island. New edition, illustrated by W. Paget. Charles Scribner's Sons. $1.50

Tomlinson — Marching against the Iroquois. Houghton Mifflin Company. $1.50

Vaile — Orcutt girls. W. A. Wilde Company. $1.50

White — Magic forest. The Macmillan Company. $1.50

Wiggin and Smith	Golden numbers.	McClure Company.	$2.00
Zollinger	Widow O'Callaghan's boys.	A. C. McClurg & Co.	$.80

Technical books.— Ours is a practical age, as was previously stated. The authors of our technical books have worked out in practice the problems of which they write. The men and the women who are familiar with the books that have been published in their respective branches of work are recognized as leaders. They know what experiments have been made, and why some have succeeded and some have failed. It is possible for a farmer to have a good technical library and for a farmer's wife to collect a valuable library on household affairs at very small expense.

The New York State Library includes in its traveling libraries books on all the topics mentioned in this lesson. You are thus given an opportunity to become familiar with some of these books and to know which you wish to own. For $1.00 you may borrow ten books for three months. These books may be renewed for three months more on payment of 50 cents. On application of five taxpayers you may have the free use for your community of twenty-five books for six months. If additional books are desired they may be obtained on the payment of a nominal charge. Books should be located in some central spot, such as the post office, a store, or a schoolhouse. A grange or a club that desires the exclusive use of books may have twenty-five books for $2.00. For each additional twenty-five books there will be a charge of $1.00. These books may be kept for six months or longer. Transportation charges are paid on all books. For further information, address the Division of Educational Extension, State Library, Albany.

The Yearbook of the United States Department of Agriculture, which is made up of papers on farm subjects, written by experts, may be procured free by applying to your congressman or senator. The United States Department of Agriculture will send also, on request, a list of the publications issued each month by the department, so that a selection may be made. Any bulletin which you see mentioned in your farm paper as being published by an experiment station, and which you think would be helpful to you, may usually be procured by writing to the director of the station and asking for the bulletin.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. Bailey, *Director*

Course for the Farm Home { Martha Van Rensselaer, *Supervisor*
Mrs. Ida S. Harrington, *Assistant Supervisor*

VOL 1. No. 9 | ITHACA, N. Y. FEBRUARY 1, 1912 | RURAL LIFE SERIES No. 1

READING IN THE FARM HOME

DISCUSSION PAPER

One is known by the company he keeps. Books are company.

We desire to know what is read in the farm home. Will you not co-operate by telling us what you read, what you find to be best, and how you solve the problem of reading in the home? We should be glad to have you answer the following questions as best you can, and return them to us. Future agricultural conditions will depend to a large extent on what is read in the farm home and on the amount of reading done.

1. Give the names of any books or stories that you have enjoyed reading aloud or that you have enjoyed listening to when read aloud. Mention the most enjoyable features of the best book you have read.

2. Have you added any books on household economy to your library this year? if so, give their titles.

3. Have you found useful any of the United States Government bulletins or the state bulletins on household topics? if so, which are they?

4. Of the books that you have read this year, which have you liked best?

5. Have you purchased during the year any books especially for children? if so, give titles.

6. What are your children's favorite books? Let the children answer this question.

7. Have you ever used one of the traveling libraries sent out by the State Library? If so, was it a house library, or a library sent to a group of taxpayers, a grange, or a club? (Underline the word or expression that shows the kind of library that you have used.)

8. Do you still have access to one of the libraries referred to in question 7?

9. What has been the most serious drawback, within your experience, to the reading habit?

10. Can you, with a group of other women, form a reading club and use our bulletins and a traveling library as a basis for study? Make an effort to do so and report to us your progress.

Name..

Address...

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 11 — ITHACA, N. Y. MARCH 1, 1912 — FARM HOUSE SERIES No. 3

THE LAUNDRY

FLORA ROSE

Cleaning is a sanitary measure; without it, health may be endangered and life shortened. Dirt in itself may not always be harmful, but its

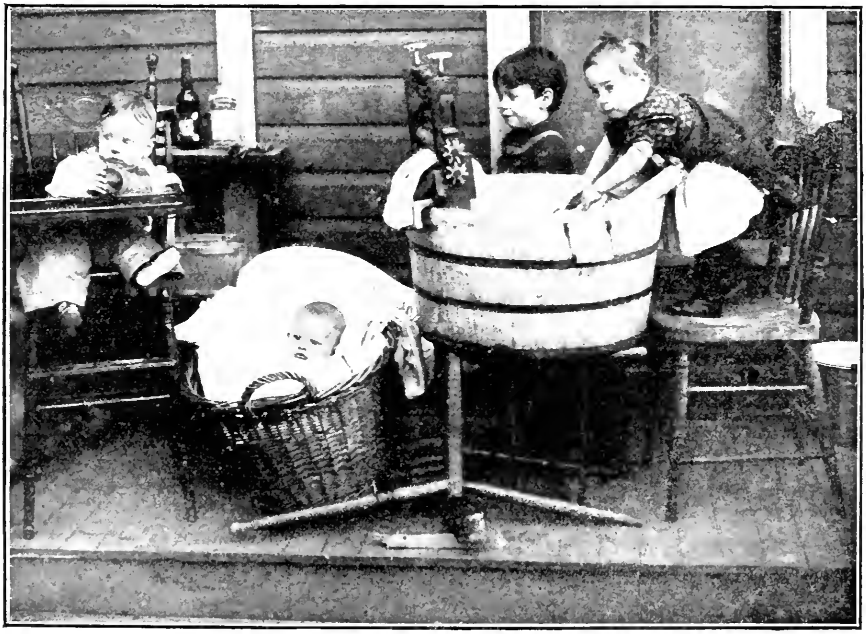


FIG. 37.—*The family, washing*

presence at least forecasts harm while its removal may be just that necessary "ounce of prevention." One of the most important sanitary measures in the home, then, is the weekly washing. It is not merely in order to gratify our sense of the æsthetic that we go to the extreme of upsetting family routine for one day each week, but also to prevent soiled clothing from becoming dangerous to its wearer.

Why is soiled clothing dangerous to its wearer?— The skin acts as a heat-regulating apparatus through evaporation of perspiration, and thus reduces body heat. It also serves in some measure to eliminate the wastes of the body in the form of secretions. Perspiration and secretions are absorbed by clothing, and bits of dead skin are continually being rubbed off to find their way into the meshes of the fabric. After a time, the limit of absorption by the clothing is reached; its pores become clogged. The clothing begins to have a damp, sticky, oily feeling. If it has been starched the garment becomes limp. In this condition, if clothing is not actually dirty it is at least unwholesome to wear, for it prevents proper absorption and evaporation of moisture from the body and thus actually increases its warmth in summer and its cold in winter. It is a matter of common experience to mothers and nurses that the fretting of a small child may sometimes be due to clothing that has become damp and sticky with wear. A change to clean garments gives the needed relief, by furnishing a fresh absorbing surface.

Washing, then, has a threefold purpose: to remove dirt and thus reopen the pores of the cloth; to dry the cloth so as to renew its power of absorption; and to destroy any bacteria that may be in it. As a household process laundering often proves an arduous task instead of an interesting occupation, for, unfortunately, many houses are not equipped in a way to remove the burdens incident to wash-day. An understanding of conditions will greatly aid the person having the washing to do, though such knowledge cannot take the place of proper equipment as a labor-saving device.

FABRICS

A first step toward gaining necessary knowledge of laundry methods is to learn something of the nature of the fabrics to be laundered and how they respond to the cleansing agents or solvents generally used in the laundry. The common fibers used for clothing are of both vegetable and animal origin. The chief vegetable fibers are cotton and linen; the animal fibers, wool and silk. Among the common laundry cleansing agents, called reagents, are two classes of chemicals known as acids and bases. Acids were so named because of the sour taste common to many of them. Acids and bases possess as a characteristic property the power to unite with each other to form a third substance called a salt. Therefore they are said to neutralize each other; for the biting acid and the eating base have through their union become harmless or neutral. For example: if hydrochloric acid (muriatic acid) and sodium hydroxid (lye), both of which if strong can almost instantly eat holes in any fabric and even into flesh itself, are united in certain proportions a harmless salt, common table salt, is formed. The bases chiefly used in the laundry are known as alkalis. The chief household alkalis are lye, washing soda, ammonia, and borax.

Cotton and linen

The soft fibrous material covering the seeds of the cotton plant is known as cotton. If a single mature cotton fiber were examined under the microscope, it would show itself to be a long, flattened, twisted tube, thicker at the edges than in the middle. Its hollow, twisted condition gives to cotton a characteristic lightness and elasticity, making it suitable for the manufacture of fine yarns. Linen is a product of the flax plant. A linen fiber under the microscope looks like a long, transparent tube with thick, smooth walls and a central canal. Fabric made from linen is stronger and more lustrous than that made from cotton and is a better conductor of heat. Both cotton and linen consist for the most part of a plant substance, cellulose, and they respond similarly to chemical substances or to cleansing agents.

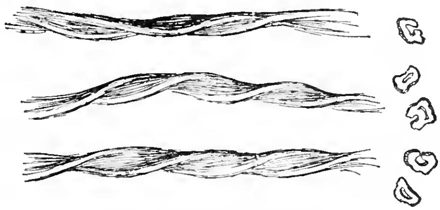


FIG. 38.—*Cotton fibers*

Action of acids on cotton and linen.— Strong mineral acids have an eating (corrosive) action on cotton and linen; if they are allowed to eat for any length of time, the fabrics are entirely destroyed. Such eating, or corrosion, is greatly increased by heat. Cold dilute mineral acids affect the fabrics but little if the acid is thoroughly washed out immediately after its use, but the cloth may be seriously injured if the acid is allowed to dry on it. The appearance of the cloth may not undergo any change, but its durability will be affected. The mineral acid having the least effect on vegetable fibers is hydrochloric acid, more commonly known to the housekeeper as muriatic acid; but hydrochloric acid also damages fabric if allowed to dry on it.

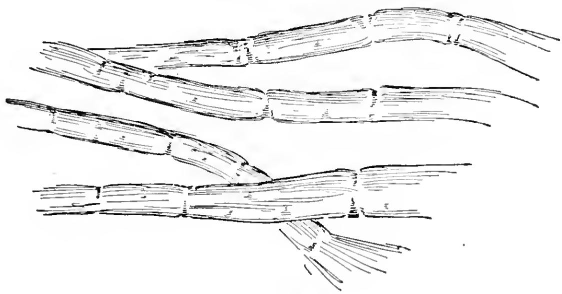


FIG. 39.—*Linen fibers*

The organic acids—such as acetic acid in vinegar, oxalic acid in tomatoes, tartaric acid in grapes, and citric acid in lemons—have no action on cotton and linen unless they are allowed to dry on the fabric and are subsequently moistened and ironed dry with a hot iron. Then destructive results are produced.

The presence of starch in the cloth lessens the destructive action of any of the acids on it.

Action of alkalis on cotton and linen.—The action of alkalis on cellulose differs from that of acids. Dilute washing-soda solution, borax, and soap have little or no harmful action on cotton or linen, but lye is more destructive to these fabrics, especially at high temperatures and if allowed to act for any length of time in the presence of air. If a fabric made from cotton fibers is immersed for two minutes in a strong solution of lye it assumes a gelatinous appearance, and if it is then immediately removed and washed free of the lye it is found to have shrunken greatly and to have become much closer and firmer in texture than it was before the immersion. The action of the strong alkali for the limited time mentioned has actually strengthened the cloth. It was thought at one time that the process just described would be very valuable in the manufacture of textile goods, but it so increased the strength of the fabric treated that garments were slow to wear out; hence its use was discontinued because it lessened sales for the manufacturer. A modification of the process, known as mercerization, gives to cotton goods a glossy, silky appearance without materially increasing its durability. It must not be thought, however, that because the limited action of strong alkali strengthens a fabric, its long-continued action will be harmless. Its first effect is strengthening, but if its action is continued beyond the brief time mentioned it will gradually destroy cloth.

Wool

Many animals have a hairy covering, called wool. Wool is the most important animal fiber used in the manufacture of clothing. When woolen cloth is washed it undergoes a characteristic shrinkage. This shrinkage is increased by the use of strong soaps, by rubbing, by quick changes in temperature while the fabric is wet, by the use of strong alkalis, or by ironing with hot irons.

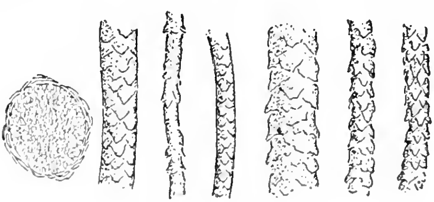


FIG. 40.—*Woolen fibers*

Wool fiber has a characteristic appearance and may readily be distinguished under the microscope from any other textile fiber. Its surface is covered with little horny scales, all laid in one direction.

According to the source of the wool from which the fiber is obtained, its surface is comparatively smooth or its serrated edge is very conspicuous. Wool fiber has been shown to be composed of numerous small segments, called cells, the overlapping edges of which give a characteristic external horny layer. When woolen cloth is wet, its fibers expand somewhat and there is a loosening of the projecting edges of their segments. As the cloth dries, the projections of adjacent fibers interlock, drawing the fibers closer together. If the cloth is dried slowly the interlocking is slight. If the cloth is rubbed briskly while wet, or if a hot iron is used in ironing it, the interlocking of its fibers is increased and the shrinkage is correspondingly greater. The use of strong soap on woolen goods greatly increases the amount of shrinkage; for the alkali of the soap acts chemically on the woolen fiber, softens it, and causes the toothed edges to become more prominent. A marked interlocking of fibers occurs, causing the characteristic decrease in the size of the garment, with the attendant thickening of its fibers resulting in the board-like condition of badly-washed wool.

Action of alkalis on wool.— Strong solutions of alkali, such as lye or washing soda, have a softening effect on wool; if allowed to act on it for any length of time they reduce it to a soapy-like liquid.

Dilute solutions of borax, or a mild soap, if not much hotter than blood heat, have only a slightly injurious action on wool. In cleaning woolen fabrics a good mild soap is the least injurious form in which to use an alkali.

Action of acids on wool.— Dilute acid does not affect wool materials, but strong mineral acids will decompose them. In no case is the action of acids on wool so destructive as on cotton. Dilute acid may be dried on wool with no noticeable weakening of the fiber.

Comparative action of acids and alkalis on cotton and wool.—A graphic illustration of the comparative action of acids and of alkalis on wool and on cotton and linen is furnished by an experiment that may be performed to determine whether a fabric is all wool, or part wool and part cotton:

Saturate a piece of the cloth to be tested in dilute sulphuric acid. Dry it without washing. Rub it briskly between the hands. If cotton is present it will fall out in the form of grayish white powder. Or weigh a small sample of the material and boil it for four or five minutes in a 4 per cent solution of lye. Dry and weigh it again. The final weighing will show how much of the material is wool, for the lost wool will have decreased the weight of the piece of cloth correspondingly.

Silk

Silk is the most delicate of all fabrics and stands halfway between cotton and wool in its reaction toward both acids and alkalis.

Action of acids on silk.— Silk is readily attacked and disintegrated by a concentrated acid solution. Dilute acid solutions weaken the fabric, but not so seriously as they weaken cotton.

Action of alkalis on silk.— Concentrated alkali solutions act on silk vigorously, but a little less vigorously than on wool. Dilute alkali solutions weaken silk and destroy its luster.

As laundering concerns itself continually with the action of alkalis and acids on fabrics, the preceding outline should aid one in grasping some of the reasons for the several laundry processes.

WATER

A bountiful supply of water good for laundry purposes is an important factor in successful laundering. Water is the natural solvent for much of the dirt that accumulates on clothing; moreover, it acts as a carrier to rid the clothing of all forms of dirt, both soluble and insoluble. Unfortunately, good drinking water is not necessarily equally good for laundry purposes, as water may hold in solution substances not hurtful to health but very detrimental to cleaning processes. A water good for the laundry should be clean, soft, clear, odorless, free from discoloration, free from iron, free from organic matter.

Hard and soft water

The very characteristic (its solvent power) that renders water valuable as a cleansing agent (detergent) is the cause of its greatest shortcomings; for on its way to us water may pass over, or through, soils that contain soluble substances of an undesirable nature. The characteristic known as hardness, possessed by some waters, is due to the presence of lime salts gathered in the way described. Hard water is not the best for laundry purposes, as lime salts decompose the soap used and form in its place an insoluble lime soap, which collects as a curd on the surface of the water. Such soap decomposition takes place as long as any lime remains in the water and the cleansing (detergent) properties of soap are not in operation until every bit of lime has combined with soap to form lime soap. By leaving minute particles of lime soap in its pores, hard water is said to weaken a fabric. If the available supply of water is hard, then, the problem of the housekeeper is to find some means of removing lime or of reducing its ill effects.

Temporary and permanent hardness.— According to the nature of the lime salts present, water is said to be either temporarily or permanently hard. Temporary hardness is caused by the presence of carbonate of lime, and such water may be softened by boiling. If the boiled water is allowed to stand, the lime settles at the bottom of the receptacle and the softened water may be drawn from the top of it. Permanent hardness is due to the presence of sulfate of lime. Boiling has no softening effect on permanently hard water.

Another salt often very obnoxious in laundry water is iron. Its presence, even in very small amounts, may give a yellow tinge to clothing, owing to the deposit of minute particles of iron rust in the pores of the fabric.

Organic matter may be present in the water used for laundry purposes, which causes clothing washed in it to become dangerous to the wearer. It is very desirable in all the cited cases to eliminate mischievous substances.

A number of materials for softening water are on the market. The cheapest and best of them are alkalis, known as washing soda, lye, borax, and ammonia. In softening water the objection to the use of any chemical is the injury it may do to the fabric.

Materials for softening water

Washing soda (sodium carbonate).— Washing soda is the best alkali to soften water for general household use, for, while effective in its action, it is not so corrosive as to render its handling difficult or its use unduly harmful, nor is it expensive. It should never be used in its dry form, however, for it is an alkali sufficiently strong to eat holes in a fabric if it is used in full strength, and wherever a particle of the dry substance falls a strong solution is formed. Carelessness causes many of the complaints against present-day laundry methods.

Lye (sodium hydroxid or caustic soda).— Lye is an alkali of far greater strength than washing soda; one pound of lye being equal to about twelve pounds of washing soda, it should be used with just so much the greater caution. It should never be used save in solution and, as the solution deteriorates very rapidly on exposure to air, if any quantity is made it should be kept in bottles or jars tightly stoppered with rubber stoppers. The compound formed by exposing lye to the action of air and water, is washing soda, so there is no advantage in using it after all. Lye is much more difficult to handle, and its action is so much more corrosive than is that of other alkalis that it is not advisable to use it in the home laundry.

Borax (sodium biborate).— One of the mildest alkalis to use in the laundry is borax. This alkali is more expensive than either lye or washing soda and is not so vigorous in its action; but in some instances it is greatly to be preferred to either lye or washing soda. Washing soda and lye, unless they are thoroughly rinsed from clothing, have a tendency to cause yellowing, particularly when starch is used afterward. Borax, on the other hand, has a tendency to whiten fabrics and is added directly to starch, in order to give it good color and to increase its clearness. When colored fabrics or wools are to be washed in hard water, borax is one of the best alkalis to use for softening the water; therefore it should be on the laundry shelf for that purpose if for no other.

Ammonia (*ammonium hydroxid*).— Ammonia is another good alkali for softening water when it is not advisable to use stronger alkalis. Ammonia is a very volatile substance, consequently it should be used only when the laundry process is to be conducted quickly. It is better and cheaper to purchase the full-strength ammonia from a druggist and then dilute it, than to buy the article known as household ammonia, which is of unknown strength.

To soften water.— Both permanently and temporarily hard water may be softened by distillation, but that method involves apparatus not practicable for the average home.

If water is temporarily hard, however, it may be softened by being boiled, then allowed to stand until the lime settles. The top water is afterward drawn off. The method of boiling water to soften it is without doubt the best if it softens the water sufficiently, as no harmful chemicals are left in the water to injure fabrics.

Either temporarily or permanently hard water may be softened by adding lime or washing soda to the water, then allowing it to stand in open kegs for several days before its use. The water should then be drawn from the top. If the water is boiled after the addition of the softening agent, the time for standing may be considerably lessened. Neither of the two processes just described is much in use in the household, as the time consumed by them is often considered unwarranted. The more common method is to add washing soda, lye, borax, or ammonia at the time of washing. The addition of one of those substances at that time prevents the action of the lime on the soap. A good suds may thus quickly be procured, but it does not rid the water of the lime-soap curd which forms and which, in part at least, becomes entangled in the pores of the cloth. The entangled curd has a weakening action on the fabric and gives it a close, filled-in appearance.

The only satisfactory method of getting rid of iron is to add washing soda to the water, then let the water settle for five or six days before using it. The top water is afterward drawn off.

Water may be softened by any of the following methods:

1. For each gallon of water, use two tablespoons of a solution made by dissolving one pound of washing soda in one quart of boiling water. The solution should be bottled and kept on hand, as it is a useful cleansing agent (detergent).

2. For each gallon of water use one fourth tablespoon of lye dissolved in one cup of water.

3. For each gallon of water use one tablespoon of borax dissolved in one cup of water.

If water is very hard, increase the amount of alkali used.

Organic matter

Organic material may be precipitated by the use of alum in the form of an alum-borax mixture. The sediment should be allowed to settle and the water may then be drawn from the top.

To remove organic matter.— For each gallon of water use one tablespoon of a mixture made up of two thirds borax and one third alum. If the water is rich in organic matter, use more than one tablespoon of the mixture. When water is very scarce, alum is sometimes used to separate the dirt from the water and the water is then filtered and used again.

SOAP

In the "good old days" when the home was the center of larger industrial activities, soap-making was conducted as a household process. In the spring it was a familiar sight to see the winter supply of wood ashes pounded down into a barrel and set on a platform ready for "leaching." A hole was made in the compacted ashes and water was poured into it. The water leached down through the ashes into little troughs in the platform. Then it was collected in kettles, ready to be used for making soap. The resulting liquid was the homemade lye of the housekeeper of old. A kettle of melted fat hung near the barrel on a big iron tripod, and to the contents of the kettle the housewife added the lye, boiled the two together, and tested the mixture now with an egg, now with a feather, in order to see if it was of the proper strength. After two or three days of anxious effort her task was completed, and the resulting mixture, called soft soap, was put away in barrels for winter use.

Alkalis.— Among the alkalis familiar to the housekeeper is that known as lye. Lye is a term that is used loosely to describe two substances similar in properties but different in composition. Caustic soda and caustic potash are names that better describe what we commonly call lye. Both kinds of lye have a strong eating (corrosive) action, caustic potash being stronger than caustic soda; both have the power of uniting with fats to form soaps soluble in water. Soap is a convenient and effective form in which to use the caustic lye in either of its two forms, as the corrosive nature of lye is so modified as to render it useful without being unduly injurious to fabrics.

There is much difference of opinion as to which kind of lye produces the better soap. That question is settled "practically" in favor of the

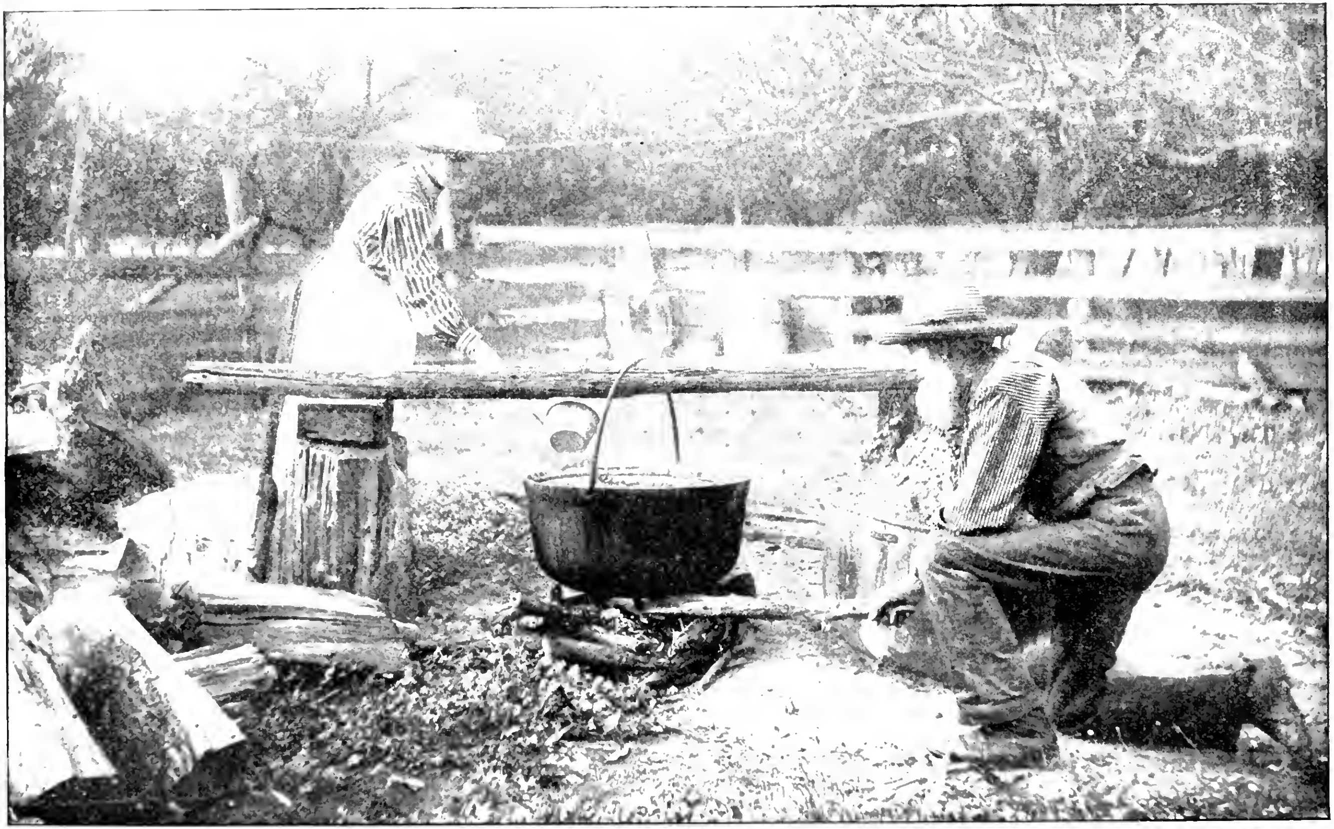


FIG. 41.—*Soap-making in olden days*

sodium lye, for it can be produced at a smaller cost. It is safe to say that much of the soap on the market is made from sodium lye.

Fats.— Fats are compounds formed by the union of a class of substances known as fatty acids, with glycerin. The nature of a fat depends on the fatty acids that enter into its composition. For example, in tallow the chief fatty acid is stearic acid. Tallow, in common with other fats containing relatively large proportions of stearic acid, has the property of "hardness" and a high melting point. The chief fatty acid in olive oil is oleic acid, which gives to the oil the characteristic softness and low melting point of fats rich in oleic acid.

When lye is mixed with a fat it breaks the fat up into the fatty acids and glycerin, of which it is composed. The lye unites with the fatty acids to form a new compound, called soap, and glycerin remains. This is the process of soap-making called saponification. As may readily be seen, the nature of the soap formed will depend, first, on the nature of the fats used, whether they are hard or soft, clean or rancid; second, on the kind of alkali used, whether potash lye or soda lye; third, on the nature and amount of impurities contained in both fat and alkali; fourth, on the completeness of the process of soap-making (saponification). If the operation of soap-making is not properly conducted, the reaction between the fat and the lye is incomplete and a soap is produced that contains free fat and an undue amount of free alkali. Such soap is greasy, unduly active, and a poor cleansing agent.

The adulteration of soap.— It is not uncommon to find some foreign, insoluble substances in soap, which have been added merely to increase its weight and bulk. In cheap soaps resin is often added as an adulterant. It is rather difficult to say when resin may be considered an adulterant, for in small quantities it is of value in laundry soaps because it whitens the clothing. Resin gives a brown color to soap, therefore a dark brown soap may safely be rejected as containing an excess of resin.

The best advice to give the housekeeper is: Select soap manufactured by a reliable firm and give it a trial. It is not economy to use cheap, poorly-made soaps in the laundry. A common mistake is to think that the use of one kind of soap will prove satisfactory for all purposes; this common belief possibly accounts for much of the dissatisfaction that exists regarding the various soaps on the market. In the manufacture of soap, when just sufficient alkali is used to change completely all the fat present into soap, the soap is known as a mild soap. If an excess of alkali is used, either a medium or a strong soap is produced, the degree of strength depending on the amount of free alkali left in the soap. Every laundry should contain all three grades of soap, mild, medium, strong. A mild soap should always be used when the presence of even a small amount of free lye would be injurious in washing flannels, woolen goods, or fabrics either frail or delicate in color. A medium soap should be used for the more durable colored goods. A strong soap is best for most white goods, both cotton and linen.

Action of soap.— This leads us to consider the way in which soap acts as a cleansing agent. Much of the dirt in clothing is due to the adherence of particles of dust to the fatty impurities that have accumulated on the fabric. While rubbing and water alone will loosen and remove much of ordinary dirt, the process of removal is greatly facilitated by the use of a soap solution. Soapsuds penetrates the pores of a fabric more completely than does water alone: thus, first, it softens dirt; second, it emulsifies the fats, that is, soapy water acts to divide fatty material into very minute particles, which are removed from clothing by rubbing and pounding. The particles are then held in suspension in the suds. The adherent dirt is caught in the emulsion and the whole is carried away in the washing process. When free alkali is present it unites with the fatty impurities present to form more soluble soap; this action removes a part of the fat and aids in removing more in the process of emulsification. These facts serve to illustrate the desirability of the use of strong soaps when much grease is present.

Aside from its use in removing dirt, soap has antiseptic properties. It is not safe to depend on it as the only disinfectant in cases of contagious diseases, but it is a valuable purifier for the ordinary household washing.

A question often arises as to the advisability of using kitchen-waste fats in making homemade soap. While some housekeepers may find such use an economy, the fact remains that homemade soaps are generally poorly made and of inferior quality. The inferiority of homemade soaps may be owing to several causes. The so-called cold process is usually followed in making homemade soaps, and rarely is the union of the fat with the lye complete. The fat used in homemade soap is often filled with impurities and they are not always removed before the soap is made. As the fat in kitchen waste varies greatly in composition, it is impossible to give the exact amount of alkali required for homemade soap. It is evident, then, that homemade soap is likely to be filled with impurities and to be both greasy and excessively caustic, " eating, " because of the presence of free fat and an undue amount of free alkali. For the benefit of those housekeepers who wish to try its manufacture, however, some formulas are given on pages 122 and 123.

Soap substitutes and accessories

Soap is the best all-round cleansing agent to use in the laundry, but there are other substances with similar cleansing properties that may be used with good results in its place:

Soap bark.— In the leaves, stems, roots, or bark of some plants occurs a soap-like substance that is closely allied to soap in its power to remove dirt. Soap bark (quillaia bark) is a familiar example of this kind of cleansing agent. When powdered soap-bark is put into water it gives a good lather, and it acts quickly and effectively to remove dirt and stains.

Ox gall.— Another substance with soap-like characteristics, but of animal origin, is known as ox bile, or ox gall. Soap bark and ox gall are doubtless well known to the housekeeper, for they are often used to wash garments easily injured by the strong alkalis, as, for instance, woolens, and fabrics printed in delicate colors.

Additional soap substitutes.— Bran, rice, potatoes, and starch are frequently recommended as good substitutes for soaps in washing delicate fabrics and colors. A story is told of one laundress who replaced soap altogether with a well-cooked potato mixture.

Substances that facilitate the washing process.— Various substances are used with soap to facilitate or accelerate the washing process. Among them may be mentioned lye, washing soda, borax, and ammonia; turpentine, paraffin, kerosene, and benzine; and fuller's earth.

We have already considered the action of the alkalis in softening water, their value in soap-making, and the effects of their use on various textile fabrics. They are often used in connection with soap, in excess of the amount needed to soften hard water, to facilitate the removal of dirt by their direct action on it. In many cases it is a mistake to pursue such a course if the alkali used is lye. The same objections may hold with washing soda, but in lesser degree. If the fabric is of such nature that limited amounts of lye or washing soda will not seriously injure it, a strong soap will contain all the free lye that it is safe to use. Borax and ammonia are mild alkalis and may be very useful when the presence of some free alkali is needed and the effect of a strong soap would be injurious. They are often utilized in connection with a neutral or mild soap for washing flannels and delicately colored fabrics.

Turpentine, paraffin, kerosene, and benzine all are valuable aids to the laundress, for they exert a solvent action on matter of a fatty nature and thus soften and loosen dirt, materially facilitating the washing process. The disadvantage in the use of turpentine, paraffin, and kerosene is, that clothing in the washing of which they have been used may be insufficiently rinsed afterward and retain the odor of them. Benzine is dangerous to handle because of its inflammability, and cannot be used with very hot water because it evaporates.

Fuller's earth is a valuable adjunct in cleaning, and is sometimes used partly to replace soap in the washing process when the articles to be washed are in a very greasy condition and the use of a strong soap is not sufficient, and when the use of a strong alkali is not advisable.

Manufacturers have put on the market various soaps and powders that have incorporated with them some one or more of the above substances. Naphtha and borax soaps and soaps containing fuller's earth may be purchased and give satisfaction. Good results may be obtained at less cost by the use of soap and the accessory material uncombined, though it may often be more convenient to use the manufactured article that is a combination of the two.

Washing powders.— Something should be said of washing powders. They are mixtures of soap and some alkali such as lye, washing soda, and borax, and may have incorporated with them some one or more of the substances of the nature of turpentine, paraffin, fuller's earth. In the case of the poorer powders a "filler" is used, that is, a substance giving weight to the powder and very properly considered an adulterant. The best powders contain large amounts of soap and only small amounts of alkali. A report is made of one of the poorer varieties of washing powder containing only 10 per cent of soap. Enough has been said in connection with the effect of alkalis and their use to guide the housekeeper in her purchase and use of these powders. There may be occasions when a washing powder is desirable, but indiscriminate use of these strong cleansing agents is inadvisable and should not be generally indulged in.

Directions and formulas

Homemade soap:

1 pound can lye dissolved in 3 pints cold water

5 pounds fat melted, 1½ tablespoons borax, ½ cup ammonia

When lye mixture has cooled add it to fat, stir until as thick as honey pour into wooden or pasteboard boxes lined with oiled or waxed paper, set away to harden.

Soap bark:

1 pound soap bark equals 2 pounds soft soap. Use in place of soap.

Bran:

1 cup bran

1 quart water

Boil ½ hour. Strain, boil bran in a second quart water ½ hour. When needed, reduce with warm water.

Potato water:

Grate two large-sized potatoes into 1 pint clean, clear, soft water. Strain into 1 gallon water, let liquid settle. Pour off and use.

Soap solution for washing colored goods:

¼ pound mild or medium soap to 1 gallon water

Soap solution for ordinary purposes:

1 bar ordinary washing soap
2 to 3 quarts water

Shave soap and put into saucepan with cold water. Heat gradually until soap is dissolved (about 1 hour).

Soap solution for soaking clothes:

1 bar ordinary soap
3 gallons water
½ to 1 tablespoon turpentine
1 to 3 tablespoons ammonia

Soap solution for washing much-soiled woolens and delicate colors:

½ pound very mild or neutral soap
¼ pound borax
3 quarts water

Soap jelly with turpentine incorporated:

1 bar soap
1 quart water
1 teaspoon turpentine or kerosene

A liquid for washing delicate fabrics and colors may be made from laundry starch, grated potatoes, rice, flour, etc. The water in which rice has boiled may be saved and utilized for the same purpose. The cleansing liquid after cooking should be as thick as cream and should be diluted from one to four times, according to the amount of dirt in the clothing. Rinse clothing in a more dilute solution, which may be blued for white clothes.

STARCH

Starch is in the form of minute compact granules, insoluble in water, obtained from many plant tissues. We are familiar with the powder that a mass of these granules forms. When starch granules are subjected to the action of heat and moisture, the heat causes the moisture to penetrate the granules; they swell, burst, and form a thick, sticky mass known as starch paste. Starch has the power of penetrating the pores of a fabric. The kind of starch used determines its penetrative power. On drying, it gives to clothing a characteristic stiffness.

There is a twofold reason for the use of starch in laundry operations: first, the glazed surface of a starched garment keeps clean longer than an unglazed (unstarched) surface; second, the increase in body of the starched garment gives it increased resistance to moisture and the garment is considered correspondingly more attractive in appearance. In the commercial laundry and in those industries in which the finishing of fabrics is a consideration, use is made, not of one kind of starch, but of several, according to the nature of the work to be done. We are all familiar with the especially attractive appearance of the nicely laundered new garment as it comes to us fresh from the factory. Starching in the factory and in the commercial laundry has been reduced to a science, in which intelligent knowledge and skill in the use of materials play an important part.

The three kinds of starch chiefly used in the commercial laundry are rice starch, wheat starch, and cornstarch. In Belgium and France, as well as in other European countries where laundry work is of noted excellence, rice starch is used almost exclusively. The finer quality of the work done seems to justify the purchase of the higher-priced rice starch.

Little rice starch is used in this country except in the textile industries for finishing fine fabrics, such as lawns and organdies. It is not used because of its cost, because of the greater convenience of using the starches that are locally produced in large quantities, the possibility of getting very good and nearly similar results with wheat starch, and the American preference for the greater body that wheat starch and cornstarch give.

The American housekeeper uses, as a rule, only cornstarch, because of the cheapness of cornstarch and a lack of knowledge of the different characteristics of the other starches. It is interesting to note how the exclusive household use of cornstarch has withdrawn other varieties of starch from the shelves of the retail grocery, until it is practically impossible for the housekeeper to obtain wheat starch unless she buys it from the big laundry-supply companies.

The purpose of the launderer is to blend starch with the fabric in such a way as to make the starch a natural part of the cloth; to give the desired degree of stiffness and yet keep the fabric pliable; to give a body as enduring as possible and capable of resisting moisture; to give clearness, good color, and any desired finish, whether dull or glazed. That purpose can be accomplished only with a knowledge of the materials to be used.

The several varieties of starch vary considerably in their ability to penetrate fabrics. The reason for the use of rice starch with finer fabrics by those considered to do a superior grade of laundry work, is because of its penetrative quality. It is said to penetrate the pores of a fabric more completely than does any other starch and to give a finer, smoother finish. Next to rice starch in penetrability comes wheat starch. Corn starch is the poorest of the three starches; it has a tendency to lump and show starch spots after ironing.

Rice starch gives a natural, pure white color to fabrics, while cornstarch gives a yellow color, and wheat starch a color between the two. Since wheat starch and cornstarch are the practical possibilities in the American household, further comparison will be between these two. When good color, smoothness of surface, pliability, and fine finish are desired, wheat starch gives the better results; moreover, it is said to hold up better in damp climates. Cornstarch gives the greater stiffness, or body, to a fabric.

According to the finish desired, advantage is taken of the different characteristics of wheat starch and cornstarch. When flexibility and finish are the main objects, wheat starch is used alone; if stiffness is the chief consideration and finish may be overlooked, cornstarch is used alone; when it is desirable to combine stiffness with flexibility and good finish, a mixture of cornstarch and wheat starch is used. There is no reason why the use of wheat starch should not extend to the home laundry, and it is to be hoped that the time will come when the retail trade will place wheat starch on the grocery shelf.

Various substances are used with starch to increase its penetrability and prevent it from sticking to the iron, as well as to give pliability to the cloth, increase its body, and improve its color. Of these substances may be mentioned borax, alum, paraffin, wax, turpentine, kerosene, gum arabic, glue, and dextrin.

Borax in starch.— Borax increases the penetrability of starch and aids in preventing it from sticking to the iron. Moreover, starch containing borax adds gloss to a garment, increases its whiteness, and gives it greater body, together with more lasting stiffness, than it would otherwise have.

Alum.—Alum is used alone, or with borax, in starch to improve color, to increase penetrability and pliability, and, last but not least, to thin the starch mixture. When alum is cooked with a starch paste it causes the paste to become thinner. "Cooking thin" with alum does not affect the strength of the starch mixture and is an advantage when a stiff starch is desirable and the thick mixture would be inconvenient to handle. By the use of alum, starch may be made thin without dilution. Alum has been objected to by some persons as being somewhat injurious to fabrics.

Wax, paraffin, turpentine, lard, butter.—Oily substances are used to add a smoothness, gloss, and finish, to prevent the starch from sticking to the iron, and to aid in preventing the absorption of moisture.

Gum arabic, glue, and dextrin.—Substances resembling glue are used with starch to increase its stiffening power. They are sometimes used alone when the white color of starch is considered a disadvantage in stiffening colored fabrics.

Directions for using starch, starch substitutes, and starch accessories.— In making starch a naturally soft water is greatly to be desired, but if the water furnished is hard it should be softened with borax, not with washing soda nor lye, since washing soda and lye tend to produce a yellow color with starch:

1. ¼ cup wheat starch to 1 quart water gives flexible, light, durable finish.
2. ¼ cup cornstarch to 1 quart water gives moderate body stiffness.
3. ½ cup wheat starch to 1 quart water gives flexible, firm finish.
4. ½ cup cornstarch to 1 quart water gives stiff body finish.

A mixture of the two starches may be varied, to produce any desired result.

Directions for cooking starch.— Starch should first be mixed with a little cold water and then stirred slowly into boiling water and cooked in accordance with the following directions:

1. If wheat starch is used, cook slowly at least 25 or 30 minutes.
2. If cornstarch is used, cook slowly 15 or 20 minutes.
3. If a mixture of wheat starch and cornstarch is used, the wheat starch should be added first and cooked 15 minutes. The cornstarch should then be added and the mixture cooked 15 minutes longer. Stir mixture frequently, to prevent sticking and formation of a skin.

Thorough cooking of starch is very desirable in laundry practice, for it increases the penetrability of the starch and decreases its tendency to stick to the iron. If borax, lard, butter, kerosene, or other like substance is used it should be cooked with the starch, to insure thorough mixing.

Thick starch:

½ cup starch, mixed with ½ cup cold water
1 quart boiling water
½ to 1 level tablespoon borax
¼ level tablespoonful lard or butter or kerosene or turpentine; or ¼-inch-square wax or paraffin
Mix, and cook as directed under directions for cooking starch.

Thin starch:

½ cup starch, mixed with ½ cup cold water
3 quarts boiling water
Other ingredients, same as for thick starch
Mix, cook as directed under directions for cooking starch.

Clear starch:

Dilute ½ cup thick starch with 1 quart hot water.
Clear starch is used for thin muslins, infants' dresses, etc.

Raw starch:

Same proportions as for thick starch.
Use borax but omit fatty substances.
Stir thoroughly before using.

Raw starch is often used with very thick or very thin goods, to increase their stiffness. A fabric will take up a greater amount of starch in the raw form than in the cooked form. The desired stiffness is produced by the cooking given the raw starch by the heat of the iron. The difficulty of ironing is increased by using raw starch, for unless the ironer is skillful the starch cooks on the iron and starch specks are then produced on the clothes. Moreover, raw starch gives a less durable finish than does cooked starch.

Rice starch:

¼ cup rice
1 quart boiling water
Wash rice, cook in water until very soft.
As water evaporates, add more to keep quantity up to 1 quart.
When cooked add another quart boiling water.
Strain, without squeezing, through double thickness cheesecloth or through flannel. Use while hot. The most satisfactory starch for delicate fabrics is rice starch, and it may be used in place of clear starch.

Glue for stiffening dark clothes:

12 ounces dark glue
1 quart water
Boil together until glue is dissolved, cool somewhat. Dip the garment to be stiffened into glue and wipe off excess of glue with piece of black cheesecloth, sateen, or calico. After sprinkling roll garment in black cloth and iron on ironing board covered with black cloth. Any glue left over may be saved and used again.

To increase stiffness:

1. Partly dry garment before starching.
2. Add 1 tablespoon powdered gum arabic reduced to liquid in ½ cup boiling water, to the stiff starch mixture.
3. Use borax.
4. Add a small amount of glue to starch mixture.
5. Dry quickly.

Gum arabic as a starch substitute:

4 tablespoons pulverized gum arabic
1 pint cold water
3 tablespoons alcohol
Put water and gum arabic in saucepan and set into saucepan containing boiling water.
When dissolved, strain through cheesecloth, cool, add alcohol, pour into a bottle, cork, set away for use. The alcohol acts as a preservative and the mixture may be kept for any length of time.

BLUING

White fabrics have naturally a creamy tint, which may be deepened to an unpleasant pale yellow by careless washing, by insufficient rinsing, or by lack of exposure to the bleaching influence of sunlight and fresh air. Bluing is used to hide the yellow color, because blue and yellow are complementary colors and when used together in proper proportions give the effect of whiteness. Bluing is unwarrantably used to hide a yellowness which comes from careless washing.

Indigo.— Indigo (originally of plant origin, to-day manufactured artificially) was at one time the chief source of bluing compounds, but now is very little used in the laundry.

Prussian blue.— Prussian blue gives a better color than does indigo and is easier to use. The objection to prussian blue is that it is an iron compound, is decomposed by alkalis, and yields iron rust. If all soap or other alkali is not carefully rinsed from clothes and they are then blued with prussian blue, they may become yellow or covered with tiny rust spots. If, however, prussian blue is used after the precaution of careful rinsing, it gives satisfactory results. As it is one of the chief liquid blues on the market, careful rinsing has become a laundry rule.

Ultramarine. — Ultramarine (originally finely ground lapis lazuli, but now artificially manufactured) is also a satisfactory blue. Finely ground it is put up in the form of small balls or squares. It is very generally used in the home. The better the product, the more finely ground it is. It is poor economy in buying ultramarine to get a cheap article, as its particles are coarse and show on the blued garment.

Aniline blue.— Aniline blue is a coal-tar product and its action in bluing is that of a dye. It is the blue used by nearly all commercial laundries, but it is not much used in the home. It will not set in an alkaline liquid and requires acid to bring out its color. Being a dye, it is difficult to wash out of clothing.

No one kind of bluing may be recommended to the housekeeper. She must experiment for herself, choose one good variety, and learn to use that one properly.

Sufficient bluing should be used to make a little of the bluing water taken up in the cup of the hand show a pale sky-blue color. More than that amount of bluing should not be needed. It is always best to make a small amount of strong bluing in a bowl of water, then draw from it to color the water in the tub.

TO REMOVE STAINS

The ordinary washing process is sufficient to get rid of most of the dirt in clothing, but certain stains may require special treatment in order to insure their complete removal. Some stains are insoluble in water, or in soap and water, or they may be made so by the action of heat and thus become permanently set during the washing. It is wise always to look over clothing for such stains and to remove them before the washing begins. Such examination will often save time, and wear and tear on garments, even when it is possible to remove the stain in washing, as only the part of the garment most affected is then treated and the removal of the stain does not involve severe treatment of the whole garment.

The process of removing stains is fundamentally the same as that of removing other forms of dirt, that is, to find some substance in which the stain is soluble or which will aid in its mechanical removal. The chief solvents valuable in removing stains that resist ordinary washing processes are:

Turpentine (inflammable)
Benzine, naphtha, or gasoline (inflammable)
Carbona
Kerosene (inflammable)
Ether (inflammable and an anæsthetic)
Chloroform (anæsthetic and a poison)
Alcohol (inflammable)
Olive oil, lard, etc.
Fuller's earth and french chalk
Naphtha soaps
Water, both hot and cold
Oxalic acid (a poison)
Javelle water
Benzol
Hydrogen peroxid
Sunshine
Ammonia
Borax
Salt
Vinegar
Lemon juice
Hydrochloric acid (a strong acid very corrosive to fabrics and to flesh)
Ink eradicator
Milk

Method of removing stains

Blood:

1. Wash in cold water until stain turns brown, then rub with naphtha soap and soak in warm water.

2. Rub with common soap, then soak in water to which a teaspoon of turpentine has been added.

3. If the goods is thick apply a paste of raw starch to the stain. Renew paste from time to time until stain disappears.

Chocolate:

Sprinkle with borax and soak in cold water.

Coffee:

Spread stained surface of the cloth over bowl or tub. Pour boiling water through the stained part of the cloth. Pour the water from a height so as to strike the stain with force.

Cream:

Wash in cold water, then with soap and water.

Fruit and wine stains:

1. Treat with boiling water as for coffee.

2. If the stain resists the boiling-water treatment, soak the stained part of the cloth for a few minutes in a solution made from equal parts of javelle water and boiling water. Rinse thoroughly with boiling water to which a little dilute ammonia water has been added. Repeat if necessary.

Grass stains:

1. Soak in alcohol.
2. Wash with naphtha soap and warm water.
3. If the fabric has no delicate colors and the stain is fresh, treat with ammonia water.
4. For colored fabrics, apply molasses or a paste of soap and cooking soda. Let stand over night.

Grease spots:

1. Wash thoroughly with naphtha soap and water.
2. Soften old grease spots with turpentine, oil, or lard before washing the cloth.
3. Dissolve the grease in benzine, alcohol, chloroform, ether, carbona, or benzol.
4. For delicate fabrics dissolve grease spots in ether or chloroform. Chloroform and carbona are useful because noninflammable.
5. Apply a paste of fuller's earth or chalk to absorb grease.

Indigo:

Treat as for coffee.

Ink:

Ink is often difficult to remove, as it varies greatly in composition. It is well to experiment with a corner of the spot before operating on the whole.

1. If the stain is fresh, soak the stained portion of the cloth in milk. Use fresh milk, as the old becomes discolored.
2. Wet the stain with cold water. Apply a ten per cent solution of oxalic acid to stain, let stand a few minutes, and rinse. Repeat until stain disappears. Rinse in water to which borax or ammonia has been added. (Oxalic acid is a very poisonous substance.)
3. Javelle water will remove some ink stains. Apply as for rust stains.
4. Treat with hydrochloric acid as for iron rust.
5. Treat with lemon juice and salt, as for iron rust.
6. Use alcohol for some ink stains.

Milk is the only reagent given that does not remove color.

Iodine stains:

Soak in alcohol, chloroform, or ether.

Iron rust:

1. Wet the stained part with borax and water, or ammonia, and spread over a bowl of boiling water. Apply a ten per cent solution of hydrochloric acid, drop by drop, until the stain begins to brighten. Dip at once into alkaline water. If the stain does not disappear add more acid and rinse again. After the stain is removed, rinse at once thoroughly in water to which borax or ammonia has been added. The borax or ammonia is to neutralize any acid that may linger. Less dilute acid may be used if the operator is skillful.

2. Proceed as with hydrochloric acid, but use a ten per cent solution of oxalic acid instead of hydrochloric acid. Oxalic acid is not so detrimental to fabrics as is hydrochloric acid, but it is a deadly poison even in dilute solution.

3. Wet the stained part with a paste made of lemon juice, salt, starch, and soap, and expose it to sunlight. This is a simple method to employ, but it takes longer and is often not effective.

4. Soak stain in javelle water for a few minutes, then wash. Repeat until stain disappears. Javelle water is weaker in action than is hydrochloric acid. All the iron-rust-removing substances destroy color, and unless care is taken will greatly weaken the fabric.

Lampblack:

Saturate spot with kerosene. Wash with naphtha soap and water.

Machine oil:

1. Wash with soap and cold water.

2. If the stain does not respond to the soap-and-water treatment, use turpentine as directed for paint stains.

Meat juice:

Wash in cold water, then with soap and water.

Medicine stains:

Soak in alcohol.

Mildew:

Mildew is very difficult to remove if of long standing.

1. Wet stains with lemon juice and expose to sun.

2. Wet with paste made of one tablespoon of starch, juice of one lemon, soft soap, and salt, and expose to action of sun.

3. Treat with paste made of powdered chalk and expose to action of sun.

Milk:

Treat as directed under cream.

Mucus:

Soak in ammonia water or in salt and water, then wash with soap and cold water.

Paint:

1. Wet the spot with turpentine, benzine, or alcohol, let it stand a few minutes. Wet again and sponge or pat with a clean cloth. Continue until stain disappears.

2. For delicate colors treat with chloroform.

3. If the paint is old it may take some time to soften. Treat old paint stains with equal parts of ammonia and turpentine.

Perspiration:

1. Wash in soapsuds and expose to the action of sunshine.
2. Treat with javelle water as directed for iron rust.
3. Treat with oxalic acid as directed for iron rust.

Scorch:

Scorched fabrics can be restored if the threads are uninjured.

1. Wet the stained portion and expose to the action of the sun. Repeat several times.
2. Extract juice of two onions, add one cup vinegar, two ounces fuller's earth, and half an ounce soap. Boil. Spread paste over scorched surface. Let it dry in sun. Wash out thoroughly.

Stove polish:

1. If fresh, remove by washing.
2. If the stain is old, treat as directed for tar and lampblack.

Tar:

Treat as directed for lampblack.

Tea:

1. Treat as directed for chocolate.
2. Soak the stain in glycerin, then wash.

Varnish:

Treat as directed for paint.

Vaseline:

Wash with turpentine. Boiling sets this stain.

Wagon grease:

Soften with lard or oil and wash in soap and water.

WASHING

While Monday has long been chosen as the home day for washing, there may be good reason to postpone the process until Tuesday. Before washing day, clothing should be thoroughly gone over to discover rents and stains, carefully sorted, and the white clothes put to soak. This preliminary work requires time which it may be inconvenient to give on Saturday and which may not be justified on Sunday.

The following outline is suggested for the preparation of clothes for washing:

1. Sort the clothes according to kind:
   a. White cotton and linen clothing

Table linen and clean towels
Bed and body linen
Handkerchiefs
Soiled towels and cloths

b. Colored clothing

c. Flannels

2. Mend rents, except in stockings.
3. Remove stains.
4. Put as many white clothes to soak as is practicable. Some colored clothes having fast colors may be soaked if very much soiled.

The purpose of soaking soiled clothes before washing them is to soften and separate the fibers of cloth in order to loosen dirt. Water alone accomplishes this purpose to a great extent; but the use of a soap solution, or a soap solution to which has been added borax, ammonia, or other alkali, and turpentine, kerosene, or benzine, makes the washing process both easier and quicker.

It is well before beginning the washing to make a soap solution, as it gives a quick suds and is more easily handled, and its use will therefore save time.

All the clothing should not be put to soak in the same tub. If three tubs are available, soak table linen and clean towels in one, bed linen and body linen in a second, soiled towels and cloths in a third. If only two tubs are available, wash table linen and clean towels without preliminary soaking. Soiled towels and cloths should always be soaked before washing.

If colds have prevailed in a family, the handkerchiefs should be put to soak in a solution of boric acid in a basin by themselves, and should be separately washed and boiled for twenty minutes.

Wet the garment to be soaked, rub the more soiled part with soap solution, and fold that part in. Fold and roll each garment separately and pack it into the tub with the other garments. Folding and rolling prevents the dirt in the soiled parts from spreading. Cover the clothes with warm soapy water, to which may have been added an alkali such as borax or ammonia, and an oily substance, perhaps turpentine, kerosene, or benzine. Directions for making soap solutions are given under the heading "Soap" (p. 117). Cover the tub, and if possible let the clothing soak in it during several hours or over night. If colored clothes are to be soaked, cover with warm water or with water very slightly soapy. No alkali should be used with the colored clothing.

No arbitrary order can be recommended for washing clothes, but flannels, white goods, and colored goods should be washed separately as the washing process differs somewhat for each case.

A few simple explanations may aid the housekeeper in solving some of her problems. Heat tends to expand the threads of the cloth, and the expansion aids in removing dirt caught between the threads. If the cloth is cooled during the washing process, the thread contracts and the dirt is again entangled; consequently, after the cloth has once been warmed, one of the objects of the launderer should be to maintain an even or a rising temperature. In the commercial laundry an even temperature is kept by turning the right amount of steam into the washing machine. In the home laundry, boiling water added from time to time will aid in keeping an even temperature. A good suds is necessary in the washing process. As the suds falls, that is, as it is used up by uniting with dirt, more suds should be supplied by adding more soap or soap solution. If insufficient soap is used, insoluble black specks are often left on the clothing.

All utensils, receptacles, and apparatus should be immaculately clean.

Outline for washing white linen and cotton clothes

1. Put water on to heat.
2. Make soap solution.
3. Rinse clothes from water in which they have soaked.
4. Wash clothes in warm suds in following order:
    a. Table linen and clean towels
    b. Bed linen
    c. Body linen
    d. Handkerchiefs
    e. Soiled towels and cloths
    f. Stockings
5. Wash again in clean suds. Wring.
6. Boil in clean, slightly soapy water.
7. Rinse in clean, clear water. Wring.
8. Rinse in bluing water. Wring.
9. Starch.
10. Hang to dry.
11. Remove from line, dampen, and fold.

Directions for washing:

1. Have plenty of hot water before beginning the washing. If possible the water should be soft; if it is not, soften it as directed on p. 115.

2. Make a soap solution; use one cake of soap to two or three quarts of water.

3. Rinse the clothes from water in which they were soaked, removing as much of the dirt as possible. Parts of the clothing that are very much

soiled should be rubbed a little and rinsed in fresh water before the garments are put into a tub or a washing machine. The precaution of rinsing saves wear and tear on the whole garment.

4. Pour warm water into tub or washing machine; if the water is hard, soften it with washing-soda solution or borax. Add enough soap solution or soap to make a good suds. A tablespoon of turpentine, kerosene, or benzine may be added to the washing water as well as to the water in which clothing has soaked. Put in clothes to be washed. Rubbing is essential for soiled garments. It may be accomplished in one of two ways: by using the washboard and old-fashioned tub, or by using a washing machine. It is well to have a board for very soiled parts, such as hems and edges, but the washing machine is a great improvement on the older method.

Whenever the water becomes dirty, use fresh suds. Clothes cannot be made clean without the use of plenty of water. Keep up a good suds while washing, and add hot water from time to time. If a washing machine is used, do not put enough water in the machine to float the clothes; if you should, they would escape the mechanical action of the dasher and would not be sufficiently rubbed. Clothes should be wrung from the wash water through the wringer. The screws of the wringer should be adjusted to bring its rolls close together and clothing should be folded so as to give it an even thickness in passing through the wringer, for heavier garments loosen the screws of the wringer. Fold in buttons and hooks and turn the wringer slowly.

5. A second suds is generally necessary, though it may be omitted if the clothing has been only slightly soiled. Shake out clothes wrung from the first suds, look them over for soiled parts, turn them wrong side out, and drop them into second suds. Wash and wring them ready for boiling.

6. Clothes should be clean before they are boiled, as the boiling process is intended not so much to remove visible dirt as to destroy germs and purify the clothing as well as to whiten it. Boiling is omitted when a naphtha soap is used, as the soap loses its effect in very hot water; it is asserted that boiling is not needed because naphtha itself is a purifier. Nevertheless, at least once a month, the clothing washed at other times with naphtha soap should be boiled.

Fill the boiler half full of cold water; if the water is hard, soften it. Add enough soap solution to make a light suds. Half fill the boiler with clothes, wrung and shaken out from the last suds. Use plenty of water and do not put too many clothes into the boiler. Bring the water very gradually to the boiling point and boil ten minutes.

Kerosene or turpentine is sometimes added to the boiler water to counteract the yellow color given clothing by the use of the dark resin soaps. It is better to avoid kerosene and turpentine at this point if possible, as clothing treated by them requires very thorough rinsing to remove the odor. Each boilerful of clothes should be started with clean cold water. Cloths or clothes containing lampblack or machine oil may be placed in the hot water left in the boiler after the last clothes have been wrung from it. Kerosene or turpentine should then be added, as they are the solvents for such dirt.

7. Rinsing is an important part of the washing process, for if soap or some of the strong alkalis are left in the cloth, they may be very detrimental in the bluing or starching process.

If water is hard it should be softened for rinsing with either borax or ammonia and not with washing soda. The rinsing water should be hot. The clothes should be slowly lifted with a clean stick from the boiler into a dishpan, and drained or wrung and shaken before being put into the rinse water. It is not always practicable to use more than one rinse water before bluing the clothes, but better results are obtained when the clothes are rinsed more than once. With some kinds of bluing, the presence of soap or an alkali precipitates the blue as iron rust. If the starch used is not pure, and any lye or washing soda or soap has been left in the cloth, a yellow color is produced from the starch impurities by the action of those alkalis. Wring from the rinsing water and shake out the garments.

8. *Bluing.*— It is impossible to give any rule for the amount of bluing to use or the depth of color to be decided upon. Some fabrics, such as soft, loosely-woven fabrics, absorb more bluing than others. The amount of bluing to be used is a matter for experimentation by the launderer. Clothes should not be allowed to stand in the bluing water, as they might become streaked.

If a ball bluing is used, tie it in a thick cloth, wet, and squeeze it into a bowlful of hot water. Use a part of the resulting solution for bluing the water. More of the bluing in the bowl should be added to the bluing in the tub from time to time as the clothing takes it up. As some kinds of bluing are in the form of minute particles, the bluing water should be stirred each time before adding clothes to it. After they are wrung, unstarched clothes will then be ready for drying.

9. *Starching.*— Make the starch according to directions previously given. Starch those garments requiring thick starch first, as moisture from the clothing gradually thins the starch and a medium stiff, medium thin, and thin starch gradually result.

Stiff starch.— Collars, cuffs, shirt bosoms.

Medium stiff starch.— Shirt waists, collars and cuffs, coarse lace curtains.

Medium thin starch.— White petticoats, duck skirts, and some dresses.

Thin starch.— Skirts and dresses when a stiff finish is not desired; shirt waists.

Clear starch.— Infants' dresses, fine laces, curtains, light-weight table linen when it is desirable to give it some body.

Raw starch.— Collars, cuffs, shirt bosoms when an extra stiffness is desired; some light curtains.

The starch should be thoroughly worked into the cloth so as to distribute it evenly through the threads of the fabric. Such working insures a smooth, even stiffness and prevents starch spots in ironing. All garments starched with boiled starch should be dried thoroughly before being dampened. They should be dampened several hours before being ironed. If articles are to be raw-starched they should be thoroughly dried first. They are then dipped into the raw starch and rubbed as for washing, squeezed dry, and spread out on a clean sheet or cloth, but not one over the other. They should cover only half the sheet. The other half of the sheet should be folded over them. Then the sheet with its contents should be rolled tightly and allowed to stand for two or three hours to insure even distribution of moisture.

10. *Drying.*— When possible the process of drying should accomplish more than the mere removal of moisture. Clothing should be hung where it will be freely exposed to the action of fresh air and sunshine. Such exposure purifies and bleaches at the same time. In many commercial laundries a chemical bleach is used to whiten clothing that is necessarily dried in steam closets, and consequently does not have the beneficial bleaching action of sunshine. The home launderer does not often have to consider the need for commercial bleaching agents.

The launderer should be provided with a clothespin bag or, better still, with a clothespin apron having a deep wide pocket.

When possible, lines should be taken down each week, but when they cannot be they should be well wiped with a damp cloth before hanging up clothes. The clothespins should be clean. Each article should be turned wrong side out and hung with the threads of the material straight; the garment should be shaped as nearly as possible in its natural shape. Avoid hanging pieces by corners, for thus hung they would be pulled out of shape. Fasten garments by their bands when possible. Table linen, bed linen, and towels should be well stretched and hung very straight; the larger pieces should be pinned in at least four places, as it is nearly impossible to iron properly a piece that was improperly hung. Careful hanging greatly reduces the labor of ironing. When the clothes are brought in from the line the clothespins should be put into the apron or basket kept for that purpose and placed where they will be kept clean.

Starched pieces should not be allowed to freeze and should be removed from the line as soon as dry. Long hanging reduces their stiffness. If flannel underwear is properly stretched and hung it may be folded and put away without further treatment.

11. *Dampening.*— Clothes should be dampened some hours before being ironed, because during the interval between moistening and ironing the moisture becomes distributed evenly and does away with the necessity of using a superfluous amount of water. The dampening is best done at night, but only as many articles should be sprinkled as can be ironed next day, for damp fabric will mildew if left wet for a few days, especially in hot weather. Although clothes should be well dampened, they should not be drenched. Very often, trouble in ironing starched pieces is owing to overwetting. The starched part is soaked and made limp and sticky. A clean whisk broom kept for the purpose is the best thing to use for sprinkling clothes. Some persons have used a toy sprinkling pot. There is, however, a danger in its use, for it may rust and give rise to rust spots on clothing. Large pieces should be sprinkled and folded separately. Small pieces may be sprinkled and laid together before folding. Care should be taken to fold and roll garments smoothly, as this aids in their ironing. The rolls of dampened pieces should be packed closely in a basket lined with a clean cloth and covered with a clean cloth.

Table linen and other linen should be made very damp, not wet. If table linen is sprinkled with a mixture of one part alcohol and four parts water, the result after ironing will be a slight stiffness resembling that of new linen.

If an ironing machine is used, unstarched pieces may be removed from the line while still damp and ironed immediately without the preliminary sprinkling.

Washing colored clothing

The processes of dyeing have so improved that almost all wash goods are now considered to have fast colors. This is particularly true of the better grades of fabrics, in which the dye seems to attach itself with especial firmness to the fibers of the cloth. Though a color may be said to be fast, it is only relatively fast. Colored goods require more careful treatment than do white goods. The conditions that most affect the stability of colors in fabrics are: long-continued action of water and soap; strong alkalis or acids; strong sunlight, which is a powerful bleaching agent and is used frequently for bleaching.

In washing colored clothing, the factors just enumerated should be kept in mind. Colored clothing should not be soaked for any length of time unless its color is known to be very stable. Any soap used in the washing process should be a mild soap in solution, or if the color of the goods to be washed is very delicate the soap solution should be replaced by soap bark, bran, rice water, potato water, or cooked-starch water. The washing process should be conducted quickly, and in water not very hot. After washing, colored garments should be turned inside out and hung in a very shady or dark place, and should be taken in as soon as dry. Fading is more often owing to careless drying than to any fault in washing. Washing powders and strong alkalis should never be used with colored clothing. If the water needs softening, use borax. If starch, bran, rice water, etc., are substituted for soap, use the mixture as if it were soapsuds.

In starching colored clothes, rub the starch in thoroughly and wipe off any excess of it; no difficulty will then be experienced with white starch spots.

To set color.— Sometimes a fabric shows a decided tendency to fade even under the best washing conditions. It is always well if there is any doubt about fading to test a small piece of the cloth before washing it. If the color fades, then an attempt should be made to set it. With most colors, the dyer uses chemical substances which cause a firmer union between the color and the cloth. Such substances are called mordants. The process of making a color fast may sometimes satisfactorily be used by the housekeeper to strengthen weak colors. The household mordants are brine, vinegar, sugar of lead, and alum, used in the following proportions:

To 1 gallon water add
½ cup mild vinegar, or
2 cups salt, or
1 tablespoon alum, or
1 tablespoon sugar of lead (poison)

Vinegar is best for pinks. Small pieces of cloth should be tested in each of the above solutions and a choice made after the test. The cloth of which the color is to be made fast should be left in the mordant solution over night and may be left in for several days with good results. It should be thoroughly dried before being washed. Even with relatively strong colors, soaking a fabric over night in a brine solution before washing it for the first time may render it far less susceptible to fading influences than it otherwise would be. The effect of brine, however, is said not to be lasting. Colored goods are often rinsed in a dilute salt solution just before drying them.

Washing woolens

The action of water and alkalis upon wool has already been explained in describing the characteristics of the wool fiber.

Strong soaps should never be used in washing woolens, nor should soap be applied directly to the garment. The soap should be used in solution. A great deal of stress is laid upon having the water used in washing flannels not much more than lukewarm, for at a lukewarm temperature soap and water have a less detrimental action on wool than at any other temperature. It is even more important than the lukewarm water to have all the waters used of the same temperature, in order to avoid changes from hot to cold water, or vice versa, as sudden changes in temperature cause shrinkage.

Have two receptacles ready for washing flannels. Pour into one of them water not too hot for the hand to bear comfortably. Add enough soap solution made from a neutral or mild soap or a wool soap to make a good suds. If the water is hard, or the clothing is very much soiled, add a tablespoon of borax or ammonia for each gallon of water used. Shake or brush the garments free from dust, and put them into the water to soak for ten or fifteen minutes. Before beginning to wash the flannels, prepare a second tub of water having the same temperature as that of the first or a slightly higher temperature. Wash one garment at a time by drawing through the hands and washing up and down in the water; avoid rubbing if possible. Pass the garments from the first to the second water; the second water should be a suds if the first suds has not removed all the soil. Rinse free of soap in several waters; be sure to keep the temperature constant. Wring through a loosely set wringer. Turn wrong side out and hang in a warm place, but not near a fire as heat will cause shrinkage. When nearly dry, turn. When drying, shape by pulling and stretching.

It is a mistake to ascribe all the shrinkage in woolen garments to washing. The moisture, heat, and movements of the body may cause a marked shrinkage.

If flannels are to be pressed, they should be allowed to dry first and should then be covered with a slightly dampened piece of cheesecloth and ironed with a moderately hot iron. The cheesecloth draws up the fibers of the flannel, giving it the fluffy appearance of a new garment. Underwear and woolen stockings should be stretched into shape and should not be ironed. For very soiled garments the soap formula given under the heading "Soap" will be useful.

Blankets are washed in the same way as other woolen articles, except that, because of their size, only two blankets or only one pair of them are washed at a time, and fresh water is used for each pair. After wringing, they may be stretched and dried on curtain stretchers. If stretchers are not available, blankets should hang on the line until perfectly dry, and occasionally the water should be squeezed from the hanging ends. To press them, fold them evenly and carefully and wrap them in a sheet. Keep them smooth and unwrinkled and place a flat board over them. Weight heavily and let them remain thus for several days.

Washing silk

Silk should be washed in much the same way as wool. While it is not so strongly affected by soaps and alkalis as is wool, its gloss is destroyed by the use of strong cleansing agents. The delicacy of the fiber makes hard rubbing impossible, for it breaks the fibers and destroys not only their durability but also their silkiness. In wringing silk, place it between dry towels or heavy cloths and put it through a loosely adjusted wringer. Iron it on the wrong side while still damp, with a moderately hot iron. Silk is very easily scorched and, if the iron is too hot, the silk will be stiff. Push the iron back and forth with a wriggling motion to give softness and pliability to the silk. It is often best to iron silk under a cloth; to do so gives less body and a softer finish.

Ribbons, if of good quality, may be very successfully washed. To iron them, cover them with a dry cloth and move the iron frequently back and forth over the surface of the cloth above them.

Washing laces

It is often best to dry-clean fine laces, as they thicken slightly in washing. To wash them, use a warm neutral soap-solution to which has been added ammonia or borax. Squeeze out the dirt by pressing the lace in the hands but do not rub it; rubbing breaks the delicate threads. A good way to wash fine lace is to baste it to strips of cheesecloth, being careful to catch down all its points. Put it to soak over night in warm soapy water containing a little borax or ammonia. Wash it, by squeezing, then rinse it free of soap. Old yellow lace may be bleached by stretching it, while wet, around a bottle, and standing it in the sun, rewetting the lace occasionally. Javelle water may be used to bleach lace. Lace may be stiffened by rinsing in a mixture of two tablespoons of alcohol to one cup of water; by rinsing in borax water, two tablespoons to a cup; or by using gum arabic, one eighth teaspoon to a cup of water. If a yellow color is desired, dip the lace in coffee or tea.

Black lace should be cleaned by squeezing it repeatedly in a mixture of one cup of strong coffee and one tablespoon of ammonia. Rinse in gum arabic water made with coffee, to give natural stiffness.

Lace curtains should be washed with as near an approach to the care given to lace as is practicable. Clear-starch them, stretch them, and pin them out on sheets, one curtain over another. If available, it is better to use curtain stretchers than sheets, but if care is taken to square off the first curtain and stretch it straight and even, good results may be obtained by pinning the curtains to sheets.

BLEACHING

In former times, dependence was placed on sunshine, fresh air, and a green sward for bleaching all manufactured cottons and linens. Such dependence on natural agents has been obviated by the ability to procure similar results from the use of chemicals.

In the home laundry, we still use natural agents to whiten and purify household linen. That is the greatest advantage which the home laundry has over the commercial laundry; in the latter, in a majority of cases, clothes are dried in steam closets, and some chemical must replace the sun's rays to bleach a garment left yellow by washing. The action of the sun and air is not merely to bleach but to disinfect, and clothes thus dried have a freshness and sweetness that cannot be duplicated by any other method.

Occasionally, even in the household, it may be necessary to supplement the natural bleaching process by the use of chemicals. If a garment has yellowed by age or by being packed away with starch in it, it may be expedient to use a chemical bleach.

The best bleach to use is javelle water, which should be made as follows:

1 pound washing soda
½ pound chlorid of lime
1 quart boiling water
2 quarts cold water

Put soda in granite pan; add boiling water and stir until dissolved; let cool.

Dissolve chlorid of lime in cold water; let settle and pour the clear liquid into the soda; let settle. Pour off clear liquid, bottle, and put away in dark place.

Use, mixed with equal parts or more of water, and do not let the garments stay in over ½ hour. Rinse thoroughly in several waters and lastly in dilute ammonia water.

Moisture is necessary if clothes are to be bleached by the action of the sun. After a garment dries, it should be made wet again and hung out. It may be necessary to repeat the wetting operation a number of times before the yellow tinge yields. It is said that clothes are whitened if they are allowed to freeze out of doors on the line. The reason given for the bleaching action is that freezing causes the clothes to retain moisture, hence the time of their bleaching is prolonged.

IRONING

While a knowledge of conditions aids greatly in ironing as in other operations, experience and skill are necessary to accomplish good results. Ease of ironing and the quality of the product depend on the skill of the operator, on the care that has been used in starching, drying, sprinkling, and folding the clothes to be ironed, and on the kind and condition of the irons. If the garments have been poorly and carelessly starched, the work of ironing is greatly increased. Starchy lumps cook on the iron and damage its smoothness, even when the lumps are immediately removed. The reason for allowing clothes to stand over night after sprinkling is to give them an even dampness that makes ironing easy and successful. If starched goods have been over-dampened, the starch is brought to the surface and a result is produced similar to that of careless starching. If linen is too dry it cannot be made smooth and free from wrinkles. If it is too wet, the process of ironing is laborious.

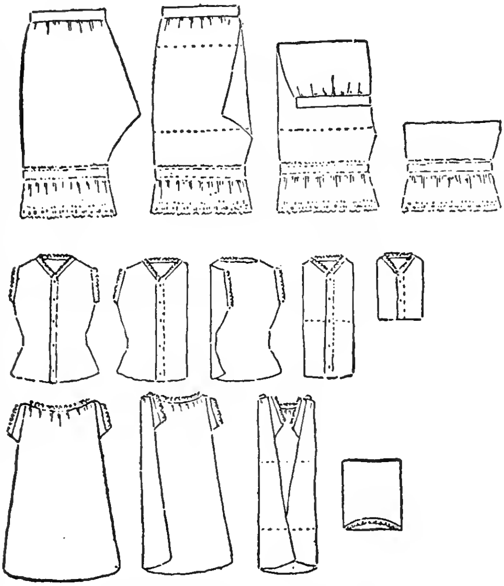


FIG. 42.—*Methods of folding underwear*

It is said that irons that are to be used for starched garments should not be polished by rubbing them on salt or emery paper. A better method is to procure a good yellow pine board, free from all sand and dirt, and rub it with a hot iron until a hard coat of burned resin is produced. The board may be used for polishing the iron. The iron should occasionally be wiped with a piece of wax or paraffin and then with a clean cloth.

Have ready and at hand: a flat, firm, unwarped ironing board or table, tightly covered with a blanket and clean sheet, securely fastened underneath; clean irons; an iron stand, which may well consist of a clean brick; two pieces of old cloth for cleaning irons; a piece of paper folded several times for testing irons; a piece of beeswax or paraffin tied in a cloth, for keeping irons smooth; a bowl of water and a clean cloth for moistening parts dried by exposure to air. Spread a large paper or place a basket under the ironing board to receive the clothes while they are being ironed.

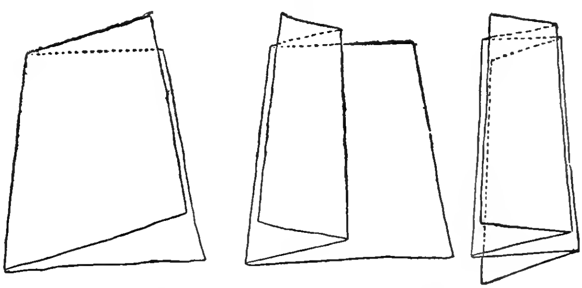


FIG. 43.—*A method of folding sheets or tablecloths*

For ordinary ironing a good firm surface is desirable. A thin woolen blanket and an outside linen cover are sufficient. For embroideries or wool, a thick covering is better, as the fabric should sink into a soft foundation to bring out the pattern in one case and to give a soft finish in the other.

The following simple rules for ironing may be followed:

Iron first that part of the garment which will be least mussed by further handling or in which a little wrinkling will not seriously interfere with good results.

If the garment is trimmed, iron laces and embroideries first, as they dry out quickly because of their porous nature.

Leave as much of a garment folded as possible, to keep it moist. Sometimes it may be convenient to lay a piece of dampened cheesecloth over any unironed part to keep it moist.

A series of illustrations appended will give some of the methods of folding various garments.

Method and order for ironing

Night dresses:

1, Embroidery; 2, sleeves; 3, yoke; 4, body.

Drawers:

1, Trimming; 2, tucks; 3, body; 4, band.

Skirt:

1, Ruffle; 2, hem; 3, body.

Shirt waists:

1, Cuffs; 2, collar band; 3, sleeves; 4, yoke; 5, back; 6, front.

Silk waist:

Iron as above on wrong side while still damp.

Embroideries:

Iron on wrong side on soft foundation, to allow design to stand out.

Laces:

Lay on piece of flannel covered with a piece of cheesecloth. Iron on wrong side and pull out points with tip of iron. Lace should be stretched and pinned out on a hard surface. Pull out at each point and catch down with a pin; or stretch and roll on a bottle.

Tablecloths:

Use heavy irons, iron on both sides, iron partly dry on wrong side and complete process on right side, to bring out pattern. The illustration shows methods of folding during ironing. Fold selvages together first.

Fold all edges evenly, except when folding the lengthwise folds in half. Draw upper half back about one half inch in making the last fold, or that part will be pushed out of place, giving an uneven edge. The same rule applies to sheets, napkins, handkerchiefs, etc. Tablecloths may be folded lengthwise twice and then rolled to avoid creases.

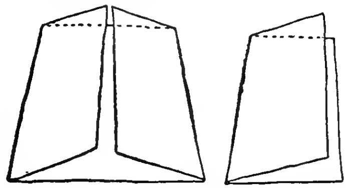


FIG. 44.—*Another method of folding sheets*

Napkins, handkerchiefs, and towels:

Iron and fold as for tablecloths.

Sheets:

The hems of sheets must be smoothly ironed. It is a good plan to iron only that part of the sheet when time is a consideration.

Flannels:

Iron after laying a dampened cheesecloth over them. If they are not covered with a damp cloth, iron on wrong side; have the iron only moderately hot.

Pillow cases:

Iron smooth.

Colored garments:

Iron on wrong side, as to do so prevents fading. Do not have irons too hot.

Silk garments:

Iron on wrong side; to do so prevents shininess.

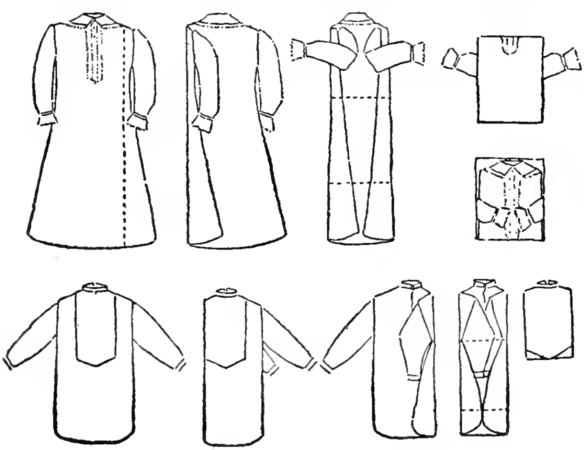


FIG. 45.—*A method of folding*

After ironing, each article should be hung on a frame or clothes-horse to dry and air before it is put away. If hung in a poorly ventilated room the clothes will have a bad odor.

Sprinkling may not be necessary when an ironing machine is used for ironing, if the operator will remove the clothes from the line just at the right time, that is, while they are still damp. The process can be carried through so quickly that it is unnecessary to keep one garment damp while the other is being ironed. One woman, a member of a family of eight persons, reports that with the help of one other person she is able to iron with her hot-roll power ironing-machine all the sheets and pillow cases for eight beds, all the towels, table linen, handkerchiefs, as well as many plain garments for five persons, in one and one-half to two hours. Another woman having a cold-roll power ironing-machine is able, with the help of a second person, to iron the sheets and pillow cases for eleven beds, as well as towels and handkerchiefs in proportion, in twenty to thirty minutes.

EQUIPMENT

A great deal may be said on the subject of laundry equipment. In no part of the house is the amount of labor so modified by the possession of proper equipment as in the laundry. If the water must all be carried into the house from the outside, heated on the stove, used, then carried outside to be emptied, the task is indeed heavy. If tubs and benches must be lifted in and adjusted, and if a washing machine does not take the place of a washboard, the labor is unnecessarily and unwisely increased. A great deal more thought should be given to laundry conveniences in the farm home, for laundry work is hard and trying under the conditions just described and in the majority of cases such conditions are unnecessary. Laundry work may be made comparatively easy and interesting.

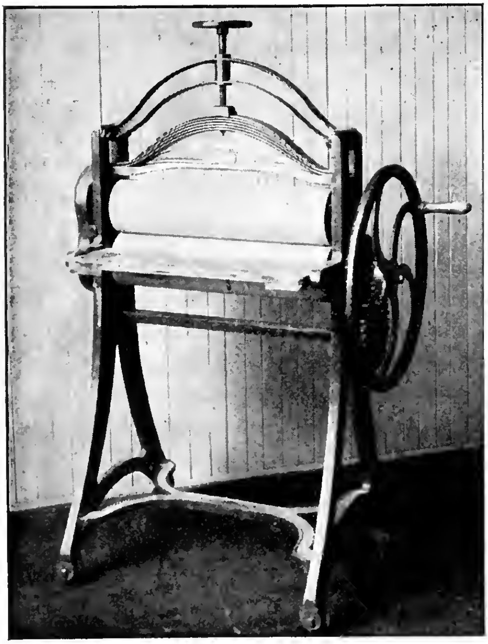


FIG. 46.—*The cold-roll ironing-machine*

Washing machine.—The home laundry should be equipped with a washing machine and at least one stationary tub. It may be that running water has not yet been introduced into house and barn, but at least it is possible to provide a drain for kitchen sink and laundry tub. This makes easier the problem of getting rid of dirty water.

There are now on the market washing machines with wringer attached, which run by power. On many farms the gasoline engine has already become a fixture for grinding corn, separating milk, etc. Why may not the same source of power be used to run the washing machine and turn the wringer? If running water is brought to the barn it should certainly be continued to the house, and, if the water power is sufficient, a water motor may be purchased that can be used for running the washing machine. Some farmhouses are already making the improvements that have been described.

The ironing machine.— The ironing machine, or, as it is often called, the

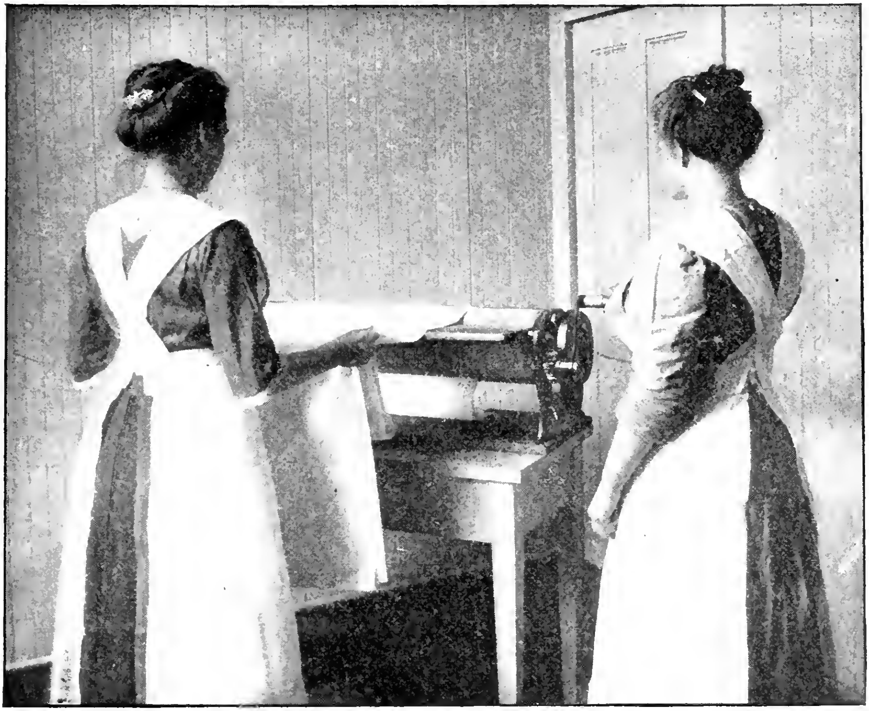


FIG. 47.—*The hot-roll ironing-machine*

mangle, is another device for making laundry work easier than it has been. It may successfully take the place of the hand iron for a larger part of the family ironing. There are two types of ironing machines on the market: (1) cold-roll ironing machines, in which the rollers between which the garment passes are made of wood and are unheated, depending on their weight and pressure to remove wrinkles; (2) hot-roll ironing machines, in which one roll is cold and is covered with a blanket and cloth, just as for an ironing board, and the other roll or concave plate is made of smooth iron and is heated. The cold roll revolves against the heated metal plate.

This is really the more economical and satisfactory ironing machine, although its original cost is greater. The plate may be heated by gas or gasoline. Both kinds of ironing machines are shown in Figs. 46 and 47. The hot-roll ironing machine shown in Fig. 47 may be heated by gas or gasoline by a slight change involving a small expense. If power is available the ironing machine may be run by power. The use of one of these machines reduces greatly the time required to iron in the usual way. Garments with gathers and sleeves cannot be thus ironed to look perfectly smooth and well shaped, but all bed and table linen, towels, handkerchiefs, stockings, such underwear as may not require perfect smoothness, kitchen aprons, etc., may be done successfully and satisfactorily.

Irons.— A number of irons are now on the market for summer use when it is not desirable to have sufficient fire in the range to heat the irons. Some of these are: electric irons, gas irons, and, most practical of all for the country home, denatured-alcohol irons.

For general laundry purposes one size of the ordinary sadiron is sufficient, but it is advisable to put several irons into a well-equipped laundry, to use for the various kinds of work to be done. Among them should be heavy, medium heavy, and small-pointed irons, the last for ironing ruffles, laces, etc.

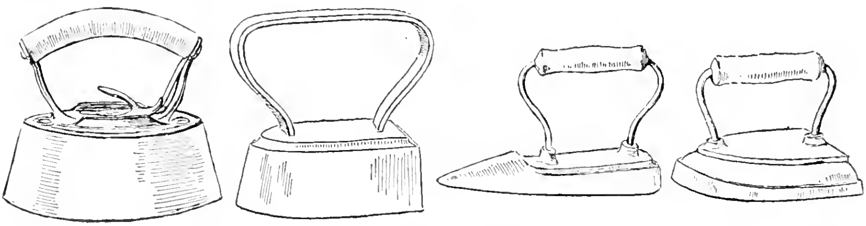


FIG. 48.—*Types of laundry irons*

A frequent cause of poor ironing is the condition of the irons. They must be kept clean and free from rust to do good work. New irons should be heated thoroughly and rubbed with wax or grease before using. If irons are to be put away for any length of time they should be covered with a thin coating of vaseline, clean grease, or paraffin, or wrapped in waxed paper. If starch cooks on, it should be removed immediately with a dull knife. If irons become dirty from careless use, or from being left on the stove during the preparation of the meals, they should be thoroughly washed with soap and water and carefully dried. To keep irons smooth while using them, rub with wax or paraffin and wipe immediately with a clean cloth. They improve with wear, if they have good treatment.

Tubs.— Although a washing machine may be used, there should be one or more tubs in a laundry. Stationary tubs are best, even though running water is not available, for some simple method of draining them can be devised. The tubs are better made of porcelain, enameled iron, or alberine stone. Wooden tubs may be more cheaply constructed; but there is danger of the wooden tub becoming unsanitary from careless handling.

A stationary tub should always be set with regard to the height of the

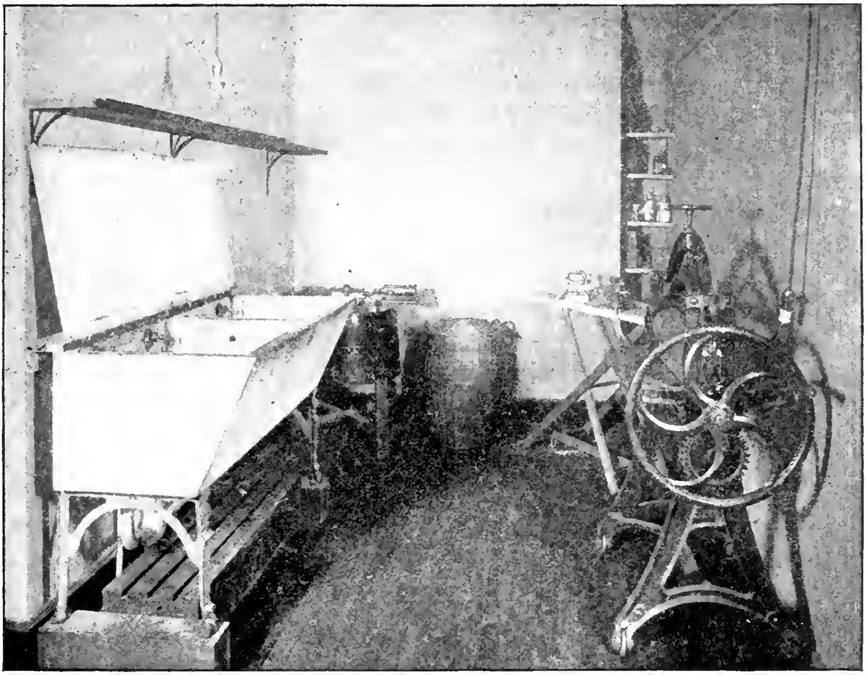


FIG. 49.—*Laundry equipment in an improvised laundry*

person who is to use it most. Many tubs are set far too low and necessitate too much back bending on the part of the operator.

If stationary tubs are not available, fiber tubs are the best to buy for the laundry, as they are light and easy to care for. Galvanized iron and wooden tubs are cheaper.

Laundry bench.— The laundry bench for holding tubs should be of the proper height. Most such benches are far too low, involving effort out of proportion to the task to be accomplished.

Wringer.— A wringer should be a part of the laundry equipment, and the best on the market is always the cheapest. After using a wringer, it should be carefully dried and the screws pressing the rollers should be loosened. When not in use it should be kept covered with a cloth to protect it from dust and dirt. The bearings should be oiled occasionally. Oil dissolves rubber, and that property of oil is taken advantage of in cleaning the rubber rollers. They are carefully wiped with a little kerosene which eats away a thin film of the rubber, exposing a fresh surface. The operation should not be performed frequently, however, and the oil should be carefully and completely removed immediately after its use.

Ironing board.— An ironing board, which has its broader end attached by hinges to the wall, is a great convenience, for then it is always in place and can be put out of the way by folding up against the wall.

Ironing blanket.— The ironing blanket and sheet should be put on smoothly and tacked securely under the board, using short brass-headed tacks. It is a good plan to have a separate blanket and sheet also, which fit the table used in the laundry, as a table is a convenient place for ironing large pieces. The ironing sheet should be kept clean.

FIG. 50.—*Sleeve board*

Sleeve board.— A sleeve board is good not only for sleeves, but for gathers and for small dresses. It is not difficult to manufacture at home.

Character of utensils.— As far as possible, all utensils that are to come in contact with clothing or to contain material to be used on the clothing, should be nonrustable. Tinware is not good for laundry use because of the ease with which it rusts. The boiler should have a copper bottom at least, and is best made entirely of copper. It then conducts heat better and does not rust.

Further supplies.—

- Rubbing board
- Wooden spoon
- Dipper
- Dishpan, enamel
- Tea kettle
- Measuring cup
- Quart measure
- Iron holder
- Teaspoon
- Clothes basket
- Strainer for starch
- Beeswax or paraffin wrapped in cloths to keep irons smooth
- Laundry bags
- Clothes stick
- Pail, enamel or fiber, for emptying water and carrying clothes
- 2 saucepans, enamel, one for starch and one for soap solution
- Iron stand
- Tablespoon
- Case knife
- Clotheshorse
- Scrubbing brushes
- Clothespin aprons, best made of ticking
- Clothespins

It is always best, when possible, to have a separate room for laundry purposes. Much of the apparatus can then be made stationary and many little labor-saving conveniences devised. Some dairy farms have running water, drains, power, steam, and cement floors. It would be a simple matter on such a farm to equip a small room in the barn with the necessary laundry apparatus. One western man has already provided such an equipment and the power and steam used in his dairy are also used in his laundry. He may be quoted as follows: "A laundry provided with stationary wash tubs, with washer and wringer for power use, is an innovation. But why should not the woman of the farm be provided with modern appliances? Why should she be compelled to toil as her great grandmother did? The farmer no longer reaps with a sickle, or even with a cradle. He rides his plow, and often his harrow. He rides his grain drill and corn planter and corn cultivator. He rides his grain harvester and his corn harvester. He loads hay by machinery and pitches it into the barn by horsepower. The time is come when it is positive cruelty to compel, or even allow, the woman to toil on without running water or machine power in the house. The same steam, water, and sewerage system that must be present for the dairy will take care of the laundry. The same power used for grinding feed and separating milk and pumping water and sawing wood will turn the washer and the wringer. Such a laundry is to be desired, also, because it will practically insure clean garments worn by the milkers. A power laundry like this may be rented to the neighbors for, say, 50 cents a day, they to come over and do the work. Such an arrangement will in a measure lighten the burden now resting so heavily on the woman of the farm." The above is quoted from First Annual Report, State Dairy and Food Commissioner, Missouri, 1907.

BULLETINS AVAILABLE IN THE READING-COURSE FOR THE FARM HOME

Farmers' Wives' Reading-Course:

No. 1. Saving steps. Martha Van Rensselaer.
No. 3. Practical housekeeping. Martha Van Rensselaer.
No. 4. The kitchen-garden. John Craig.
No. 5. Flowers and the flower-garden. Compiled.
No. 6. The rural school and the farm home. Martha Van Rensselaer.
No. 7. Boys and girls on the farm. Martha Van Rensselaer.

New Series

No. 4. Bacteriology of the household. Martha Van Rensselaer.
No. 6. Human nutrition, Part I. Flora Rose.
No. 7. Human nutrition, Part II. Flora Rose.

Reading-Course for the Farm Home:

No. 1. The care and feeding of children.— Part I. Flora Rose.
No. 3. The care and feeding of children.— Part II. Flora Rose.
No. 5. Household decoration. Helen Binkerd Young.
No. 7. Household furnishing. Helen Binkerd Young.
No. 9. Reading in the farm home. Martha Van Rensselaer.
No. 11. The laundry. Flora Rose.
No. 13. Cornell study clubs. (On the press.) Martha Van Rensselaer.
No. 15. Personal decoration. (In preparation.) Gratia L. Rice.

The bulletins listed under the Farmers' Wives' Reading-Course can no longer be sent at pound rates. In writing for them, please send one cent postage for each bulletin asked for. The bulletins listed under the Reading-Course for the Farm Home will be mailed without remittance.

The lessons are free of charge. The work is under state appropriation and is available only to residents of New York State. Numerous requests are made from out of the State; we regret that these cannot be filled. It is our custom, however, to place an out-of-state library or the name of a teacher of home economics on our list when requested to do so.

There is no provision for selling the lessons of the reading-course.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 11 | ITHACA, N. Y. MARCH 1, 1912 | FARM HOUSE SERIES No. 3

THE LAUNDRY

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist in your study of scientific home-making. We want your assistance as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the work of the State College in its efforts for rural progress.

Will you please send your opinions on the following points to the Supervisor of the Cornell Reading-Course for the Farm Home?

1. Suggest three ways for making the wash day easier.

2. Compare the cost of having the washing done at home with the cost of having it done at the laundry, taking into consideration the value of the woman's time, the cost of water, soap, heat, and wear and tear of equipment.

3. What laundry equipment have you in your house? Is any part of it run by power? What is your opinion of it?

4. Give your ideas of a well-equipped laundry; if possible, draw a floor plan for a small home laundry, showing where each piece of equipment should be placed to save steps and labor.

5. Is washing good exercise? May it be made so? How should a person stand over the washtub?

Name..

Address..

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 13 | ITHACA, N. Y. APRIL 1, 1912 | RURAL LIFE SERIES No. 2

CORNELL STUDY CLUBS

MARTHA VAN RENSSELAER

"*We have reached the point where no woman dares say that her education is finished.*"

The Cornell Reading-Course for the Farm Home is for individual or club study. Ten or twenty persons in the same neighborhood or vil-

FIG. 51.—*A Cornell study club*

lage may be reading the lessons of the course, but not reading them together. If they would unite in a group, read and discuss the lessons, and afterward "have a little visit" together, they would probably learn more than if each person studied alone; they would surely enjoy more. They might first discuss the subjects of the lessons and afterward have a social hour with something worth while to talk about. In themselves the lessons are not sufficient to give a thorough understanding of the subjects of which they treat. They do, however, introduce those subjects and stimulate to a further acquaintance with them. For such wider acquaintance provision is made by reference to books, so many and so carefully selected that any desired phase of the various subjects may be studied. That the Reading-Course is not only profitable but necessary, has been repeatedly shown by correspondence.

Let me tell you why one woman organized a study club. "I had told my husband all I knew," she said, "and he had told me all he knew; so there was nothing left but for me in the evening to darn stockings and for him to read the papers. Sometimes we were too tired to do even this and went to bed, to get up to go over the same program the next day. Afraid of the monotony of such routine, I asked my husband to drive with me to all the neighbors' houses. When I suggested the formation of a club, one neighbor said, 'I am too old, I have forgotten all my schooling and could not take any part in a program.' Another woman declared: 'I am too busy to spend any time in study.' Still another said, 'I am sure we would have trouble and I guess I will keep out of it.' Nevertheless, I invited all the neighbors to my home. Enough came to elect officers and arrange for future programs. The number grew until both men and women organized for a study of subjects relating to their work. Acquaintance was renewed among those who did not often meet; women who had once been musical practiced again and contributed to the program; and it must be said that refreshments added not a little to the interest of our meetings. One member gave this testimony: 'I feel younger ever since I began to think of something besides getting the meals and washing dishes and cooking and cleaning.' Another said, 'I have only just begun to be interested in farm work. Since studying for the club I like to think my housework is scientific just the same as the farm work. I like knowing the reason why I do things.'"

It may not always be expedient, however, to organize a new group. There may already be a good grange in the community, or there may be other means to keep up mental stimulus and to provide for the social side of life. If there is reason for forming a club, some one should assume its leadership, see others in the community, and arrange for a time and place for meeting. The meetings may be started in a home. Members may take turns in inviting the club to their homes. In some cases membership in such clubs as have been described has increased so rapidly that the schoolhouse, the church, or the hall is used as a place of meeting.

Study-club meetings should be held frequently enough to keep up interest in them; twice a month is usually considered sufficiently often. Home clubs that began with only winter meetings are holding a monthly meeting during the summer; thus, interest in the club is kept up. It is suggested that each meeting be divided into two parts: the first hour may be devoted to a study of the Cornell Lessons for the Farm Home; the second hour may be given to travel (page 186), study of music, literature, history, or current topics. The meeting should be made formal enough to observe

Fig. 52.—*The social hour*

rules of order (page 231) and to secure strict attention to the program until the time for the social hour.

While it is desirable that men and women work together on the farm lessons, as well as on the farm home lessons, in some cases men and women have met in the same building on the same evening but have separately discussed the farm and the farm home; later in the same evening the two meetings have come together, to enjoy a literary program.

CLUB ORGANIZATION

Small gatherings often get along very well informally; but when more or less vital questions are to be settled in either large or small meetings, every one is happier if the meeting follows rulings based on adopted principles. It is easier to conduct a meeting with some established rules of order than one without such rules. Besides, the businesslike conduct of a meeting lends dignity to it.

The following constitution has been adopted by several Cornell study clubs. It may be varied sufficiently to meet the individual needs of any club. A discussion on the adoption of the constitution and on other parliamentary usage will be found at the end of this lesson and should be made a frequent study.

CONSTITUTION OF THE CORNELL STUDY CLUBS

Article I

The club shall be known as the Cornell Study Club of.............

Article II

The object of the club is to study scientific ways of conducting home work in order to preserve the best interests of the family; to discuss the best expenditure of time, strength, and money to secure the highest efficiency; to broaden the outlook of the family through the culture of the mother of the household; to encourage a social spirit in the community while working together for the good of the family; to consider the home as a part of the community and therefore having relations with church, school, and social well-being; to elevate the character of rural life to the end that the farm home shall be the best in America and most attractive to the rising generation.

Any person interested in the foregoing objects for study is eligible for membership.

Article III

The officers shall be a President, a Vice-President, a Secretary, a Treasurer, and a Corresponding Secretary.

The duty of the President shall be to preside at all meetings and to call extra sessions whenever practicable.

The duty of the Vice-President is to act for the President in the absence of the latter or whenever she is unable to attend to her duties.

The duties of the Secretary and the Treasurer shall be, respectively, to keep minutes of the meetings, and to care for the finances of the club if there be any.

The Corresponding Secretary shall give notice of meetings, conduct the correspondence of the club, send a report of meetings to the Department of Home Economics of the New York State College of Agriculture, Cornell University, and write for state and government bulletins that shall aid in the study of the club.

Article IV

The majority of the members present at a meeting shall constitute a quorum.

Article V

The officers of the club shall constitute an executive council, which shall determine the place of meeting and the time and number of meetings, and arrange for the year's program.

Article VI

The club shall be under the supervision of the Department of Home Economics at the New York State College of Agriculture, which department will be ready to assist by answering questions, by aiding in the preparation of a program, by visiting the club for purposes of teaching.

The club shall have for a basis of work the lessons of the Cornell Reading-Course for the Farm Home, with whatever related work may be deemed advisable. The club is to have correspondence with the Department of Home Economics along lines that shall be of helpful interest to the club.

At least some of the members shall answer the questions of the discussion papers in the Farmers' Wives' Reading-Course, and they shall be forwarded regularly to that department by the secretary.

Article VII

"Roberts' Rules" shall be the guide to parliamentary usage.

SUGGESTIONS FOR CLUBS

In most instances clubs should prefer to make their own programs. Appoint a program committee before the end of a year to prepare a program for the next year. Preparing a program takes a good deal of time and thought on the part of a committee, but it is excellent mental exercise. Programs should be outlined six months in advance, in order that every one may know in time what preparation to make for her own part in them. Each member of the club is able to take some part in a program. Fear discourages many, but fear can be overcome. When Theodore Roosevelt was a lad in school he attempted to recite the poem, "When Greece her knees in suppliance bent." He bravely began: "When Greece her knees"— he stopped, unable to proceed. He began again: "When Greece her knees"—. After his third effort with no more progress, the schoolmaster called out to him, "Grease her knees once more, Teddy, then she'll go." He greased her knees once more and has been going ever since.

When called on to say something at a public meeting, take ten full breaths and go ahead. That was John B. Gough's remedy for stage fright. We learn to speak by speaking, not by dreading the necessary effort and putting it off.

The music on the program is of too much importance not to receive special attention. The town and city furnish concerts given by artists, which custom helps to establish a high standard of music. The amount

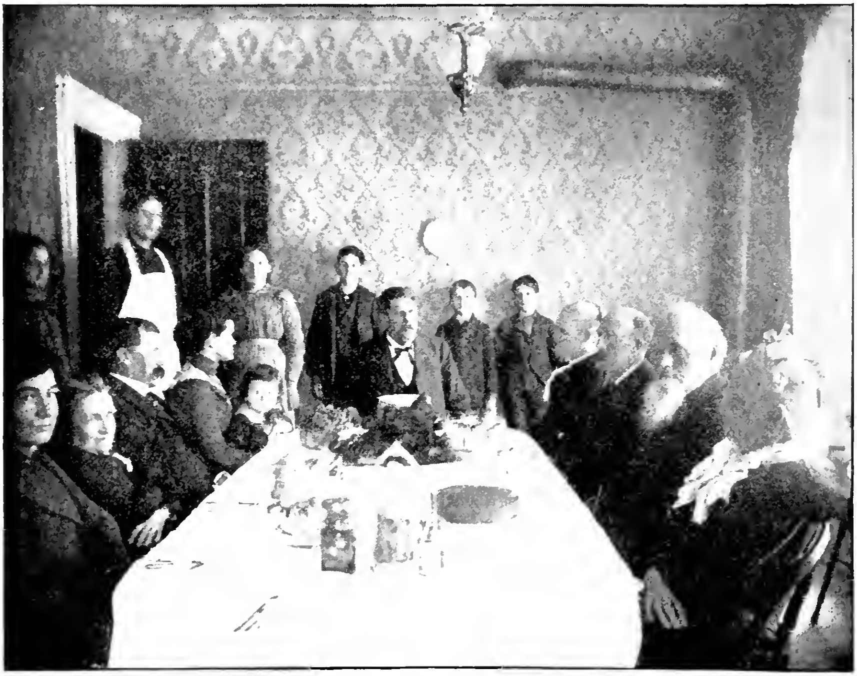


FIG. 53.—*The good cheer of a meeting where men and children are not left out*

of professional music that is heard in rural communities is necessarily limited. Music, however, is a means of expression fully as fitting among pastoral as among urban scenes. The birds sing among trees and by meadow brooks; their song is sweeter there than in a cage. Doubtless many of our artist singers would enjoy listening oftener to the thrush, the skylark, and the rippling brook. Why should not those who are brought up in the country pay especial attention to their musical talents?

The selection of music is important. On every counter of a music store may be found " ragtime " and flippant sentimental songs, but it is also possible to find " Annie Laurie," " Auld Lang Syne," " Robin Adair," "Suwanee River." Music is not named in the programs here printed. It is left for the program committee to supply, since that committee will know the possibilities of the club.

Another feature not repeated here, but one that should be found at the beginning of every program, is the reading of the minutes of the last meeting and of the treasurer's report. Parliamentary drill also may form a part of the program. That is still another feature omitted from the programs printed in this lesson, but a drill may be introduced whenever the president thinks it advisable.

Most clubs frequently serve refreshments. There is a psychology in the custom not to be ignored. It is said that the way to a man's heart is through his stomach; but this is probably a human trait, not merely masculine. The practice of "breaking bread" together is very old; the poetic justice of it is lost, however, if the menu is so elaborate that women find it a hardship to prepare refreshments for social occasions. Unless the refreshments served are to take the place of a regular meal, the bill of fare may be discarded which embraces cold meats, salads, pickles, rolls, pie, several kinds of cake, ice cream, and coffee. Good cheer may be easily obtained by coffee or cocoa with sandwiches, by ice cream and cake, or by fruit salad and sandwiches. The writer has enjoyed such delicious elaborate meals at the Cornell clubs that she hesitates to make suggestions. Such feasts are good for hungry travelers, but are hard on the women who have to prepare them and who then hurry home to get supper for the family. The service may be made simple and should be so. Paper napkins and paper plates save washing, while white paper, bought in the roll or large sheet, may cover the table. Always, daintiness is an asset. Daintiness of service with wholesome food, plentiful but not too elaborate, makes for good cheer.

Perhaps there is more than is needed in the programs suggested in the following pages. Take that which pleases you most.

Register as a club by addressing Reading-Course for the Farm Home, Cornell University, Ithaca, N. Y. Have the secretary keep the club in close touch with the University. Possibly the Supervisor of the Reading-Course may be able to visit the club at a regular meeting.

Unless you prefer to buy the books, a traveling library will be quite indispensable to the carrying out of the programs. Apply soon for the library. It is not connected with the College of Agriculture, but with the Libraries Division, Department of Education, Albany, N. Y., where application should be made. The library may be kept six months, and a fee of $1 for ten books pays transportation both ways. See Reading-Course Lesson No. 9, "Reading in the Farm Home."

PROGRAMS FOR STUDY CLUBS

SAVING STEPS

(Farmers' Wives' Bulletin No. 1)

" *The care of the body and the care of the soul are not two duties, but two parts of one duty.*"

Reading minutes and treasurer's report

ROLL CALL Response by members, each member mentioning her favorite labor-saving device

PAPER Plan of a house to save time and strength. Mrs.................

To what extent are labor-saving devices economical? Discussion led by Mrs..

In the economy of the house what occupation can better be cared for outside? Consider baking, canning, laundry. Consider the advisability of a public laundry at the creamery. Discussion led by Mrs...................................

SAVING STRENGTH

(Farmers' Wives' Bulletin No. 1)

" *Cling to your youth. It is the artist's stock in trade. Don't give up that you are aging and you won't age.*"— Stevenson.

ROLL CALL Each member responds and illustrates a physical exercise that is beneficial to health

PAPER The effect of play on health; how can housekeepers have more stimulating recreation? Mrs. ....

PAPER How to adjust household work so as to avoid monotony and insure recreation? Mrs...............................

Physical attitudes in household work. Bad postures in standing, sweeping, etc. Discussion led by Mrs..............

At the end of the hour, try some of the exercises suggested in the bulletin on " Saving Strength." Appoint a leader, preferably some one who has given special attention to the study. Exercises improperly taken may bring undue strain and lead to unnatural attitudes.

References:

Bishop, Emily M. Daily ways to health — The road to " seventy years young." B. W. Huebsch, New York. $1.50

Call, A. P. Power through repose. Little, Brown & Co., Boston. $1.00

Gulick, L. H. The efficient life. Doubleday, Page & Co., New York. $1.20

Saleeby, C. W. Health, strength and happiness. Mitchell Kennerly, New York. $1.50

Pamphlets from the Russell Sage Foundation, 1 Madison Avenue, New York:

Brown, Elmer. Health, morality, and the playground. No. 48. 5 cents

Gulick, Luther H. Folk and national dances. No. 28. 5 cents
Exercise and rest. No. 76. 5 cents

Perry, C. A. Organized athletics, games, and folk dancing. No. 86. 5 cents
Recreation the basis of association between parents and teachers. No. 87. 5 cents
The unused recreational resources of the average community. No. 104. 5 cents

Roessing, Mrs. Frank M., and Burchenal, Elizabeth. Athletics for girls. No. 37. 5 cents

From the Psychological Clinic Press, Philadelphia, Pa.:

Johnson, George E. The playground as a factor in school hygiene. No. 29. 5 cents

Household Decoration

(Cornell Reading-Course Lesson for the Farm Home, No. 5)

ROLL CALL Each member responds, names her favorite color, and states where it could be properly used in household decoration

PAPER How the purpose of a room determines its furnishing: a boy's room, a girl's room, a living-room. Mrs. ....
Household furnishings that save labor. Discussion led by Mrs. ....

Household Furnishing

(Cornell Reading-Course Lesson for the Farm Home, No. 7)

ROLL CALL Each member responds and gives some principle of good decoration

DISCUSSION Making the rough places smooth. How to treat walls and floors. Led by Mrs. ....

PAPER Things we want and things we do not want in our dining-rooms. Mrs. ....

PAPER Bric-a-brac, what to do with it. Mrs. ....

Household Conveniences

ROLL CALL Each member responds by giving the name of her favorite household labor-saving device

DEBATE Question: Resolved, That the woman of to-day has more to do than had the woman of one hundred years ago

Affirmative	Negative
....	....
....	....
....	....

DISCUSSION Saving time and steps in the household

1 How to save the time and strength of the help. Led by Mrs. ....

2 How to make the children as helpful as possible. Led by Mrs..............................

3 Cooperation between the housekeeper and her husband in saving time and strength. Led by Mrs..............................

PAPER What engineering has done for the household. Mrs..............................

THE FIRELESS COOKER AND PAPER BAG COOKERY

ROLL CALL Each member responds and gives a written fireless cooker recipe

PAPER The principles and history of the fireless cooker. Mrs..............................

Demonstration of a fireless cooker. Mrs. ....

Demonstration of paper bag cookery. Mrs. ....

References:

Mitchell, Margaret J. The fireless cooker. Doubleday, Page & Co., New York

Soyer, Nicolas. Paper bag cookery. Whitcomb & Barrows, Boston

BACTERIOLOGY OF THE HOUSEHOLD

(Farmers' Wives' Reading-Course Bulletin No. 4)

ROLL CALL Response by members, each member stating a good or bad use of bacteria in the household

PAPER Methods of harmless preservation to conquer bacteria. Mrs..............................

PAPER Germs and fumigation. Mrs. ....

PAPER The relation of bacteriology to sanitation, to bread-making, and to butter- and cheese-making. Mrs. ....

PAPER The germ theory of disease. Mrs. ....

Insect Pests of House and Garden

(Farmers' Wives' Reading-Course Bulletin No. 2)

"And there's never a leaf nor a blade too mean to be some happy creature's palace."

ROLL CALL Members respond by each naming a pest and telling how to eradicate it

PAPER Insects as carriers of disease. Mrs. ....

PAPER Fumigation and other methods of exterminating insects. Mrs. ....

DEBATE Question: Resolved, That insect pests of the house have caused more expense than have those of the garden and orchard

Affirmative	Negative
Mrs..	Mrs...

*References:**

The principal household insects of the United States. Bulletin No. 4, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

How insects affect health in rural districts. Farmers' Bulletin No. 155, United States Department of Agriculture, Washington, D. C.

House flies. Circular No. 35, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

House ants. Circular No. 34, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

The true clothes moths. Circular No. 36, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

The carpet beetle, or "Buffalo moth." Circular No. 5, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

Cockroaches. Circular No. 51, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

Control of flies and other household insects. Education Department Bulletin, February 15, 1910. Albany, N. Y.

Control of household insects. Ephraim Porter Felt. Education Department Bulletin, May 1, 1909. Albany, N. Y.

* Note.—Copies of publications will be sent free, unless otherwise indicated, on application to the Secretary of Agriculture, Washington, D. C., as long as the department supply lasts. When this supply is exhausted, applicants will be referred to the Superintendent of Documents, Government Printing Office, from whom the publications can be obtained at a nominal price. In ordering publications, be careful to state not only the number of the document, but the kind of publication (farmers' bulletin, circular, yearbook reprint, or document), the name of the issuing bureau when indicated in the list, and the title of the publication.

Injurious and other insects. 25th Report of New York State Entomologist. Education Department Bulletin, July 15, 1910. Albany, N.Y.

The principal household insects of the United States. L. O. Howard and C. L. Marlatt, Division of Entomology, United States Department of Agriculture, Washington, D. C.

Remedies and preventives against mosquitoes. L. O. Howard. Farmers' Bulletin No. 444, United States Department of Agriculture, Washington, D. C.

Economic loss to the people of the United States through insects that carry disease. L. O. Howard. Bulletin No. 78 (revised), Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

House ants. C. L. Marlatt, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

Preventive and remedial work against mosquitoes. L. O. Howard, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

The bedbug. C. L. Marlatt, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

House flies. L. O. Howard, Farmers' Bulletin No. 459, United States Department of Agriculture, Washington, D. C.

THE RURAL SCHOOL

Program No. 1

(Farmers' Wives' Reading-Course Bulletin No. 9)

ROLL CALL Each member responds with a suggestion for improving the rural school

PAPER The educational system of New York State

Review of Cornell bulletin, "The Rural School and the Farm Home." Mrs. ....

DISCUSSION How to make the rural school a healthier place for children than it is now. Mrs. ....

THE RURAL SCHOOL

Program No. 2

ROLL CALL Each member responds, giving the name of an educator and the work for which he is noted

PAPER Medical inspection in the schools. Mrs. ....

PAPER How the school building and grounds can be made more artistic. Mrs. ....

PAPER How can domestic science be taught in a rural school? Mrs. ....

PAPER Agriculture in the public schools. Mrs. ....

References:

Farmers' Wives' Bulletin No. 9. The rural school and the farm home. New York State College of Agriculture, Cornell University, Ithaca, N. Y.

Dean, A. D. The worker and the state, Chapter V. The Century Company, New York

Gulick, Luther H., and Ayers, Leonard P. Medical inspection of schools. Charities Publication Committee, New York

Draper, Andrew S. Addresses and papers, 1908–9. State Education Department, Albany, N. Y.

Elementary syllabus, Manual and household arts — Agriculture. State Education Department, Albany, N. Y.

Hunt, Caroline L. The daily meals of school children. 1909. United States Bureau of Education, Bulletin No. 3

Burrage and Bailey. School sanitation and decoration. D. C. Heath & Co., New York

Farmers' bulletins, United States Department of Agriculture:

134 Tree planting on rural school grounds
218 The school garden
409 School lessons on corn
428 Testing farm seeds in the home and in the rural school

Office of Experiment Stations circular:

60 The teaching of agriculture in the rural common schools

Forest Service circulars:

96 Arbor day
130 Forestry in the public schools
382 The use of illustrative material in teaching agriculture in rural schools

CARE AND FEEDING OF CHILDREN

(Lessons for the Farm Home, Nos. 1 and 3)

Program No. 1

ROLL CALL Each member responds and suggests a balanced meal for a child, giving age of child

PAPER or TALK How to plan the meals for the family so that the needs of each member may be cared for. Mrs..............................

PAPER How the study of animal feeding may help in the study of the feeding of children. Mrs......................................

PAPER How to dress children. Mrs...

CARE AND FEEDING OF CHILDREN

Program No. 2

ROLL CALL Each member responds and states a false theory regarding the feeding of children and how it has been disproved

PAPER School lunches, how the child's diet affects his school work as well as his health. Mrs..................

REVIEW OF BOOK "On the Training of Parents," by E. H. Abbott

Does the health of the average person indicate the right diet during childhood? Discussion led by Mrs. ....

PAPER Government laws that are for the good of children. Mrs..

LITERARY AND DOMESTIC PROGRAMS

It is suggested that a part of the hour be given to a domestic subject and a part to history, literature, science, or art. An example is given in the following programs covering New York State history. The Library Bureau of the State Department of Education, Albany, N. Y., will furnish very helpful suggestions on program making, together with aid in securing a traveling library on subjects related to the program.

EARLY HISTORY OF NEW YORK STATE AND OF HOME ECONOMICS

I

ROLL CALL Members respond, each giving an Indian name and its meaning

PAPERS The Indians of New York:

In savagery. Mrs..

At the present time. Mrs..

Housekeeping customs of the Indian women. Mrs..................

II

ROLL CALL Members respond, naming a good substitute for meat

PAPERS Henry Hudson. Mrs..

The legend of Rip Van Winkle. Mrs..

DISCUSSION Is vegetarianism desirable?

Leader, affirmative, Mrs..

Leader, negative, Mrs..

III

ROLL CALL Each member to give a simple menu planned on the basis of the hundred-calorie portion. See Human Nutrition Part I

PAPERS The New Netherlands. Mrs..

Colonial difficulties. Mrs..

Dutch New York. Mrs..

DISCUSSION Will the menus given in Human Nutrition, Part II, supply a sufficient amount of food for a farm family?

Leader, affirmative, Mrs..

Leader, negative, Mrs..

IV

ROLL CALL Members respond, giving names of famous men and women in colonial times and for what they were famous

PAPER Colonial life in the 18th century. Mrs..

READING OR PAPER The French and Indian War. Mrs..

DISCUSSION What part shall the garden play in the family dietary? Led by Mrs..............

Who shall care for the garden? Led by Mrs......

What helps may be had from the State and from the Federal Government for instruction in garden-making? Led by Mrs..

Fig. 54.—*Housekeeping in other days*

V

ROLL CALL Each member responds by giving the name of a book, with author, on early New York life in Indian or colonial times

PAPERS Homes of the colonists. Mrs..

The lights and stoves of the colonists. Mrs..

Kitchens and serving of meals in colonial days. Mrs................

Food of the colonists. Mrs..

VI

ROLL CALL Each member responds by giving a favorite recipe

PAPERS The Stamp Act. Mrs..

The Mohawk Valley and its history. Mrs................................

Story of weaving and similar handwork. Mrs............................

Comparison of past and present in the handwork of women. Mrs..

VII

ROLL CALL Each member responds by naming some economy in food preparation

PAPER Taxation and colonial opposition. Mrs..................................

Reading from Hugh Wynne or description of book. Mrs............................

The best methods in canning fruit. Discussion led by Mrs............................

VIII

ROLL CALL Each member responds by naming a natural wonder of the State

PAPERS Benedict Arnold. Mrs..

George Washington. Mrs..

READING Mrs..

PAPER The canning of vegetables. Mrs..

IX

ROLL CALL Each member responds by telling what value the club has for her

PAPERS New York after the Revolution. Mrs..

The women of revolutionary days. Mrs....................................

DEBATE Question: Resolved, That women are just as busy now as women were a hundred years ago

Leader, affirmative, Mrs..

Leader, negative, Mrs..

X

ROLL CALL Members respond, naming agencies for the improvement of home conditions

PAPERS The national constitution and its effect on New York State. Mrs..

The domestic science movement. Mrs..

How can domestic science be taught in a rural school? Mrs..

XI

ROLL CALL Members give names associated with the War of 1812 and an interesting fact connected with each name

PAPERS New York's part in the War of 1812. Mrs..............................

Food adulteration and the warfare against it. Mrs....................

XII

ROLL CALL

PAPER Some inventors of New York State (Robert Fulton, etc.). Mrs......................................

What benefits may be derived in the home and on the farm from the New York State College of Agriculture? Discussion led by Mrs......................................

XIII

ROLL CALL Members respond, naming means of saving the income by more expert buying

PAPERS Dewitt Clinton. Mrs......................................

A journey on the Erie Canal:

In 1825. Mrs......................................

In 1912. Mrs......................................

The warfare on false weights and measures. Mrs....................

XIV

ROLL CALL Members respond, giving personal reminiscences of the Civil War

PAPER The sanitary commission during the Civil War. Mrs..............

How to make a model kitchen. Discussion led by Mrs......................................

XV

ROLL CALL Members respond, naming a favorite household labor-saver

PAPERS Results of the Civil War. Mrs......................................

Improvements in housekeeping since the Civil War. Mrs......................................

XVI

ROLL CALL Members respond, giving names of historic towns in New York State, and for what they are famous

PAPERS Famous women in New York State and their work. Mrs......................................

Woman's share in the cost of living. Mrs.............................

XVII

ROLL CALL Members respond by suggesting means of improving New York State

PAPERS The commercial development of New York State. Mrs...

The Consumers' League. Mrs...

What is Farmers' Week at Cornell? Mrs...

XVIII

ROLL CALL Members respond, naming prominent educators of New York State and what they have accomplished

PAPERS Schools of New York State in early days and to-day. Mrs...

How to improve the rural school. Mrs...

DISCUSSION Is as much done for the girl to make her contented with rural life as is done for the boy? Led by Mrs...

XIX

ROLL CALL

PAPERS Some New York State institutions:

Health department
Charitable organizations
Prevention of cruelty to animals
Prevention of cruelty to children
Reformatories
State asylums and hospitals
Prisons, etc.

Mrs...

What to do till the doctor comes. Mrs...
(If preferred, a local physician may take the subject)

How a knowledge of home-making decreases the number of dependents and defectives. Mrs...

XX

ROLL CALL Members respond, giving a suitable bill of fare for the supper of a child, naming the child's age

PAPERS New York City one hundred years ago. Mrs...

New York City to-day. Mrs...

The children's bill of fare. Mrs...

XXI

ROLL CALL Members respond by telling an amusing story

PAPER How to entertain one's friends simply. Mrs...... ....

Refreshments and social hour

This meeting may have invited guests.

OUTLINES FOR CLUB STUDY

There are several sources of material for club study: not only the book, the magazine, the government and state bulletins, but one's own experience and observation. The final outcome of study should be so to digest printed material as to make it a part of one's self. Added to life experience and to observation, study properly done helps to make a cultured individual.

The bulletins sent to the clubs from month to month are not a sufficient study of any subject. We are therefore giving references to books, which may be secured from dealers, borrowed from a library, or included in a traveling library.*

After reading thoroughly a subject for a talk, a paper, or a discussion, it is helpful to have an outline furnished suggesting material to be presented. We are giving outlines of various subjects that have been presented in the Cornell Reading-Course, as a help to club officers in the preparation of programs for their clubs or as a help to individuals in preparing papers:

HOUSEHOLD FURNISHING

Helen Binkerd Young

The problem of furnishing

1 Objects to be discarded
2 Objects to be retained
3 The value of sentiment and association

A point of view

1 Personality vital in home surroundings
2 Virtue in furnishing
3 What qualities constitute good taste
4 Readjustment and rearrangement
5 Harmony of decoration and furnishings

Floor coverings

1 Value of rugs versus carpets
2 The weight of the rug
3 Where to use large and small rugs

*See Cornell Reading-Course Lesson for the Farm Home, No. 9, "Reading in the farm home."

4 Bare or covered stairs
5 Color and pattern in rugs
6 How to use old carpets
7 Rag rugs; sorted for color and woven into harmonious designs
8 Comparative expense and satisfaction of various weaves of rugs: ingrain, body brussels, velvet, axminster, and straw, or matting
9 Oriental rugs

Furniture: its construction and decoration
1 Object of furniture
2 Study carefully the illustrations on page 72 of Cornell Reading-Course Lesson for the Farm Home, No. 7, "Household Furnishing," showing studies in construction and decoration, and test two or three pieces of furniture at the club meeting
3 Vital points to consider in selecting furniture
4 How to tell the difference between true decoration that beautifies, and false decoration that cheapens
5 Furniture built with drawers
6 Relation of chair to bodily form

Styles and fads in furniture
1 Characteristics of colonial work: sound workmanship, simple forms, beautiful wood, appropriate and restrained decoration
2 Repainting or refinishing old pieces
3 Walnut furniture: beautiful wood; designs too ornate; less valuable than colonial work
4 Varnished oak furniture: excellent wood, abused by machinery, manufacture, and cheap finish; machine decoration; false ideals of beauty
5 Burnt-wood fad. Decoration substituted for form and usefulness. Tawdry products. Poor art
6 Mission or craftsman furniture: an answer to the craving for plain, genuine forms; wholesome and permanent influence of the style

Furnishing the hall
1 Atmosphere of orderliness and cheer
2 Color scheme
3 Rug
4 Coat closet, hatrack, or other furniture
5 Absence of pictures and ornaments

Furnishing the living-room
1 Atmosphere of comfort and harmony
2 Influence of this room especially on lives of others
3 Nothing that is not useful and beautiful in this room

4 Color scheme of entire effect: harmony of walls, woodwork, floors, and furnishing
5 General arrangement
6 To what extent mixed furnishings may be used
7 The passing of elaborately upholstered pieces
8 Furniture selected for simple forms, well-finished wood, restrained decoration, and ease of care
9 Curtains: the purpose of the window; the use of curtains; the passing of the long lace curtains; appropriate materials; how to hang the curtains; the mental and spiritual effect of a good view
10 Purpose and worth of pictures; what to do with photographs of persons
11 Good taste in clocks and vases

Furnishing the dining-room
1 The necessary furniture: table, chairs, sideboard, dish closet; advantage of wax-top table
2 Plate rails: decorations, or dust catchers
3 Pictures
4 How to avoid confused appearance in dining-room
5 May not the wall treatment be sufficient decoration?

Furnishing the bedroom
1 Atmosphere of repose
2 General color scheme
3 Arrangement of furniture
4 Placing of rug or rugs
5 Closets: homemade and purchased
6 Advantage of metal over wooden beds
7 The equipment of the bed: springs, mattress, pillows, and bedding
8 Pictures and ornaments, depending on use of room
9 The personal touch. The inspiration of favorite quotations

The aim of a true home: efficient family life; unselfish service to community.

References:

Priestman, Mabel Tuke. Artistic homes. A. C. McClurg & Co., Chicago. $2.00

—— Handcrafts in the home. $2.00

—— Art and economy in home decoration. John Lane Company, New York

Daniels, Fred Hamilton. The furnishing of a modest home. The Davis Press, Worcester, Mass. $.85

Crane, Lucy. Art and the formation of taste. Educational Publishing Company, Boston and New York

Wheeler, Mrs. Candace. Principles of home decoration. Doubleday, Page & Co., New York. $1.80

—— Inexpensive homes of individuality. McBride, Nast & Co. $1.25

—— Distinctive homes of moderate cost. McBride, Nast & Co. $1.50

—— Bungalows

—— Craftsman homes. The Craftsman, 41 West 34th Street, New York. $2.00

—— Studio year book of decorative art. John Lane Company, 110-114 West 32d Street, New York. $5.00

Magazines for household art subjects

Country life in America. Doubleday, Page & Co., New York

The house beautiful. House Beautiful Company, 315 Fourth Avenue, New York. $3 per year

House and garden. McBride, Nast & Co. $3 per year

The craftsman. Craftsman Publishing Company, 41 West 34th Street, New York. $3 per year

Suburban life. The Suburban Press, 200-210 Crescent Street, Harrisburg, Pa. $3 per year

American homes and gardens. Winston, McBride & Co., Philadelphia. $3 per year

Ladies' home journal. Curtis Publishing Company, Philadelphia. $1.50 per year

International studio. John Lane Company, New York. $4.50 per year

CARE AND FEEDING OF CHILDREN

Flora Rose

Care of the mother before the birth of the baby

1 Effect of poor conditions for the mother on the child, such as overwork, underexercise, wrong feeding
2 How the mother may care for the baby before its birth
3 What is meant by prenatal influence and how it affects the child

Care of the child after birth

1 The newborn baby
2 Care of the child
   a Clothing
   b Bathing
   c Exercise
   d Food

3 Effects of poor care on the baby
4 Training the child
  a What effect the formation of good physical habits in babyhood, such as regular meal times and sleeping hours, may have in developing self-controlled, well-poised men and women
  b The need of the child for quiet and freedom from the constant attention of grown persons
  c Play, games, and toys as factors in the training of children

Method of infant feeding
1 Natural method, or breast feeding
  a Composition and characteristics of mother's milk as compared with the milk of other animals
  b Relative feebleness of the baby and of other young animals
  c Reasons for better results obtained by using mother's milk
  d Causes of the inability of the mother to nurse her baby and of the failure of the child to flourish
  e How these causes may be remedied
  f Has the State any responsibility to legislate so as to secure to the working woman the privilege of nursing her children?

2 Artificial feeding
  a Milk of some other animal
    (1) Cow's milk
      Characteristics as compared with human milk
      Reasons for difficulties in using cow's milk for infant feeding
      Underlying principles in modifying milk
      Methods of adapting cow's milk to suit the baby
      The use of various gruels in making modified milk mixtures
      Causes of differences in results obtained by using milk from various breeds of cattle
      Clean milk
        Relative cleanness of cow's milk and human milk when it reaches the child
        Possibilities of infecting cow's milk on its way to the child
        Practical problems in producing clean milk
        Sterilization and pasteurization
        Sterilized milk, pasteurized milk, or milk produced under clean conditions — the best choice

(2) Goat's milk, etc.

b Patent or proprietary foods

(1) Comparative composition of various foods and human milk

(2) Reasons for the use of patent foods

(3) Their use and abuse

(4) Possible injury from ignorant use of patent foods

(5) Reasons for advantages of cow's milk over other foods in artificial feeding

Feeding of children after weaning

1 Underlying principle in feeding children

2 Food for children of various ages

3 Effects of wrong nutrition on children

4 Disorders caused by malnutrition

5 Comparative value of milk and eggs, and of meat, as foods for the growing child

6 The use of sugar in the child's dietary

7 Fruits and vegetables for children

8 Mineral matter in the diet of the growing child

9 What is to be learned about feeding children, from feeding experiments performed on animals?

10 The interrelation of right food, exercise, fresh air, and rest

11 What about eating between meals?

12 Shall children share the family meal?

13 Plan a week's meals for your family, considering the needs of each member and arranging the meals as far as possible so that most of the food may be partaken of by all

References:

Cornell Reading-Course Lessons for the Farm Home, Nos. 1 and 3. The care and feeding of children

Abbott, E. H. On the training of parents. Houghton, Mifflin & Co., Boston. $1.00

Addams, Jane. The newer ideals of peace. The Macmillan Company, New York. $1.25

The spirit of youth and the city streets. The Macmillan Company, New York. $1.25

Bateson, W. Mendel's principles of heredity. G. P. Putnam's Sons, New York

Burbank, Luther. The training of the human plant. The Century Company. $.60

Comstock, Anna B. Handbook of nature study. Comstock Publishing Company, Ithaca, N. Y.

Dock, L. L. Hygiene and morality. G. P. Putnam's Sons, New York. $1.25

Gulick, Luther H. The efficient life. Doubleday, Page & Co. $1.20

Morley, M. W. The renewal of life. A. C. McClurg & Co., New York. $1.00

Needham, James G. General biology. Comstock Publishing Company, Ithaca, N. Y.

Food

Flora Rose

The elements that compose the body

The compounds that feed the body — the foodstuffs

1 Protein
- a Composition of protein
- b Sources of protein
- c Uses of protein in the dietary
- d Effects of too much or too little protein in the dietary
- e Relative merit of proteins supplied by milk, eggs, meat, cereals, legumes, nuts

2 Carbohydrates
- a Composition of carbohydrates
- b Kinds of carbohydrates
- c Sources of carbohydrates
- d Uses of carbohydrates in the dietary
- e Sugar and starch compared: food value, use of each, and power of one to replace the other
- f Effects of eating too much or too little carbohydrate
- g Best way of including carbohydrates in the dietary
- h Cellulose, its food value and its function in the body

3 Fats
- a Composition of fat
- b Sources of fat
- c Characteristics of fat obtained from different sources
- d Function of fat in the body
- e The relative merits of different types of fat, such as cream, butter, suet, olive oil, cottonseed oil, bacon, tallow
- f Effects of eating too much fat
- g Relation of carbohydrates and fats in the diet

Mineral matter
- a Chief elements of mineral matter
- b Sources of iron, phosphorus, calcium, potassium, sodium, magnesium

c The chief functions of mineral matter as a whole and of each of the above elements in particular

d Effects of a lack of each of the above elements

e Relative merits of various sources of mineral matter

The relation of the foodstuffs to one another in the dietary

The body's food needs and how they are measured

Dietary standards

Planning the family dietary

1 Occupation and age of each member of the family
2 Season, climate, sex, vigor, etc.
3 Total food requirements
4 Balance of foodstuffs

The well-planned meal

The relation of right nutrition to welfare

Disorders caused by wrong diet

Diet in disease

Care of food

1 Cause of spoiling of food
2 How to prevent it
3 Rules for caring for typical foods

Preparation of food

1 Characteristics of the foodstuffs and the relation they bear to cookery
   a Proteins
   b Starches
   c Sugars
   d Fats
   e Cellulose
2 Cookery of typical foods, such as meat, eggs, cheese, cereals, sauces, puddings, vegetables, fruits
3 Leavening agents
   a Baking powders
   b Use of soda with acid
   c Yeast
4 Bread, cake, and pastry making
5 The breakfast, the dinner, the luncheon: what they should contain; how they should be prepared; how they should be served
6 The school luncheon: what it should contain; how it should be packed
7 The social function: the tea; the supper; the reception; the dinner; the banquet

References: Farmers' Wives' Bulletins Nos. 6 and 7. Human nutrition. Parts I and II

BACTERIOLOGY

History

What the study of bacteriology has done for science, agriculture, commerce, the household

Bacteria as friends and as foes

Bread-making an agricultural process in miniature: crop bacteria and weed bacteria

The making of butter, cheese, and vinegar

Bacteria as scavengers; septic tanks; filtration beds

The fight against harmful bacteria

1 Times and methods of cleaning
2 Consideration of the dust problem in house planning
3 Safeguarding food against bacteria: by drying, by cold storage, by preservatives, harmful and harmless, by canning, by packing
4 Methods of destroying bacteria: disinfectants, germicides, fumigation, sterilization
5 How should the house be cleaned?

References:

Conn, H. W. Bacteria, yeasts, and molds in the home. D. Appleton & Co., New York. $1.00
Courses in bacteriology for home economics. Journal of Home Economics, December, 1910
Practical dairy bacteriology. Orange Judd Company, New York. $1.25
The story of germ life. D. Appleton & Co., New York. $.35

Elliott, S. Maria. Household bacteriology. American School of Home Economics, Chicago. $1.25

Lipman, Jacob G. Bacteria in relation to country life. The Macmillan Company, New York. $1.50

Wagner, E. Recipes for the preserving of fruit, vegetables, and meat
The leavening agent in salt-rising bread. Journal of Home Economics, February, 1911
Mildew, mould, and fungous growth National Laundry Journal, November 15, 1909

HOUSEHOLD DECORATION

The principles of home decoration

1 Unity of effect
2 Atmosphere
3 Harmony
4 Simplicity

How to carry out the principles

1 Walls: their importance in the scheme of decoration
  - a They shut in space and act as background
  - b They should be quiet and restful
  - c Colors
    - (1) Primary colors: red, blue, yellow
    - (2) Their differing effect on persons, as shown by experiments
    - (3) Nervous strain from being surrounded by glaring colors
    - (4) Soothing influence of softened and subdued colors, called tones
    - (5) How tones made up of several colors unite and harmonize mixed furnishings
    - (6) The color influence of nature: shifting masses of brown and green that nature uses, a good suggestion for interior color scheme
    - (7) Warm and cool colors
    - (8) Crude colors, when used in home decoration, are gradually faded, or toned, by nature
    - (9) Bright colors used in nature only to accent effects
  - d Figures and patterns for walls
    - (1) Walls, as flat surfaces, should represent only length and breadth, not thickness
    - (2) Paint a better treatment for shelves than shelf paper
    - (3) Oilcloth or varnished tile paper as wall coverings

2 Floors and woodwork
  - a Treatment of old floors: if slightly cracked; if badly cracked
  - b Mattings
  - c Flooring strips
  - d Wood carpeting
  - e Colors and finishes
  - f Kitchen and bathroom floors: how to make nonabsorbent; treatment of linoleum for best service
  - g Woodwork: proper finish depends on grain; time, labor, and patience necessary to achieve lasting effect

References:

Bailey, L. H. The outlook to nature. The Macmillan Company. $1.25

Burrage and Bailey. School sanitation and decoration. D. C. Heath & Co.

Crane, Lucy. Art and the formation of taste. Educational Publishing Company, Boston and New York

Daniels, Fred Hamilton. The furnishing of a modest home. The Davis Press, Worcester, Mass. $.85

Kellogg, Alice M. Home furnishing, practical and artistic. Frederick A. Stokes Company, Philadelphia, Pa. $1.50

Priestman, Mabel Tuke. Art and economy in home decoration. John Lane Company, New York

Ruskin, John. Seven lamps of architecture. Longmans, Green & Co. New York. $2.40

Wheeler, Candace. Principles of home decoration. Doubleday, Page & Co., New York. $1.80

The Laundry

Flora Rose

Fabrics

1 Kinds of fabrics, and their characteristics
2 Effects of strong cleansing agents on fabrics

Cleansing agents

1 Water: water best for laundry purposes and how to obtain it
2 Soap: what it is, how it acts, kinds best to use, how to make soap
3 Soap substitutes: what they are, how they act, and when they should be used
4 Alkalis: what they are, how they act, time for using each kind, precaution in their use
5 Materials for removing various stains: how they act to remove the stain; what effect they have on fabrics and on colors; how they should be used

Methods of washing

1 When to wash
2 How the washing is accomplished in the best way
3 Various processes, such as soaking, washing, rinsing, bluing, starching, and drying

Ironing

1 The easiest way of ironing
2 Shall all clothes be ironed?

Labor-saving laundry machinery

1 Stationary tubs
2 A drain
3 Running water
4 Hot and cold water

5 Washing machines
 a Hand power
 b Mechanical power
6 Irons: gas, electrical, alcohol
7 Ironing machines

References:

Cornell Reading-Course Lesson for the Farm Home, No. 11. The laundry

Balderston, Ray, and Limerick, M. C. Laundry manual. Balderston and Limerick, 1224 Chestnut Street, Philadelphia

FOOD PRESERVATION

Flora Rose

Reasons for the spoiling of food

Methods of retarding or preventing the spoiling of food

1 Packing methods
 a Trenching vegetables
 b Packing fruit in paper
2 Low temperature maintained by
 a Cold storage
 b Use of refrigerators
 c Ice houses
 d Cellars
 e Cold water
3 High temperature: canned food
4 Removal of moisture
 a Drying
 b Evaporating
5 Use of preserving substances
 a Harmful
  (1) Borax and boracic acid
  (2) Salicylic acid and the salicylates
  (3) Benzoic acid and the benzoates
  (4) Formaldehyde
  (5) Sulfur and the sulfates
  (6) Copper
 b Harmless
  (1) Sugar
  (2) Salt
  (3) Vinegar
  (4) Some spices

c Doubtful

(1) Saltpeter

(2) Smoke

Full discussion of reasons for each of the methods named, their effectiveness, and conditions indicating their use.

Laws governing the use of preservatives and government reports concerning the preservatives

Canned food

1 Underlying principle of canning foods

2 Methods of canning foods

a By use of hot water bath

(1) On the stove

Single process

Intermittent process

(2) In the oven

(3) In the fireless cooker, or a modification of it

b Stewing

c Baking

d The autoclave

3 Reasons for intermittent process in canning vegetables

4 Types of cans best for household use

5 Amounts of sugar or salt, water, etc., to use and best method to follow in canning typical foods such as peaches, pears, plums, strawberries, tomatoes, beets, carrots, corn, beans, cherries, meat, asparagus

6 Are recipes necessary in canning fruit if the principle of canning is understood?

7 Causes for spoiling or deterioration of canned foods

8 Discussion of the cost of home-canned food as compared with the cost of the commercial product

9 Discussion: May fruits and vegetables be canned profitably on a commercial scale in the home or on the farm?

a What is the cost of an outfit?

b Where is a market for home-canned goods?

c Should such canning be done in glass?

10 The effect of foods on the tin cans containing them, and the effect of tin salts on health

Preserving foods

1 Food preserved in sugar

a Methods of making preserves, marmalades, and jams

b Reasons for their keeping

2 Use of vinegar
3 Smoking, salting, and pickling foods
4 Discussion of home-dried foods
5 Use of water glass for preserving eggs

Jelly Making

Pectin, its sources and characteristics
Essentials for a good fruit jelly
Methods of extracting fruit juices
1 First extract
2 Second extract
3 Third extract
4 Fourth extract
Classification of fruit juices according to juiciness of fruit
Possibility of canning fruit juice for future use
Conditions to consider in jelly-making
1 Type of fruit juice
2 Number of extract
3 Time of boiling before adding sugar
4 Amount of sugar according to type of juice used
5 Time of boiling after addition of sugar
How to test jelly
1 Causes of failure to jelly
2 Causes of formation of crystals in jelly and how to avoid

References:

Farmers' Bulletins, United States Department of Agriculture, Washington, D. C.
Bigelow, W. D. Fruits and fruit products. Bulletin 66, Bureau of Chemistry
Breazeale, J. F. Canning vegetables in the home. Bulletin 359
Gould, H. P., and Fletcher, W. F. Canning peaches on the farm. Bulletin 426
Husman, G. C. Home manufacture and use of unfermented grape juice. Bulletin 175
Parloa, Maria. Canned fruits, preserves, and jellies. Bulletin 203
Wiley, H. W. Influence of food preservatives and artificial colors
I Boric acid and borax
II Salicylic acid and salicylates
III Sulphurous acid and sulphites
IV Benzoic acid and benzoates
V Formaldehyde

Cornell Reading-Course for the Farm Home. Preservation of food (in preparation)

From University of Illinois, Urbana, Ill.

Goldthwaite, N. E. Principles of jelly-making. Vol. VIII, No. 7

From North Carolina Department of Agriculture, Raleigh, N. C.

Shaw, S. B. The home canning of fruits and vegetables. Vol. XXXI, No. 5

From University of Wisconsin, Madison, Wis.

Adams, Mrs. L. H., and Sandsten, E. P. Practical directions for preserving native fruits and vegetables. Bulletin 136

The perfect art of canning and preserving. From Butterick Publishing Company, New York

TREES IN THEIR RELATION TO MANKIND

Elizabeth H. Spalding

The friendliness of trees

1 Man's instinctive choice of them as a refuge

a In storms

b From heat

2 Their power to comfort. See

a Lowell's "The birch-tree"

b George Macdonald's "David Elginbrod"

c Sidney Lanier's "The marshes of Glynn"

"The ballad of the trees and the master"

The gifts of trees

1 A list of practical benefits

a Banana, date palm, breadfruit, cocoanut palm, etc.

b Fans, cloth, rubber, etc.

2 The tributes of poets to the generosity of trees; for example, Hiawatha's building of his canoe

Trees in history and in literature

1 The stories of Absalom, King Charles, the Charter Oak, etc.

2 George Macdonald's "Phantastes"

Shakespeare's "As you like it," etc.

3 Trees in the Bible

Conclusion: "And he shall be as a tree planted by the river of life"

A NEIGHBORHOOD TRAVEL CLUB

ELIZABETH H. SPALDING

The great steamship swings off. We watch her. She bears away, away, away — to the shores of Araby the Blest, to far Cathay, to some land of our heart's desire. If we could only go, too! Shall we? Let us do it. Let us invite three or five or seven others to go with us. Let us form a Travelers' Club. Here is a plan for it.

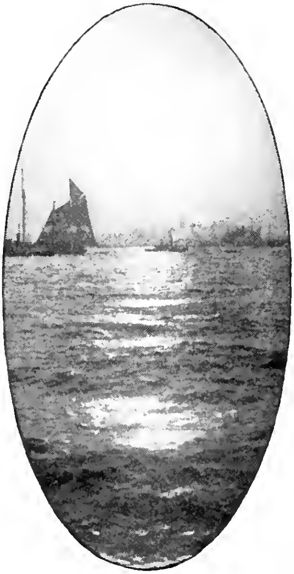


FIG. 55.— *New York Harbor*

THE PLAN

First of all, it will be frankly acknowledged that although the club intends to gain interesting knowledge and experience and to learn much of history and art, yet it is abroad, primarily, for recreation and pleasure. It is not going to bury itself in encyclopedias. It is going to see things and do things; it is going to travel.

THE FIRST MEETING

The first meeting will be devoted to getting ready for the trip and to the voyage itself. An experienced traveler will describe entertainingly the necessary preparations for the intended voyage, give a graphic account of daily life on shipboard, and show souvenirs from a former voyage, such as photographs of scenes on the steamer, menus, a concert program, a copy of the daily bulletin printed on the ship. A nonmember will be invited to render such service, if no club member has crossed the ocean.*

A committee previously appointed by the club will have gathered from various sources — from home and public libraries — a collection of novels and other entertaining as well as suitable books. Each member of the club may take home one or two of them, to read before the next meeting, in his imagined steamer chair, on an imagined deck. Books that tell about life on a steamship would be pertinent, such as: "On blue waters" by Amicis; "An amateur emigrant" by Stevenson (which gives a glimpse

* Few know, perhaps, how generally helpful libraries wish to be. When the plan for a travelers' club outlined in this article was explained to the head of a free library, she said: "I shall be glad to go to the opening meeting of such a club, to tell the would-be travelers what I know about ocean travel, and to give them a 'Bon voyage!'"

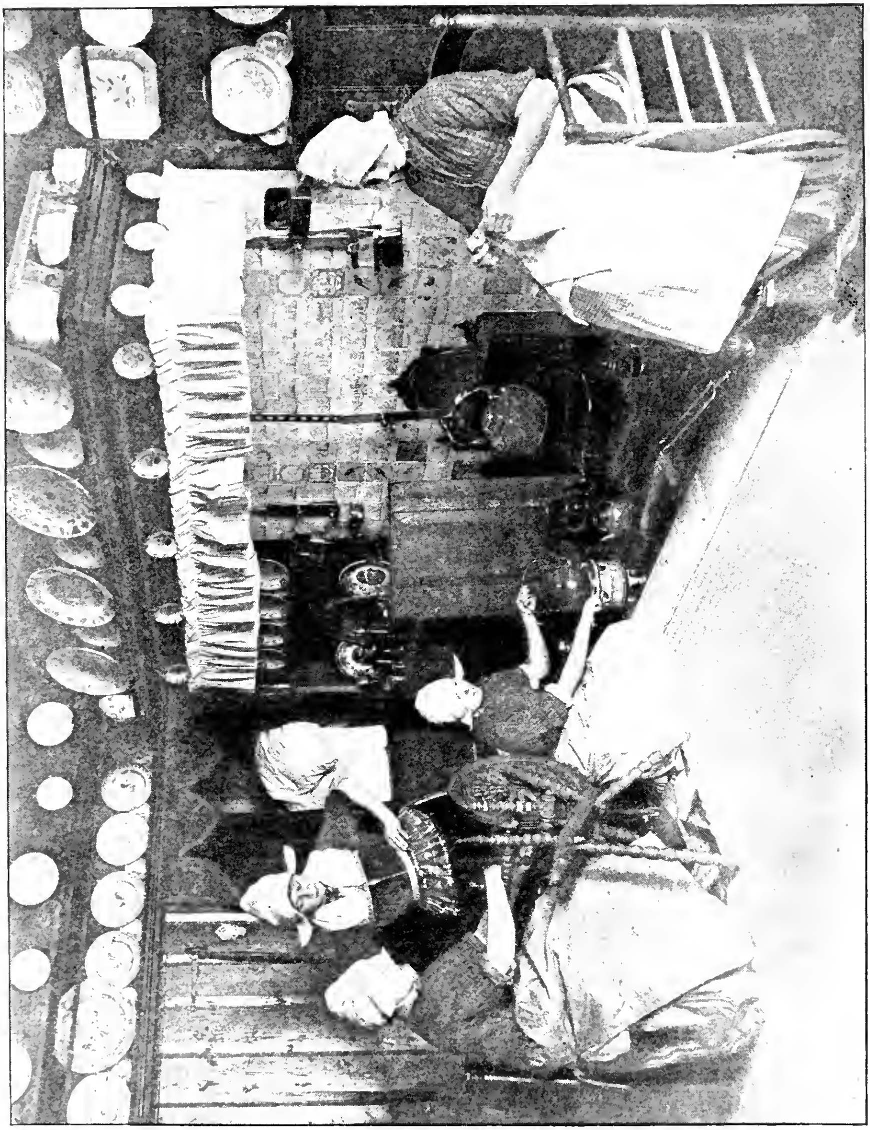


FIG. 56.—*Dutch interior, family group*

of second-cabin and steerage life); "The lady of the Aroostook" by Howells; "European breezes" by Pitman; "Going abroad" by Luce; "A world pilgrimage" by Barrow; Irving's "The voyage," in "The sketch book."

Refreshments — for the club believes, does it not, in the added geniality that comes from the breaking of a crust with one's friends — will be a reproduction of the steamship luncheon — bouillon and a variety of thin sandwiches or little cakes. Before the afternoon or the evening is over, a contributed steamer-letter may be read aloud and a steamship game or two, such as "bean bags," may be played; possibly shuffleboard could

FIG. 57.—*Going to market*

be managed. Since gifts of "goodies" have become a feature of the ocean voyage, a little box filled with homemade candy may be given to each member of the club at the close of the meeting, as a steamer present. Possibly, if napkins are used, some member of the club may so fold them that they will represent a boat or a sail.

At the end of its initial meeting, the club will go home to dream of the "Yo! heave ho!" of sailors lifting anchors, of handkerchiefs fluttering from the pier, of steamer letters and toothsome viands discovered in its staterooms, and of the wonder and the mystery of drawing away from the known out into the new and untried.

THE SECOND MEETING

The club has its plans well laid and knows that its steamer, the "Alaska" of the Red Star Line, is headed for Antwerp. The first contribution at its second meeting comes from the " natural-born traveler," who, the club unanimously votes, is the very one, and the only one, of its members to get them and their belongings ashore in good shape. She describes just what must be done and soon has her group on the train for Bruges.

The club has a number of strong desires. It wishes (1) to take a short trip; (2) to make a journey that will be a preparation for other journeys; (3) to see the art of medieval times before that of more modern days; (4) to go directly to a thoroughly foreign and old town. For such reasons it has chosen to travel first in Belgium, afterward in Holland, to become acquainted with Antwerp later on, and to stay chiefly in Bruges, Ghent, Brussels, Antwerp, while in Belgium; in Delft, The Hague, Leyden, Haarlem,

FIG. 58.—*On the dunes*

Amsterdam, while in Holland. It will make excursions into the country as time and opportunity offer. It seeks Bruges first because that Venice of the North, retaining more medieval splendor than any other part of northern Europe, charms the visitor with quiet waterways and ancient houses, and because it " stands at the very base of the art of the Low Countries."

SUCCEEDING MEETINGS

The club will give two or three evenings to Belgium and an equal amount of time to Holland. Each member will learn and will tell the story of a town. Allen's " The European tour " (Chapter VIII) and his " Historical guide to the cities of Belgium " will convoy the club satisfactorily over the first part of its way. As for Holland, plenty of information may be gleaned from such works as " Dutch life in town and country " by Hough;

"Through the gates of the Netherlands" by Waller; "A wanderer in Holland" by Lucas; "Brave little Holland," "The American in Holland," and "The Pilgrims in their three homes," by Griffis.

Books taken home for swift reading may well be stories and novels; for example, "The black tulip" by Dumas; "Joost Avelingh," "Greater glory," and other novels by Maartens; "The cloister and the hearth" by Reade; "The burgomaster's wife" by Ebers. The well-known "Hans Brincker" might be looked through once more, for, although not written for adults, it is readable and depicts Dutch life faithfully.

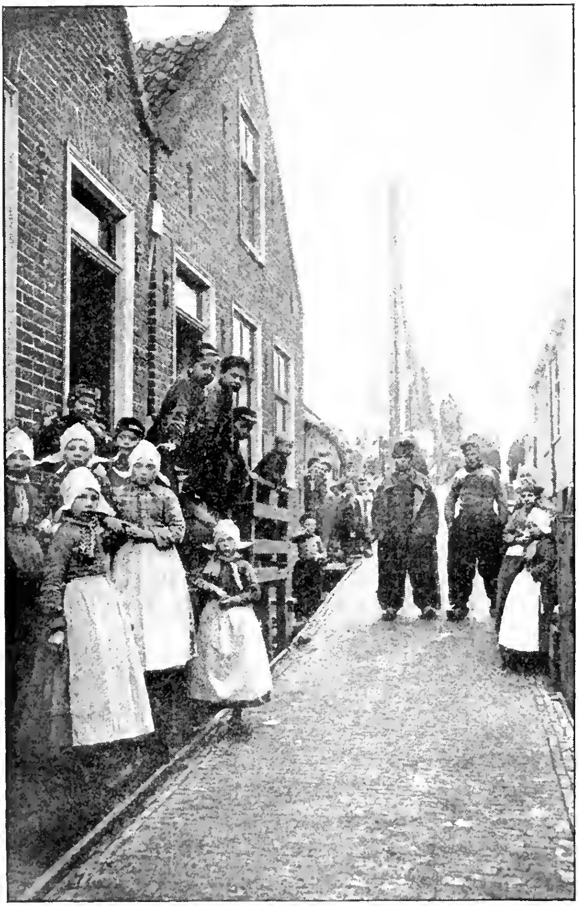


FIG. 59.—*A Dutch street scene*

Longfellow's lively ballad, "A Dutch picture," must surely be read aloud during one evening, and a game of proverbs may be played with some of the following Dutch proverbs:

God giveth the fowls meat, but they must fly for it.

No crown cureth headache.

Ride on, but look about.

An idle person is the devil's pillow.

Velvet and silk are strange herbs: they blow the fire out of the kitchen.

The Dutch are at home on skates. At a favorable time, therefore, the club might have one of its meetings at a suitable outdoor rendezvous and imitate some Dutch skating feats.

REFRESHMENTS

As for refreshments at the later meetings, they will, of course, be eaten from delft if the club owns such ware, and they must be exceedingly simple: biscuits and edam cheese, thin sandwiches of brown loaf containing raisins, hot milk boiled with aniseed; perhaps gingerbread and tarts and taffy. Taffy made by a club rule will do, but it should go by the name of "haagische hopjes."

FIG. 60.—*Children of Holland*

ACTUAL VISITS TO ART MUSEUMS AND LIBRARIES

Some one has said that "by far the best and truest teachers are the eyes." Be that as it may, the club is going to visit the nearest art museums and the library that has the finest illustrated works. Moreover, it is going to make its own collection of photographs that reproduce the masterpieces before which it has stood in imagination. Copley prints and Perry pictures are too familiar to need description. There are many photographic companies that furnish reproductions of the world's art treasures.

WHAT TRAVEL SHOULD DO FOR THE CLUB

Its journey has not been long, but if every member has told well the story of the town assigned to him, the club has acquired a variety of knowledge.

It realizes that "long before England had risen above the condition of an agricultural country, Belgium ranked as a mighty commercial focus;" that "while Liverpool was a tidal waste on the Mersey, Bruges was the great port for the exportation of cloth and the importation of wool, and furs, and spices;" that "while Manchester was a rural market town, Ghent was the center of the textile industries of Europe." It understands, therefore, why Flemish art deals with commercial life, why the Belfry, the Cloth Hall, the Town Hall, the Exchange, are its great buildings, and why its pictures are largely portraits of rich merchants. In Ghent it stood before the "Adoration of the Lamb" by Hubert and Jan van Eyck, the first great picture of the Flemish School, and in Bruges it had its first vivid lesson in the history of the Netherlands in front of the tombs of Charles the Bold and his daughter, Mary of Burgundy. In Brussels it lived in the airy Upper Town, reveled in the Old Square, haunted the Cathedral of St. Gudule, traced the development of Flemish art from its beginning as seen in Bruges and Ghent. It has learned to appreciate the saying, "All the Dutch towns are amphibious, but some are more watery than others," and might chuckle comprehendingly over anecdotes illustrative of Dutch cleanliness and of the masterful ways of the earlier Dutch women.

FIG. 61.—*A portrait by Rembrandt*

The club has joined the gossips on the Lange Pooten at The Hague and has learned that the footboard of the steam tram in Holland is as satisfactory to the sight-seer as is the London "bus" or the New York Fifth Avenue motor-coach. It has traveled from Leyden to Haarlem in April—the tulip season—"through floods of color," the color of the rich blossoms, and has driven out from the latter city over the dunes that stretch to the North Sea. It has visited Naarden and Muiden, medieval and still surrounded by moats and fortifications, and it has been on the wide sands at Scheveningen, where Dutch costumes are seen at their best.

Above all, the club has been invited by both Belgium and Holland to an acquaintance with great artists, such masters as Memling, Jan van Eyck, the founder of the Flemish School, Jan Steen, and Rembrandt

SOME ADVANTAGES OF STAY-AT-HOME TRAVEL

Travel by stay-at-homes has some advantages. Such travelers are never seasick nor homesick. They never miss boat or train. They lose no luggage. They sleep well o'nights, in comfortable beds. They may change the season at will, skate on a frozen canal to-day and sail between tulip fields bordering the same waterway to-morrow. They have many of the delights of travel with none of its fatigue. The club is not tired. Whither away now? Let it be to Paris, where the old Île de la Cité is living history and the Louvre will change the club's introduction to the old masters into a more intimate acquaintance with them; where, too, the merry modern world invites one to make holiday.

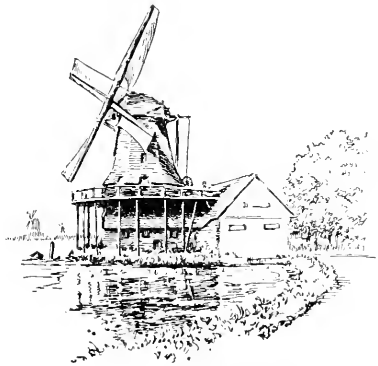


FIG. 62.—*A Dutch windmill*

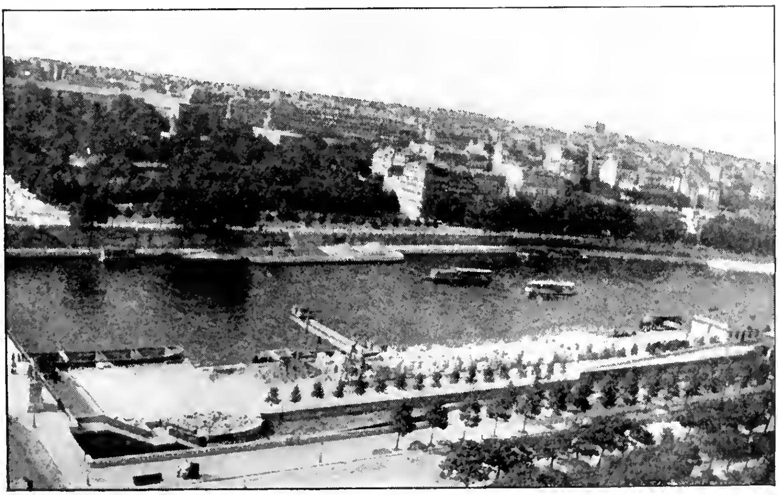


FIG. 63.—*Paris, a glimpse of the Seine*

PROGRAMS ON THE OUT-OF-DOORS

ADA E. GEORGIA

A SEASON'S BIRD STUDY

Winter is a good time to begin the study of birds. Their numbers are not then so great as to be confusing to the learner; they are not, as a rule, so shy and difficult to approach as at other seasons, when family cares make them secretive and doubtful of man's friendship. They endure the unkind season, too, with such sturdiness that our admiration goes out to the " scraps of valor that just for play front the north wind."

A study club desiring to make the acquaintance of the winter birds should let them know the fact, advertising it by many and repeated invitations to breakfast, dine, and sup at the club's expense. Scraps of suet, pork or bacon rinds, tied or wired to the limbs of trees; hayseed, grain, or the crumbs from the table, scattered in some sheltered spot for the seed-eaters — such food will draw the birds to partake of its bounty and will give the club a chance to learn their names and appearance and to study their ways.

But there are other winter birds of great economic importance, with which only chance is likely to bring about an acquaintance, such as the hawks and the owls, or such rare visitants from the North as the longspurs and the crossbills. A good plan for study is to prepare a list of such birds as may be abroad in the season of snow and cold weather, and then by diligent observation seek to know them personally.

The following is a list of the winter birds most likely to be met in field and wood and by the roadside:

Downy and hairy and red-headed woodpeckers, chickadees, and nuthatches, who will come to the suet feast, where perhaps the blue jay and the crow will join them; flocks of juncos, sometimes called the slate-colored snowbirds, who drop down in fence corners and along roadsides to clean seeds from neglected weeds; the rarer snow buntings and tree sparrows, driven southward by the severity of the weather; song sparrows singing as bravely as in June; goldfinches, dressed in sparrow-like brown instead of in black-and-gold, but always to be identified by their dipping, undulating flight; cedar birds, particularly if there are berry-bearing shrubs about; dainty redpolls, hardly as big as one's thumb yet preferring arctic weather and driven southward only by snow so deep as to bury the seed-bearing weeds and plants on which they depend for food; pine grosbeaks,

NOTE.—In some instances men and women in the community have a club for study of both farm and household subjects, or the women vary their programs with subjects pertaining to the out-of-doors. With this fact in mind we are giving material that will aid in the making of a program, and are offering direction for home reading on birds and trees, the soil and gardening.— Editor.

the males dressed in rusty red, as are also those other strange visitors from the North, the crossbills. The latter are always seen in evergreen trees, where their queer bent and crossed beaks prove to be the best tools in the world for the opening of cones and the securing of the seeds they hold.

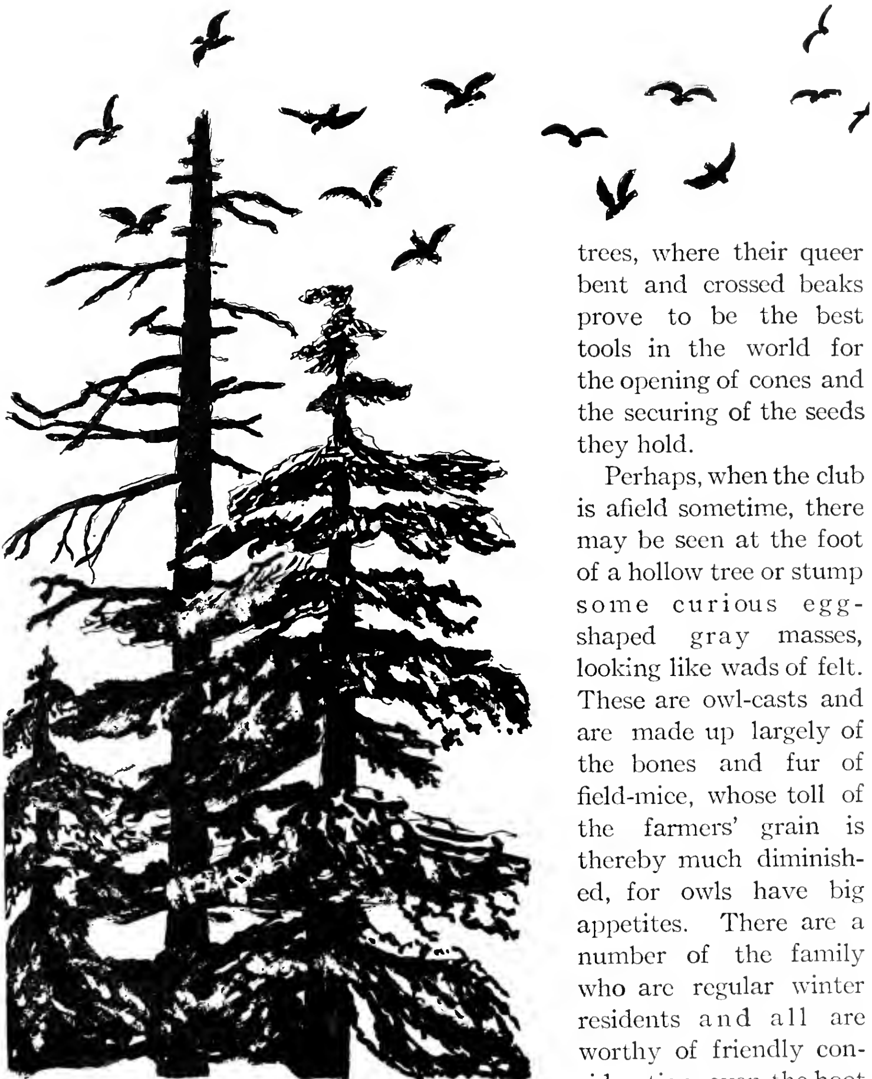


FIG. 64.—*Evergreens and crow caws*

Perhaps, when the club is afield sometime, there may be seen at the foot of a hollow tree or stump some curious egg-shaped gray masses, looking like wads of felt. These are owl-casts and are made up largely of the bones and fur of field-mice, whose toll of the farmers' grain is thereby much diminished, for owls have big appetites. There are a number of the family who are regular winter residents and all are worthy of friendly consideration, even the hoot owl and the great horned owl preferring rabbits to fowls when they are as easily come by. Poultry houses at night should be proof against such visitors. As for the barn owl, the screech owl, and the little saw-whet, or Acadian owl, the farmer who destroys such allies against his enemies makes a grave mistake.

It will be noticed that, though they gratefully accept the bounty of seed or of suet, none of the winter birds ever neglect their regular business of gathering the wild seeds or of searching the crannies of the tree trunks for the eggs and the larvæ of insect pests, which if allowed to increase would become the destroyers of the forests.

FIG. 65.—*Nest of Wilson thrush*

A small library of bird books for the use of a study club is a much-needed help, and when expense is a consideration it should be remembered that Uncle Sam has carefully studied the bird question from the standpoint of economics and is willing to give the result of his investigations free or to sell them for the mere cost of the paper on which they are printed. A letter to the Representative of the Congressional District or to the Division of Publications, Department of Agriculture, Washington, D. C., will obtain bulletins of great value. Circulars 2 and 3 of this division are lists of publications for free distribution and of publications for sale. Many of the latter are worth many times their cost to the nature student, particularly the circulars of the Bureau of Biological Survey and of the Bureau of Entomology.

One of the most instructive bird books published is " Useful birds and their protection " by Edward H. Forbush, issued by the Massachusetts State Board of Agriculture. Nonresidents of that favored State must pay a dollar for the book, plus postage of thirty-six cents; but it is worth much more than that, for it is a thick, well-bound octavo volume, beautifully illustrated.

Other bird books are so many and so excellent that it is difficult to make a choice among them. Perhaps the best for a beginner is "Bird neighbors" by Neltje Blanchan, published by Doubleday, Page & Co.; its descriptions are clear and its colored plates are very helpful in identification. Chapman's "Bird life" is more advanced, accurate, scientific, and also illustrated in colors; it is published by D. Appleton & Co., New York. Hoffman's "Guide to the birds of New England" is equally suited to the latitude of New York State and has the advantage of being small enough to be carried afield for reference. A small "Bird guide" of the land birds east of the Rocky Mountains is published by Charles K. Reed of Worcester, Mass.

The appended subjects are such as might be of interest to study in connection with the observations made at first hand during the season and to discuss at meetings of the club.

Small birds known to be resident in the vicinity during the winter

1 Their food and where it is obtained.
2 Adaptations of structure that help in securing food: shapes of beaks, tail feathers, position of toes, extensile tongues.
3 Color markings; distinguishing of sexes.
4 Does it pay to attract the resident birds by placing food for them in safe places?
5 Birds have keen appetites and swift digestion; it is safe to say that every woodpecker, nuthatch, or brown creeper needs at least a half-ounce of food daily in order to sustain life. Putting the low estimate of but a half-dozen of these birds to the square mile, compute the amount of noxious insect larvæ and eggs destroyed during the months of December, January, February, and March in the 47,000 square miles of New York State. Answer in pounds or in tons. Make the same computation as to the weed seeds that the ground-feeding birds destroy.

List of birds likely to be found resident:

Woodpeckers	Hairy	Brown creepers	Crows
	Downy	Nuthatches	Blue jays
	Red-headed	Chickadees	Goldfinches
English sparrows		Cedar birds	Golden-crowned kinglets
Song sparrows		Prairie horned larks	
White-throated sparrows		Juncos	

Birds of prey resident in the vicinity

1 What can be learned about the food of birds of prey?
2 What are the structural adaptations indicating that their food consists of creatures captured alive? (In this connection the speed and silence of their flight should be remarked; there is no whirr of wings from the swooping owl or hawk).
3 Aside from the occasional robbery of the poultry yard, do these birds destroy many creatures of economic value to the agriculturist? Are different species of these birds of varying economic value to the farmer?
4 Habits of seclusion when not seeking food.
5 Field mice devour an immense quantity of grain and grass seed and roots of plants; rats add to these depredations a heavy toll from bins and stacks; weasels are the pests of chicken coops and yards; rabbits are most destructive of green crops, nursery stock, and young orchards—and all these animals are excessively prolific. If only one of these creatures is killed each day of the year for each square mile of New York State, how many millions will be the total? What might conditions be were they allowed to live and increase?

List of birds likely to be found resident:

Hawks:
- Sharp-shinned hawk
- Cooper's hawk
- American goshawk
- Red-shouldered hawk
- Red-tailed hawk
- Great duck hawk, or peregrine falcon

Owls:
- Barn owl
- Screech owl
- Long-eared owl
- Hoot owl
- Acadian, great gray, and snowy owls from the North

In some localities the bald eagle

Visitants from the North

1 Conditions that force the birds to change of place.
2 Are these birds usually gregarious or solitary?
3 Observations on feeding habits.
4 Color markings; distinction of sexes.
5 In what ways may it redound to the prosperity of our own country to protect and preserve these birds while they are our guests?

List of northern birds often seen in New York State:

Snow buntings	Lapland longspurs	Red-breasted nuthatches
Evening grosbeaks	Golden-crowned kinglets	Tufted titmice
Pine grosbeaks		Redpolls
Crossbills	Northern shrikes	Greater redpolls
Pine siskins		

Birds usually migratory but occasionally resident in New York

1 Local conditions that may have induced the braving of winter.
2 Does it pay to encourage the birds to brave the season, by furnishing shelter and abundant food?
3 Observations as to whether it is the whole family that remains, or only unmated males.
4 What changes in feeding habits are the birds obliged to make in order to survive the season?
5 To what dangers beside cold are the birds exposed?

List of migratory birds of which some are resident in winter:

Robins	Purple finches	Shore larks
Bluebirds (more rarely)	Meadow larks	Chipping sparrows
Song sparrows	Flickers	Seaside sparrows
Swamp sparrows	Myrtle warblers	Ruby-crowned kinglets
	Rusty blackbirds	

Bird migrations

1 What can be learned concerning the reason or the necessity for migration? Of the extent of the migrating flight?
2 Which birds are the earliest migrants? the latest? What is the season of most abundant passage?
3 Consideration of the perils to which birds are exposed during migration.
4 When migrating, do the birds fly by night or by day? At what hour of the twenty-four can the flight of birds of passage best be observed?
5 What evidence has been collected that birds return to "the old homestead," and do not merely go south or north?

Laws of the various States for the protection of useful birds

1 Annoyance and injustice wrought by lack of uniformity.
2 Work done by Audubon societies.
3 Bird enemies that should be suppressed by law but are not. Ought a bird-killing cat to have more liberty than a sheep-killing dog?
4 The training of children to realize the value of birds and to respect the protective laws.
5 Has the country suffered an economic loss in the complete or partial extinction of such birds as the passenger pigeon and the fast disappearing wild turkey? If so, what can be done to restore their numbers?

Mating and home building

1 Birds are ardent wooers; does the female seem to have entire freedom of choice in selecting her mate?

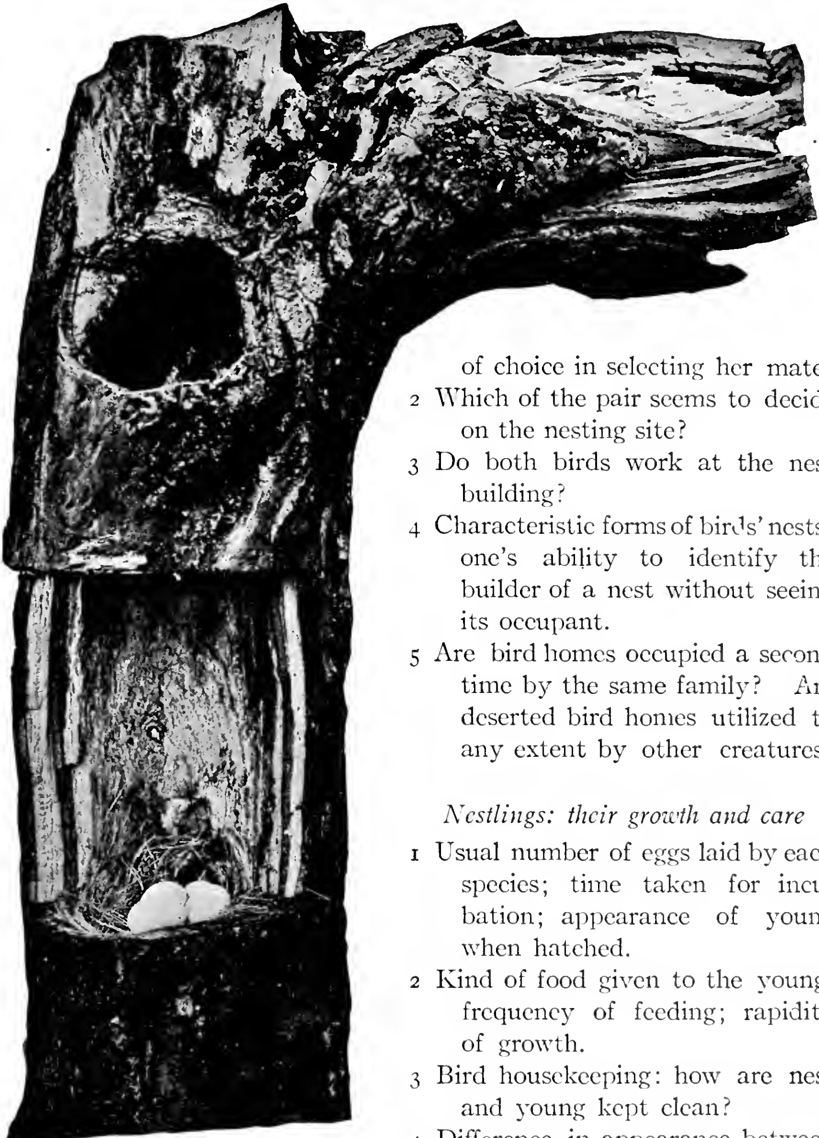


FIG. 66.—*Eggs of bluebird in the nest of an old apple-tree*

2 Which of the pair seems to decide on the nesting site?

3 Do both birds work at the nest building?

4 Characteristic forms of birds' nests: one's ability to identify the builder of a nest without seeing its occupant.

5 Are bird homes occupied a second time by the same family? Are deserted bird homes utilized to any extent by other creatures?

Nestlings: their growth and care

1 Usual number of eggs laid by each species; time taken for incubation; appearance of young when hatched.

2 Kind of food given to the young; frequency of feeding; rapidity of growth.

3 Bird housekeeping: how are nest and young kept clean?

4 Difference in appearance between the young and their parents; time required to put on adult plumage.

5 If but one pair of each species studied nested in each square mile of New York State, and reared the usual brood of four or five nestlings,

what would be the number of the multitude of his feathered benefactors surrounding man? And what must be the vicissitudes of bird life to cause the present constant diminishment of their numbers!

Birds of the dusk, other than owls

1 Whippoorwills and nighthawks; appearance, habits.
2 Their food and how obtained.
3 What is known of their nesting habits; number of young.

FIG. 67.—*Family of young chipping sparrows*

4 Are these birds economically valuable to man? Are they in any way harmful?
5 Enemies: are the birds increasing or diminishing in numbers?

Birds as planters

1 Seeds most disseminated by birds and how scattered.
2 Are birds sometimes responsible for the spread of new weeds or of noxious plants such as poison ivy?
3 Are birds pests in grainfields and in meadows?
4 What is the explanation of the thickets of wild cherry, thorn apple, sassafras, bittersweet, and woodbine, which spring up along old fences?

5 Squirrels captured by owls and hawks leave hoards of nuts uneaten; jays tuck away chestnuts and acorns in secret places, and are killed for their lovely plumage: suppose a dozen cases of this kind occur in a year on each square mile of the territory of New York, what would be the amount of such forestry?

Birds as food for man

1 What birds of the vicinity are on the game list?
2 Food habits of game birds; their fecundity.
3 Query: In which capacity is "Bob White" of most value: as a destroyer of potato bugs and grasshoppers, or as a titbit for the table?
4 Responsibility of the agriculturists in any locality in seeing that the close season is respected.
5 Would it be a profitable proceeding on the part of agriculturists to provide food supplies and shelters of berry-bearing shrubs for these birds, in order to mitigate their winter hardships?

Autumn migration

1 Species of birds among earliest migrants; reasons.
2 Are there assemblies and concerted action at the beginning of the trip, or does each family start off alone?
3 Are there regular lines of travel, or is there only a general southern trend? How extensive are the journeys?
4 Are the flocks greatly augmented after their arrival in spring, or does the natural increase merely serve to hold the balance even against the perils of bird life?
5 So far as known, do any of our migrant birds nest and rear young during their southern sojourning?

References

Bulletin 12 of the Bureau of Biological Survey, Department of Agriculture, Washington, D. C., is on "Legislation for the protection of birds other than game birds"; 92 pages; price, 10 cents. Bulletin 28 of the same bureau is on game commissioners and wardens, their appointments, powers, and duties; 285 pages; price 35 cents. Farmers' Bulletin 376 contains game laws for 1909; a summary of the provisions relating to seasons, shipments, sale, limits, and licenses; 56 pages; distribution free. Information as to work done by Audubon societies may be obtained by addressing the National Association Headquarters, 141 Broadway, New York.

Yearbook reprints:

37 Part 2. The meadow lark and Baltimore oriole
66 The blue jay and its food
132 Danger of introducing noxious animals and birds
194 The food of nestling birds
197 How birds affect the orchard
247 Two vanishing game birds—the woodcock and the wood duck
443 Does it pay the farmer to protect birds?
486 The relations between birds and insects
504 Plants useful to attract birds and protect fruit
545 The migratory movement of birds in relation to the weather

TREE STUDY

"*And out of the ground made the Lord God to grow every tree that is pleasant to the sight, and good for food; the tree of life also in the midst of the garden, and the tree of knowledge of good and evil.*"

Winter is a good time to begin to get acquainted with the trees. Their characteristic outlines and manner of growth can best be observed when not obscured by their covering of leaves. It is the best time, too, to note the differing color of trunk, branches, and twigs; the shape, color, and arrangement of the leaf and flower buds, which, though they will not unfold until next spring, were all formed during the last summer. Even though unskilled with the pencil, the attempt to reproduce what one sees helps to fix it in the memory, and it is well to try to make drawings showing the relation of trunk and branches, whether springing upward in a tapering shaft or forking into an open and wide-spreading head. Draw also the buds, showing, if possible, how the protecting scales are arranged. The leaf scars, too, are characteristic; they are to be seen most plainly in early winter when the leaves have lately fallen, and to try to draw them helps one to remember their form.

Winter is a good time, too, to study the history of trees from an economic point of view: to find out, if possible, all the industries in which wood of certain species is used; or the bark or leaves, as in tanning: or the pliant twigs, as in the basket-willow industry; or whether the fruit only is valuable. It is a good time to make special studies, as of sugar-making in connection with the maple tree; of the nut bearers and their economic value; of the special fitness of some woods for particular purposes, such as the very hard, strong, yet light-weight wood of the black walnut, which has caused it to be turned into rifle stocks for the armies of the world. Procure, if possible, a piece of the wood of each tree studied, in lengthwise and in crosswise sections, showing its grain and color in the natural state as well as when oiled and polished in a manufactured form.

It is best to begin with the study of a tree with which we believe ourselves already familiar. One cannot " look a bit " and then go away and forget, if one would really know a tree. The study calls for an intimate love and an almost daily questioning. At any hour some secret of its ways may be revealed: when the buds begin to swell; whether a bud develops into blossom or leaf; whether the leaves or blossoms first appear; whether the flowers are perfect, or the staminate or pollen-bearing flowers grow on one part of the tree and the pistillate or seed-bearing flowers on another part or even on another tree; whether the pollen is scattered by the wind or carried by insects, and, if the latter, the discovery of the insects to which it is most indebted.

The unfolding of the leaves is a wonderful thing, and the attempt to draw them in different stages of development is a fascinating study. So, too, is their arrangement with reference to the light when fully unfolded; in order to appreciate this fact, a tree should be studied from above and from below; one can then understand why the beech yields so slowly to the penetration of the rain and is better shelter from sun and shower than is the thickest evergreen.

The study of the formation and growth of the fruit is equally interesting. If possible, successive drawings should be made, showing development and position of the fruit, whether growing on new wood or on twigs of the previous season, how it is wrapped to protect it from cold weather or from other harm. Note the period of ripening and the manner of seed dispersal.

Observe and chronicle the habits of different species of trees in the doffing of their apparel in the autumn as well as in its donning in the spring: the characteristic coloring of the leaves in their ripening process and whether their fall is early or late, gradual or swift.

One cannot study a tree without observing the bird life that it shelters; the harmful insect life from which it needs to be protected by its human friends as well as by its bird neighbors; the beneficial insects that prey on its enemies and that need to become better known and protected.

One should learn something also of the physical composition and the powers of the tree: of its ability to temper the torrid heat of summer by the transpiration and evaporation of the tons of water drawn from the depths of the soil by its feeding roots and lifted to its green-leaf laboratories; of the work going on in those laboratories — for it is here, in the green substance of its leaves, that the food taken from the soil is combined with that drawn from the air and, with the help of the heat and light given by the sun, is changed to the starchy form in which alone it can be assimilated and used in the making of new growth. By this yearly miracle, taking place in the green leaves of trees and of all other growing plants, the world is sheltered, fed, and clothed. Many are the gifts it brings, and finally it yields its very substance to man for the many uses that experience has taught him. If continual benefits are an indication, a tree is a true philanthropist.

Appearance of trees in winter

1 General outlines: whether the bole extends to the top of the tree or forks into an open and spreading head; if the latter, is the head of a rounded outline, or a long oval, or largest at upper or lower part?
2 The bark: whether smooth or rough, light or dark, or blotched with different colors. If rough, are the ridges and furrows far apart or close together, vertical or apparently diagonal? Or is the bark broken into small ragged plates or scales, or long thin or shaggy ones? Are there transverse sutures or markings?
3 If the bark is smooth, what is its texture? Does it peel or roll, and, if so, does it come off in vertical strips or transversely?
4 The branches: whether large or small, many or few; and what is the angle at which they generally stand to the bole? Do they differ in color from the bole or from the twigs?

Buds and leaf scars

1 Are the leaf scars and the winter buds opposite each other on the twigs, or alternately spaced? This is an important help in identification, as only three of our common trees, the maples, ashes, and horse-chestnuts, have the buds and the leaf scars opposite.
2 Are the buds large or small, compared with the twig on which they grow? Are they short and rounded, or long, pointed, and slender; smooth and shining, fuzzy or woolly, or seemingly covered with sticky varnish? Their color and the number of their protecting scales.
3 In what ways do the buds at the tips of the twigs differ from those that grow at the sides?
4 Leaf scars: their size, shape, and relation to the bud. This knowledge is very helpful in determining species.

Swelling and bursting buds

1 The earliest date when buds of any species are noticed to be increasing in size; their rapidity or slowness of growth.
2 The scales: do they persist, or fall away? do they grow, or change in shape or color? Note the wonderful folding and packing of the leaf and flower within the protecting scales.

3 The buds of the cone-bearing trees; how they differ from those of other trees.

4 In what condition must be the buds of such fruit trees as the peach and the plum, to be blasted by freezing? Explanation of the fact that a sheltered hollow is not so good a location for a peach orchard as an open upland.

Roll call.— Favorite wood for burning, particularly in open fires. Reason.

Forcing of twigs in water — Grafting, budding, and pruning

1 Although it is well to watch nature when she is "taking her time" at her work, it is sometimes a convenience to hasten her. Large twigs of most trees will unfold their buds very quickly when brought indoors, placed in jars of water, and kept where it is warm and light. The buds may then be studied more frequently and closely.

2 Grafting. This is usually done before the sap starts in the spring. It is a process requiring a deft hand to match cambium to cambium and women should be able to do it well. Why not get the neighborhood expert to teach the members of the club? Many an apple or pear tree continues to bear "scrubs" because the men folk are too busy to change its nature by grafting.

3 Budding: though usually done in late summer, it may be done in early spring before the sap flows so freely as to drown the buds; the process at least might be learned at the earlier season.

4 Pruning: nature's ways of doing it; how man has improved on her process. Why not secure a teacher and learn details? Much depends on a tree's growing right when young, and the work is healthful and not too difficult for a woman, with the low-headed trees now preferred, which can be worked from a stepladder.

The unfolding of the leaves

1 Whether the leaves precede or follow or come at the same time as the flowers. Differing habits of different species.

2 The varying colors of young leaves as they grow: on white oaks they are a lovely pink, and "gray hossches'nuts' leetle hands unfoid, softer'n a baby's be at three days old."

3 Whether the leaves are downy, hairy, woolly, or sticky when young, and whether the condition is more or less persistent. By noting this, one can at any time distinguish the butternut from the black walnut. Note whether there is a fragrance or any odor from the leaves when crushed or bruised.

4 The development of the leaf stems: stipules, whether present or not, and whether persistent or transitory.

The time of bloom

1 The trees that blossom earliest; whether or not the flowers precede the leaves. What are the habits of the later-blooming trees in this regard?

2 Are the flowers perfect—that is, containing both pistils and stamens—or do these organs grow in separate flowers, or in some cases on separate trees?

3 How the flowers are fertilized; whether any tree is dependent on insects for pollination; trees valuable to the bee-keeper for the amount of nectar yielded by them.

4 Whether the trees that have the most beautiful flowers are valuable also for their timber or for their fruit.

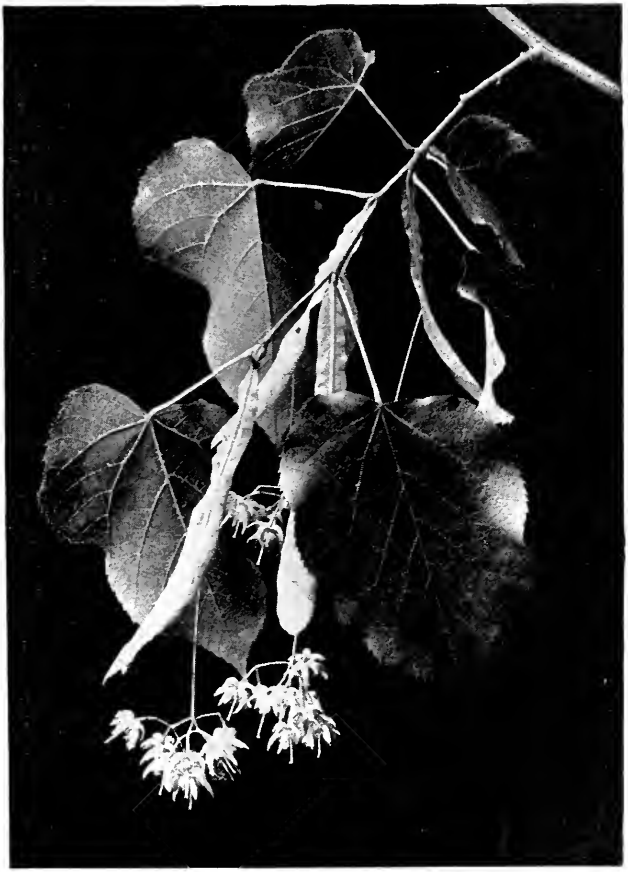


FIG. 68.—*A spray of basswood, or linden. Are the flowers fragrant?*

The fruits of the trees

1 Study of the home and orchard trees and their manner of fruiting; benefits of thinning some fruits when the crop is heavy.

2 Value of the nut harvest from forest trees; whether the crop would be profitable under cultivation.

3 Study of unfamiliar and seldom noticed fruits, such as those of the hackberry, sassafras, tupelo, and cucumber trees.
4 Dispersal of fruits by birds and animals; manner of dispersal of fruits that are inedible, such as those of the ash, elm, birch, and maple.

The evergreens, or conifers

1 How these differ from other kinds of trees: in their ways of growth; in their foliage, flowers, and fruit.
2 Pine needles: difference in length, size, and stiffness in the different species, and also the differing number of needles in a sheath or bundle.
3 Other conifers: hemlock, spruce, fir, cedar, and the larch, or tamarack; how to recognize each from the character of its leaves.
4 The fruits: whether maturing in one year or in two years, and the identification of species by their help.

Uses of trees in the industries

1 Observe, during the household work of one day, all the various articles used or handled in the accomplishment of this work, which are made of wood or produced by trees.
2 Learn something, if possible, about the kind and the amount of timber used in making charcoal and gunpowder; in the paper-pulp industry; in distilling wood alcohol and producing tar and turpentine; to furnish tannin either from leaves or bark; also for the making of apparently insignificant things, such as matches, lead pencils, and spools.
3 Number of agricultural tools for some part of which wood is necessary; the lack of care that many farmers give to such tools for their preservation and long efficiency.
4 The unnecessary use of wood in building and in many industries where more lasting materials would be more serviceable and economical.

The farmer's interest in tree growing

1 Value of trees to the land merely as objects of beauty.
2 Trees a paying investment when planted along roadsides, on the banks of every stream, around the borders of fields, and on all hillsides so steep as to be difficult of cultivation.
3 Trees a benefit to any locality in keeping the atmosphere pure, tempering the heat and the cold, and conserving moisture; why the shade of orchard or wood is so much cooler than are shadows cast by buildings.
4 Value to certain crops of sheltering windbreaks; "living fences" better than some other kinds.

Legislation for the protection of trees

1 Should there be state legislation to reduce taxation on woodlots and forested areas?
2 Can town legislation be brought to bear in saving the finest trees of a locality?
3 The most valuable forest trees of the region and what means may be brought to bear for their preservation.
4 What penalties has the State enacted for wanton destruction of trees or for carelessness in endangering the destruction of forests by fire?

Schools of forestry and the government bureau

1 Whether some knowledge of the principles of forestry is not necessary to a good farmer.
2 Whether it will pay the farmer to place his wooded acres under the supervision of the Bureau of Forestry, free of cost, as offered by that department of the Government.
3 Does systematic forestry as greatly improve on the wasteful ways of nature as does systematic agriculture, and if so will it not pay to learn the better way?
4 The value of wood crops as compared with other crops. The fact that proper harvesting maintains a forest. For a thousand years the city of Zurich in Switzerland has owned and managed a forest; that forest has yielded and still yields a definite amount of timber and fuel each year, and is now in better condition than ever before.

The help of a few books and other publications on the subject is almost indispensable, and winter is a good time to consult authorities such as the government bulletins, the circulars of the Bureau of Forestry, and the publications of the various state schools of forestry, as to the necessity for planting new forests and for the preservation of those now standing; as to the value of forests as soil binders, conservers of soil moisture, and regulators of stream flow. Find out what state legislation has been enacted for the protection and preservation of forests; for the reduction of taxation on forested areas; for the punishment of wanton destruction of forests. A few titles of helpful tree-books, with cost and name of publisher, are appended, as well as a list of bulletins and circulars to be obtained without cost from the United States Department of Agriculture. It would be well for applicants to write first to The Division of Publications, Department of Agriculture, Washington, D. C., asking for circulars No. 2 and No. 3, which are, respectively, the "List of publications for free distribution," and the "List of publications for sale." The latter are extremely valuable and the prices are so moderate as barely to cover the cost of printing and paper. Applications should be sent to The Superintendent of Documents, Government Printing Office, and payment should be by express or post-office money order or by registered currency; checks and stamps are not acceptable.

References

Bailey, L. H. The pruning book. The Macmillan Company, New York. $1.50

Britton, Nathaniel. North American trees. Henry Holt & Co., New York. $7.00

Emerson and Weed. Our trees and how to know them. J. B. Lippincott Company, Philadelphia. $3.00

Gifford, John. Practical forestry. D. Appleton & Co., New York. $1.20

Going, Maud. With the trees. The Baker Taylor Company, Boston. $1.00

Keeler, H. L. Our native trees and how to identify them. Charles Scribner's Sons, New York. $1.75

Lounsbury, Alice. A guide to the trees. Frederick A. Stokes Company, New York. $1.75

Mathews, F. S. Familiar trees and their leaves. D. Appleton & Co., New York. $1.75

Parkhurst, H. E. Trees, shrubs, and vines of northeastern United States. Charles Scribner's Sons, New York. $1.50

Rogers, Julia Ellen. The tree book. Doubleday, Page & Co., New York. $4.00

Roth, Filibert. First book of forestry. Ginn & Co., New York. $1.00

Publications of the United States Forest Service, Washington, D. C.:

Farmers' Bulletins:

(Unnumbered) The use of the national forests

No. 76 How to grow and plant conifers

134 Tree planting on rural school grounds

173 A primer of forestry (paper)
(A reprint of Bulletin 24, Part I)

181 Pruning

228 Forest planting and farm management

327 The conservation of natural resources

332 Nuts and their uses as food

341 The basket willow

358 A primer of forestry (paper)
(A reprint of Bulletin 23, Part II)

468 Forestry in nature study

Circulars:

No. 96 Arbor Day

130 Forestry in the public schools

140 What forestry has done

166 The timber supply of the United States

167 The status of forestry in the United States

171 The forests of the United States; their use

172 Methods of increasing forest productivity

Reprints:

No. 112 Trees of the United States important in forestry

270 Practicability of forest planting in the United States

329 The relation of forests to stream flow

434 National forests and the lumber supply

Cornell Reading-Course Lesson for the Farm, Vol. I, No. 12, March 15, 1912: The improvement of the woodlot

WINTER WORK

Study of soils

Experiments on soils of various kinds may readily be made in winter; for, even though the ground is frozen, a few blows with a pick will procure enough earth for use in the schoolroom. Loam, clay, sand, gravel, muck, and woods earth may be tested and compared as to capacity for absorbing and retaining moisture; as to the amount of air that would be permitted to reach the roots of growing plants; and as to the amount of plant food that these soils may contain. Discussions may be held as to what kinds of plants should be grown on these different soils and what treatment should be given to make some of the soils more fertile. Answers to these questions may not be as accurate as a chemist would desire, but one will be able to arrive at reasonable conclusions; for example, that a peaty bit of muck, able to hold its own weight of water, would not do at all for a potato patch, but might make a good celery bed.

Testing seeds, and observing the amount of plant food stored in roots, bulbs, and tubers

Seeds, and roots and tubers for planting, like all living things, are likely to have a more vigorous growth if they come of strong parentage and have received good care. If through accident, age, or neglect they have lost any part of their vitality, it pays the farmer to know the fact before the time to plant. These lessons and experiments may be made exceedingly interesting to children and they should be encouraged to make and keep notes, which may be helpful to them later, when planting in the open ground.

A good seed tester may be made with a five-cent cake-tin. Place in the bottom a fold of cotton wadding or thick woolen cloth, and over this a sheet of blotting paper marked off in equal squares, which are numbered. On the squares place the seeds to be tested, numbering the ear of corn or the packet of seeds to correspond with the square, and keeping in a note-book a record of the marks and of the growth of the seeds. Moisten the cloth and the blotting paper thoroughly and keep them moist during the test. Cover with another tin or a bit of board — since seeds sprout best in the dark — and keep in a warm place. A shallow wooden box in which about two inches of damp sand or sawdust is placed beneath the numbered squares also makes a good tester.

Seeds in a tester may be closely studied, as the cover may be lifted every day and observation taken. Pupils should be required to note the quality of the seeds to be tested, whether they are large or small, plump or shriveled, and whether the quality makes any difference in the vigor of the germ. Some gardeners sift their seeds and plant only large ones; after noting the results of their test, pupils might discuss whether or not it is worth while to take so much trouble.

A box or flat containing soil may be used for a test of deep and shallow planting, in rows side by side, of such small seeds as radish, turnip, and cabbage, noting whether the germs in the deeply planted seeds seem to have lost any vigor in the struggle to reach the surface. Comparisons may be made, also, of the effect on the germ of leaving the soil loose above the seed or of firming it down around the seed with care. Pupils should observe the effect of too little or too much moisture, and of changes of temperature.

Beets, turnips, onions, and potatoes may be brought to the schoolroom and sprouted in boxes of sand or in jars of water, and observations made of the amount of food stored by the plant for the sake of future growth. Discussions may be held as to whether or not harm is done to these vegetables by allowing them to become dried and withered before planting; whether it would be best to choose seed corn from a stalk bearing one extraordinarily fine ear or from one bearing four or five good average ears; whether potatoes from which sprouts have been removed are still as good for planting as before; whether it would pay to watch the potato hills when digging and choose seed from stems that were especially prolific of good-sized and well-shaped tubers, rather than to take the finest seed at random from the bin.

The study of trees in winter in orchard and wood

Not only is winter the best season during which to get acquainted with the names and appearance of the different kinds of trees in the fields and woods—when they are divested of their obscuring dress of leaves and when the characteristic marks of trunks, twigs, and winter buds are plain to view—but much may be learned at this season about the cultivation and care of the trees of the grove and garden.

The farmer who would derive an income from orchards of apples, pears, peaches, plums, or cherries will never neglect to care for them in winter. He will search his plum and cherry trees for black knot and other fungous growths and will see that these diseases are destroyed while dormant. He will examine the bark to see if scale insects are infesting it; then, when the time for spraying comes, he knows just where the work should be most thoroughly done. In autumn he will have planted cover crops or spread mulches beneath the trees in order to keep the frost from biting too deeply into the earth above their feeding roots. He takes care that the bark is not gnawed from the tree trunks by the hungry rabbits and rats and mice. If he wishes his young trees to make a vigorous growth of wood the next summer, he will prune them in winter, and the number and distribution of the buds on the branches will often decide for him as to what should be removed. After a "killing frost" he examines the buds to see if the promise of fruit has been destroyed; if it has been he will plan for a between-row crop in order to save the land from being unproductive.

Study of the care of domestic animals and poultry in winter

This is a study having many sides and it should be one of unfailing interest. It gives the sort of knowledge that should become almost a "second nature" to its possessor. The farm boy or girl who has a love for animals will find a perennial pleasure in learning how to make them more comfortable and happy, and as a consequence more profitable to their owners. Numberless discussions may arise from observations made by members or through suggestions from reading: for example, that one neighbor has plenty of eggs in winter when the price is highest, while another neighbor's flock, apparently as well cared for, produces few eggs or none; that one flock of sheep increases without mishap, while another loses many lambs through the owner's lack of knowledge of the proper care and feeding of the ewes in winter; that this dairy herd must make up to its owner in summer for the loss occasioned by its unproductiveness in winter, while that one, by a wiser use of balanced rations and other proper care, is profitable the year round; that a horse which lives in a dry and well-lighted stable, whose coat is curried and brushed regularly, and whose food is calculated and balanced, is a happier animal and can work better for his master than another horse which receives less intelligent care.

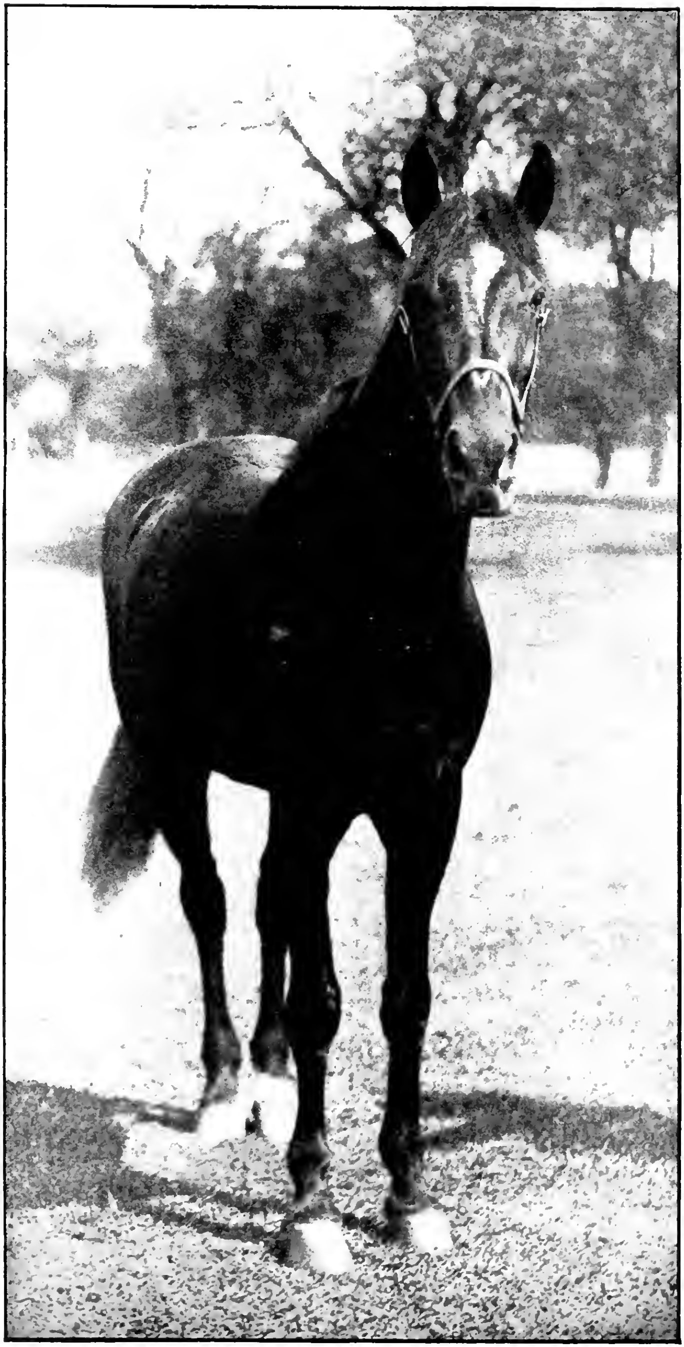


FIG. 69.—*A distinguished member*

Study of the winter birds in their relation to agriculture

Birds are few in number, but their very rarity makes them more interesting as a study, and in general the birds that brave the winter are more confiding and familiar during that season than at any other. A " free lunch " placed where they may enjoy it safely will, if regularly offered, attract nearly every resident species during the course of the winter.

Bits of suet or unsalted meaty bones, which may be obtained from the scrap meats of the butcher, should be tied or wired to the underside of a branch or nailed to the trunk of a tree as a special invitation to the woodpeckers, chickadees, brown creepers, and nuthatches, who, being acrobats, are able to feed comfortably in positions impossible to the sparrows, jays, and crows, who might otherwise leave their table bare. Experience has proved that feeding the birds does not cause them to relax their labor of clearing trees of the eggs and the larvæ of harmful insects, which food they seem to prefer, taking the suet and meats as a sort of dessert.

For the seed-eating birds, a shelf placed for the purpose on some sunny porch or window sill, beyond the reach of cats, is a good place to scatter crumbs from the table, small grains, or the swept-up chaff and seeds that have rattled from the hay fed to the horses or cattle.

The fortunate owners of evergreen windbreaks and shade trees should be observant of them when the cold is especially severe. At such places and at such a time the rarer visitants from the North appear: red crossbills or their brothers of the white-barred wings may come for a day or two and rifle every cone of its seeds; or the pine grosbeak may take a share of the feast; the wee kinglets, particularly the golden-crown, may be seen searching the needles and the small twigs for eggs or for aphids or other small insects. A few seeds scattered under or near the trees will make these favorite haunts of the northern birds even more attractive.

SPRING WORK

Gardening

Almost innumerable are the lessons, experiments, and tasks that Mother Nature makes ready in the springtime to busy the minds and bodies of all who are so fortunate as to live in the country. More than ever at this season,

> " The world is so full of a number of things,
> I'm sure we should all be as happy as kings."

Everything is wakening to new life and action — many things so useful to man that all the world must have them in order to live, and some things so harmful that, unless they are intelligently fought and conquered,

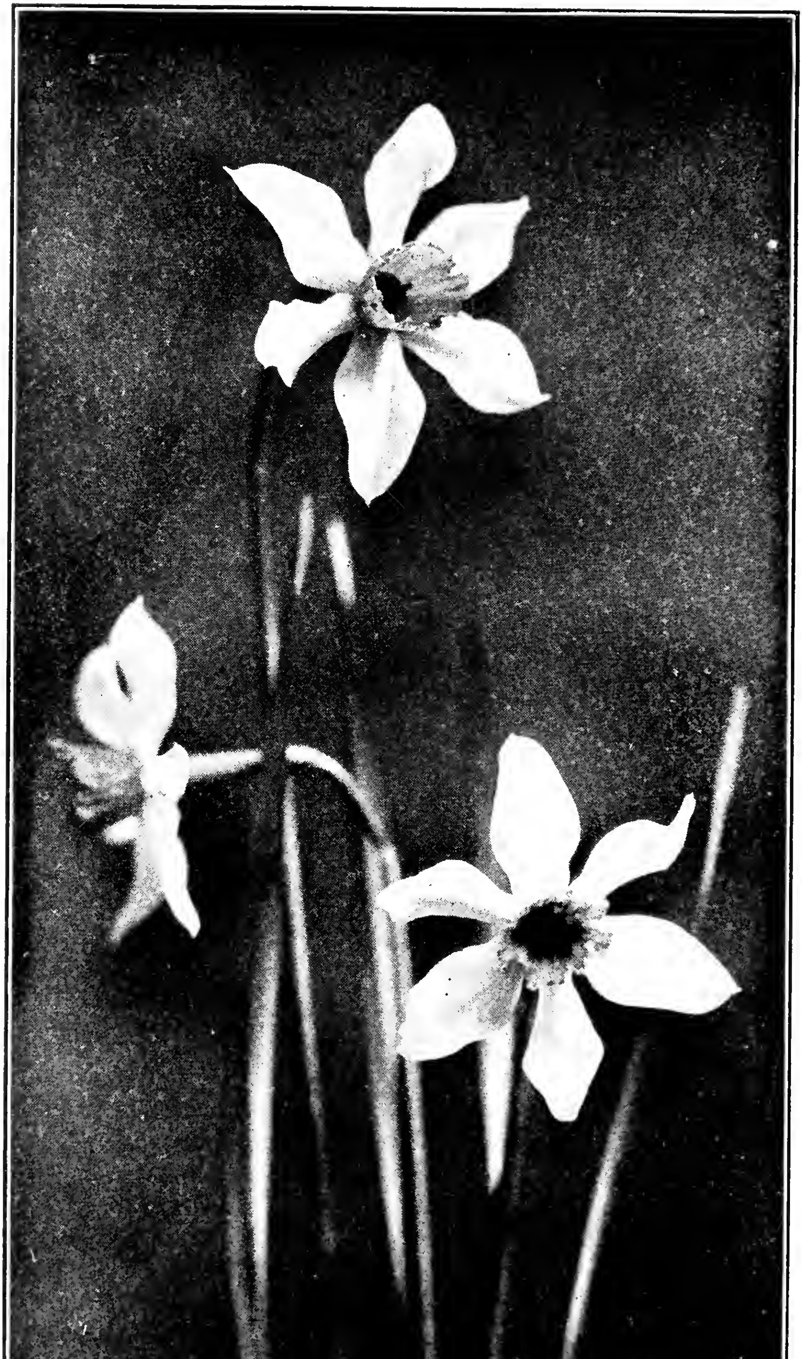


FIG. 70.—*Springtime*

the people must suffer in health and in pocket; and a knowledge of the best ways to help or to hinder their growth and increase should be a part of the teaching in every country school in the land.

How to make the garden more productive and profitable than it ever has been; how to make and manage hotbeds, cold frames, and pits; the right ways to sow and plant and transplant; the right ways of cultivation and reasons for them; how to recognize plants when seedlings and to know when a plant is a weed; how to know friends from foes among the insect and animal life, and how best to preserve the one and destroy the other; above all, how to appreciate and enjoy the glory and beauty of the new-clad earth and so govern the work of one's hands on it that it may become still more beautiful and fruitful: these are problems nearly as important to the individual pupil and to the community of which he is a part as is the mastery of the three R's.

Fig. 71.—*The best Easter Lily, the so-called "Bermuda"*

Even though the teacher of the rural school may feel a lack of preparation for this work, it may nevertheless be undertaken and very successfully carried out, with the help of some good textbook on elementary agriculture.

Study of bird life

Children who have watched and fed the resident birds during the winter will be the first to note when their numbers are augmented by the first comers from the South, or by stray visitors from the North whom hunger has driven to the milder regions for a short time. These rarer visitants give but a fleeting glimpse of themselves, but that only increases one's delight in meeting them; and to have seen and identified pine grosbeaks or red crossbills in the evergreens, or horned larks along the weedy fields or roadsides, is a pleasure long to be remembered.

If a strong sentiment in favor of the birds as "desirable citizens" can be wrought into the minds of the young folk while their joy at the first appearance of the little songsters is keenest, it may help to give them the gentleness that is a part of all strong character; and whatever protection to their feathered friends is thus brought about will surely be an economic benefit to the district about their homes.

Study of insect life from an economic standpoint

It has been stated with authority that the loss occasioned by noxious insects every year in the United States is so great that the amount, if saved, would more than pay the cost of all the public schools of the country. Moreover, the actual destruction of valuable crops is not the greatest harm that is charged against some of our most common insects: mosquitoes and flies have been proved to be capable of carrying infectious diseases and are a menace to health and life.

FIG. 72.—*Freesias*

This being true, it would certainly pay the country to see to it that the children in the schools are taught something about their insect foes and how to fight them: that adult mosquitoes and house flies hibernate during the winter, and every one destroyed as it crawls forth in the spring to sun itself on garret or cellar windows is an act of self-defense against future swarms; that domestic animals and poultry are often rendered miserable and unprofitable to their owners by being infested with noxious insects and must be helped to get rid of such vermin; that there is a proper time to spray for the destruction of the scale insects that do so much harm to the fruit trees; that there is hardly a plant of the farm or garden which has not one or more insect enemies to be combated and that the government of the country has thought it a good investment of public money to employ skillful men to make a study of the best means for carrying on the battle.

But all insects are not bad. Many are pollen carriers for the flowers and the blooming trees: farmers who raise fruits know that raspberries, blackberries, and currants "set fruits" more abundantly if their blossoms are freely visited by the bees; and some plants, such as the peas and beans, and the locust trees, and the squashes and pumpkins whose deep golden vases protect their pollen from the wind, could hardly exist without the good offices of their insect friends. Ladybirds and aphis lions feed on the plant lice; dragon flies dart through the air on a continual hunt for the smallest winged insects; and ichneumon flies of many kinds and sizes deposit their eggs in the bodies of caterpillars and other larvæ, and in their development the living host is destroyed.

Study of wild flowers and blossoming trees

Almost greater than the pleasure of hearing and seeing the returning

FIG. 73.—*Once a week while the girls of the sixth grade, Bradley, are at sewing school, the boys have gardening lessons. In March they begin by sowing seed, picking out the lettuce and tomato plants*

birds, is that of finding — not always picking — the first flowers of spring; and, as in the case of the birds, a better knowledge of the flowers and their habits may lead to their care and preservation. The writer has taught in country districts where hepaticas, anemones, trailing arbutus, shadbushes, and wild azaleas were all classed by the children as "May-flowers," though most of them bloom in April. For one who loves plants, it will but increase that affection to have a few simple lessons on their names, characteristics, and family relations. To learn how to make a small herbarium, in which the plants are neatly arranged, with name, family, date, and the sort of place where each plant preferred to grow, is a good exercise for both mind and body.

Few persons note the beauty of blooming trees; the white mass of bloom on the cherry and apple trees or the pink clouds on the peach may catch the eye, but that the oaks and elms and evergreens have flowers, too, is a surprise to many. Yet the trees last mentioned have very interesting flowers to study, particularly those which, like the nut-bearers and conifers,

FIG. 74.— *A clump of bishop's-cap*

have their pollen-bearing and seed-bearing flowers on different parts of the tree, or, like the willows and poplars, have them on separate trees.

Children should be encouraged to take notes on the trees of the neighborhood, beginning early in the season: observing when the buds begin to swell; the arrangement of the buds; whether a bud develops into a blossom or a leaf; whether the leaves or the blossoms first appear; the shape and color of the blossoms; the color and position of the leaves when they first appear; the different stages of the unfolding of the leaves. If an attempt is made to draw what is observed, the eye is greatly helped to "see what it looks like."

Study of the small wild animals about the farm

Spring is the season when family cares come on the dwellers in the field and wood, and the necessity of getting food for their little ones makes them very bold. Raccoons, woodchucks, and ground squirrels have left their winter quarters, and the marauding skunks, foxes, and weasels that have levied tribute all winter on the poultry yard, and even more heavily on their wild neighbors, the field mice and the rabbits, grow still more daring in their efforts to keep a hungry family well fed. They may not be so interesting to the hunter and trapper as they were in the winter, when the peltry was in finest condition, but for the nature student now is a good time for the study of their life and habits.

FIG. 75.— *Black walnut in blossom*

Care of young poultry and domestic animals

Like their wild kindred, the domestic birds and animals begin the rearing of their young in the spring; and learning how to care for them properly is not only a most useful accomplishment for every farm boy or girl, but it should be a pleasant pastime as well. A sense of ownership helps wonderfully in removing the feeling of drudgery from such responsibilities; and if the children are given proper rights to a brood of chicks or ducklings, or a wabbly-legged calf or lamb, the desire for knowledge of the best way to make them comfortable and happy comes with the delight of possession. But " Mary's little lamb " should belong to her always and not become her father's property when the time arrives for shearing the wool or marketing the mutton; too often the only return for her service is the gift of another little lamb to pet and rear.

SUMMER WORK

Spring is a pleasant season of planning, and of sowing and planting, but the beginning of fulfillment comes with the summer. The first of the early fruits and vegetables are then ready to be harvested, and perhaps the larger part of them marketed; and the coins received for the first picking of strawberries or for the earliest "mess of peas" seem to have a pleasanter chink than those in the fuller purse gained from the later abundance. Weeds of many kinds have sprung up and must be studied to learn the best means of getting rid of them; drought may come, with its problem of irrigation or mulching or continual surface tillage to conserve soil moisture; plants or green fruits that are crowded for growth must be severely thinned — a hard lesson for children, who cannot bear to throw away the plants they have tended; but if they are taught that the resulting crop will be much finer for the loss, and also that the thinnings may be used to help the growth of pigs or chickens, they may begin to see some of the advantages of diversified farming.

Summer study of birds and their nestlings

Many of the birds that are persecuted and destroyed by the farmer and the farmer's boys because of their liking for the berries and cherries to which the farmer thinks he has exclusive right, are so truly useful as destroyers of noxious insects and weed seeds that if their habits were more closely studied it would be seen that they really earn the right to a share of the fruit in its season. Most birds feed their young on "soft meat," which is composed almost entirely of insects and their larvæ, and a nestful of hungry, growing birdlings eat more than their parents do; many nestlings are said to consume more than their own weight in food each day, during the time of attaining their growth and their covering of feathers. But the grown birds also are insect eaters: robins keep as plump as aldermen all through the spring and early summer on the grubs and worms that they dig from the ground; the beautiful rose-breasted grosbeak has earned the name of the "potato-bug bird" because of his fondness for those insect pests; goldfinches are "thistle birds" because they build their nests of thistledown and eat the seeds of the pernicious thistle; the warblers spend their restless days in searching the trees for insects and for their eggs and larvæ, to feed their nestlings and themselves. Even the larger birds, such as the hawks and the owls, do far more good than harm: most of the casts scattered at the foot of the owl's roosting tree contain the bones and fur of field mice, moles, and other vermin; the sparrow hawk would better be named the grasshopper hawk, so tireless is he in hunting grasshoppers, nighthawks and whippoorwills and little brown bats live on the night-flying beetles and moths, most of which are a damage to the farmer in either adult or larval stage.

Insect study

Spring work against insect enemies consists largely of preventive measures; and if that part of the work is neglected the result is likely to be very evident at a late season, for some of these pests rear two broods and a few are said to be triple-brooded. Ants are as busy and as interesting to study as they were when wise Solomon used them to point a moral against idleness. If bumblebees' nests are plenty in the clover field, the crop of clover seed is likely to be heavy and profitable. It is interesting to note that the United States sent bumblebees to the Philippine Islands when trying the experiment of introducing the clover plant there.

Seed study and selection

Farm work would lose a large part of its drudgery if the eyes were kept open for the discoveries that may come to one who is interested in Nature and her ways. If when gathering a load of sweet corn for the market a particularly fine and prolific plant is found, the ears from that plant should not be picked, but should be marked and carefully kept for seed in the hope that its progeny may inherit its superiority. Perhaps one of the rare "seed balls" may be noticed when spraying the potato field: if so, it should be kept from harm and carefully allowed to ripen, for it may be the progenitor of new varieties of great value; the plant on which it grew should be studied well and the amount and quality of its yield recorded, as a promise of the future capabilities of its descendants. Some of the best varieties of wheat, rye, and other grains have been produced by observant farmers who selected plants that showed great superiority to their kind and preserved their seed, to the improvement and increase of the harvests of many men.

Study the weed seeds, too, and their manner of traveling about the world in spite of all attempted prevention. With such weeds as are annuals and biennials, it is only necessary to prevent seed formation in order to destroy them utterly; a knowledge of their habits will help to show the best means for their extermination.

Budding and summer pruning

The making over of one kind of tree into another is such a seeming miracle that it cannot fail to be interesting to any intelligent boy or girl. Young fingers are often exceedingly deft, and when once the knack of placing a shield so that the cambium layers of scion and stock exactly match is learned by boys or girls, they may become very efficient help in a nursery. The proper time for "pinching back" and for removing the old canes in the blackberry and raspberry patches, the necessity of occasional summer pruning in order to check excessive growth of wood and to stimulate fruit production in young plum or peach orchards, are things of interest and profit to know; and if the young folk of the farm were given more often a direct share in such profit, their desire for knowledge of the best methods of propagation and cultivation would naturally increase, and with it the desire to stay on the farm and put the knowledge into practice.

Summer work in the dairy and poultry yard

Plenty of food of the proper kinds, pure water, and room for exercise, are the chief needs of the domestic animals and fowls after their young are sufficiently grown to be treated as are the rest of the herds and flocks. But the proper management and disposal of their produce is a matter for much study and it should be made as interesting a problem to the young folk of the farm as it is to their elders.

AUTUMN WORK

Gardening

A large part of the beauty of the flower garden, and of the productiveness and profit of the fruit and vegetable garden, is due to the care expended on them in the fall. Bulbs must be planted at this season and it is also the best time for planting many shrubs and herbaceous perennials, and for dividing and re-setting those that have become too crowded. The summer bulbs and tubers, such as gladioli and dahlias, must be taken up and carefully dried for their preservation during the winter. The peonies in the flower garden and the rhubarb and asparagus beds in the vegetable garden may be covered with a compost blanket, which can hardly be made too warm and rich for them, particularly if it is intended to force the aspar-

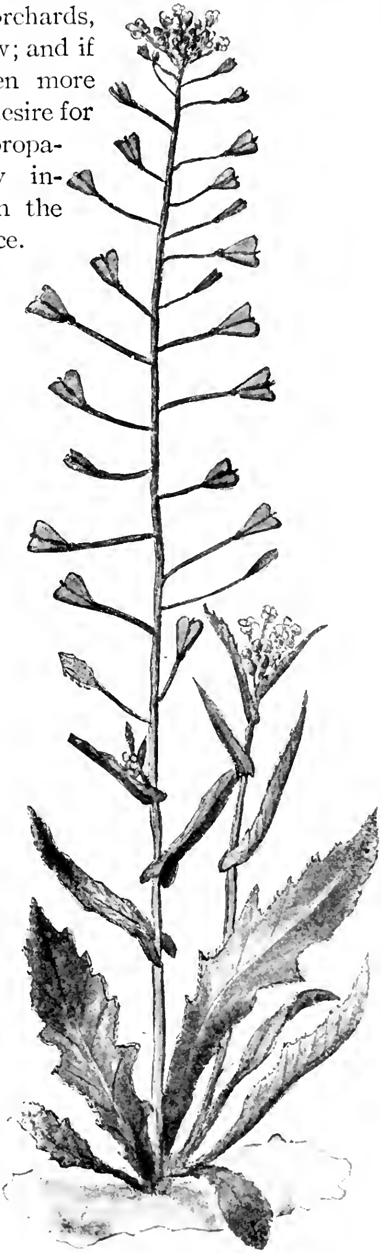


FIG 76.— *The shepherd's purse. A study in weeds*

agus to the swift and early growth that is so profitable in the spring. A large part of the "cleaning up," which is often all left till spring, is better done in the fall.

Study of leaves

Leaf "starch factories" have finished their work for the year and their ripening is shown by their changing color, which is not all due to the action of the frost. The study of the difference between the various species of the same family, such as oaks and maples, and of the infinite variety of form to be found in the leaves of other trees, shrubs, and plants, is most excellent training of the powers of observation.

Harvesting and preserving vegetables and fruits

Both men and women on the farm should make a careful study of this part of their yearly work, for it usually means all the difference between small profits from sales when the market is overstocked and large returns obtained from carefully harvested and well-preserved goods offered when scarcity has brought prices to the top of the market. The art of storage can be learned and utilized by the farmers themselves, either as a single business venture or by cooperative support, as well as by the city dealers to whom such knowledge and skill brings large profits.

Study and protection of game birds

When the game birds are all gone, the farmer will have to raise the tamer birds to take their places as food; and he will not grudge the grain he feeds them, because they will pay it back. But the quail, partridge, and woodcock, the wild ducks and geese, feed themselves in such ways that they are often a benefit and not an expense to the farmer, and he should use his influence in the direction of strengthening the laws for their preservation.

FOOD VALUES AND CARE OF POULTRY AND STOCK

The management of the dumb dependents of the farm, particularly the breeding, feeding, and marketing of the poultry and other stock, is seldom entirely the care of the men of the household; it should never be, for it is one of the most interesting departments of farm life and work and much of it would seem better adapted to women than to men. The *how* and the *why*, at least, should be understood by the women, even though the actual work be done by stronger hands than theirs. If the strong hands should be removed, or if for any reason the woman must assume the burden of responsibility, her necessary knowledge must be gained somehow, often by experience of loss and failure. It would be better if all the problems of farm living could be studied from both masculine and feminine points of view and the benefits gained from such study and experiment be a joint possession. Two heads are better than one and four hands better than two, particularly if the proceeds as well as the labor be justly shared.

Then the farmer's wife who grows " tired of four walls and a ceiling " and the treadmill round of indoor tasks, would find pleasure in the change of going out to feed well-balanced rations to a flock of well-bred, well-housed fowls, ducks, geese, or turkeys; or to tend the early lambs that are so much more profitable than those born late, provided the mothers and their young have both received proper care and feeding; or to bring keen housewifely eyes to bear on the work of stable and dairy, seeing that it is done with all regard to the laws of sanitation yet as cheaply as is consistent with them.

The following topics are suggested for discussion by the readers of the Cornell Reading-Course who have formed study clubs interested in making the occupation of farming more profitable and businesslike as well as more pleasant and wholesome:

Dependence of the farmer's prosperity on his live stock

- 1 Necessity for knowledge of proper feeding in order to secure the greatest value and efficiency.
- 2 How one may find out whether or not an animal is an " unprofitable servant."
- 3 Plans for record-keeping that will not involve more skill, time, and labor than a busy farmer's wife has to spare.

The chemistry of living things

- 1 How an animal grows by transforming plant substance into animal tissue.
- 2 Composition of plants
    - a Nitrogenous
        - (1) Albumen.
        - (2) Gluten.
        - (3) Casein.
    - b Non-nitrogenous
        - (1) Starch.
        - (2) Cellulose.
        - (3) Sugar.
    - c Minerals
- 3 Composition of animals
    - a Nitrogenous
        - (1) Red meat.
        - (2) Wool and hair
        - (3) Feathers.

b Non-nitrogenous
Fats.
c Mineral
Bones.

Summary of the process of digestion
1 Constituents of foods and special duties of each
a Water.
b Fats.
c Minerals.
d Carbohydrates.
e Proteins.
2 The blood: its composition and purification.
3 Computing balanced rations.

Practicability of successful stock-raising by women
1 Whether it is better to undertake but one line of animal husbandry, as poultry or pig raising, or whether it is better for the farm and for its owner to support some of all kinds of farm animals.
2 Limitations imposed by locality, soil, markets.
3 How one may guard against danger from dogs, so deterrent to sheep raising.

Poultry houses and yards (See Bulletin 16, Farmers' Reading-Course)
1 Reasons why the fowls' home should be commodious and comfortable in order to get the largest return value from the food given them.
2 Reasons for or against keeping breeds distinct for purposes of egg or meat production, or for merely raising chickens.
3 Influence of breed, food, age, and health on the production of eggs or on the quantity and quality of meat.

Various poultry foods and their value (See Bulletins 17 and 18, Farmers' Reading-Course)
1 Consulting the tables in Bulletin 17, which show that the highest percentage of protein, or muscle-forming material, of carbohydrates, or fat-forming material, and of manurial value is contained in flaxseed, peas, and sunflower seed, why would it not be profitable to raise such crops for consumption in the poultry yard?
2 The farmer's problems of feeding are different from those of the village or suburban poultry keeper, who must get all his food in the market. Would it pay the farmer to buy meat scraps, oil meal, or ground bone for his poultry?
3 Are the returns sufficient in value to repay the trouble of cooking such foods as turnips, beets, or potatoes for the poultry?

4 Can destruction of noxious insect pupæ be secured by locating poultry runs in fruit orchards?
5 Give record of one particular hen: her weight; the number and weight of her eggs; the length of time it takes her to return to her owner her weight in eggs, or her meat price in eggs.

Care of young poultry (See Bulletin 19, Farmers' Reading-Course)
1 Considering the increased labor and care and the higher death rate among incubator chicks, is it not better for the farmer's wife to keep to the natural method of raising poultry?
2 Discussion of the best foods for growing chicks; for ducklings, goslings, or turkey poults; use and abuse of condiments.
3 How to prevent loss from vermin and from prowling animals. Care of the mother hen before the chicks hatch.
4 Diseases of young fowls; their remedies.

Sheep farming a profitable occupation for women
1 Choice of breeds: for wool, for increase, for mutton.
2 Winter lambs: how to care for, feed, and market them.
3 Housing the flock; its proper feeding; protection from dogs and other enemies; cleansing, shearing, storing, and marketing of wool.
4 Diseases and their remedies.

The pig as a mortgage lifter and the farm-wife's ability to raise him
1 Choice of breeds.
2 Study and choice of foods: the popular demand for leaner pork, and the profitable balancing of rations that shall contain less fat-forming food and more foods that help to make lean meat.
3 The hog's reputation as a lover of filth and his real delight in cleanliness when given a chance to enjoy it.
4 The pig as an ally against curculio and codling moth when he is turned into orchards to pasture and to keep windfalls cleaned up.

The raising of dairy and beef cattle (See Bulletins 6 and 7, Farmers' Reading-Course)
1 The profits in quickly fattened veal; why cannot the farmer's wife feed the calves and have the proceeds?
2 Regulating the food of
    a Milkers.
    b Workers.
    c Young stock and fattening animals.
3 Increased profit, if comfortable and sanitary housing accompanies the feeding of properly balanced rations.
4 What to do with an animal that does not pay for its keep.

The profit to the average farmer in raising "general-purpose" horses

1 The care and feeding of a weanling foal so that its growth may have no check.

2 Frequent handling and petting of the colt so that it may be gentled preliminary to breaking in.

3 Value to a woman of a knowledge of the arts of riding and driving and of the ability to harness and care for a horse.

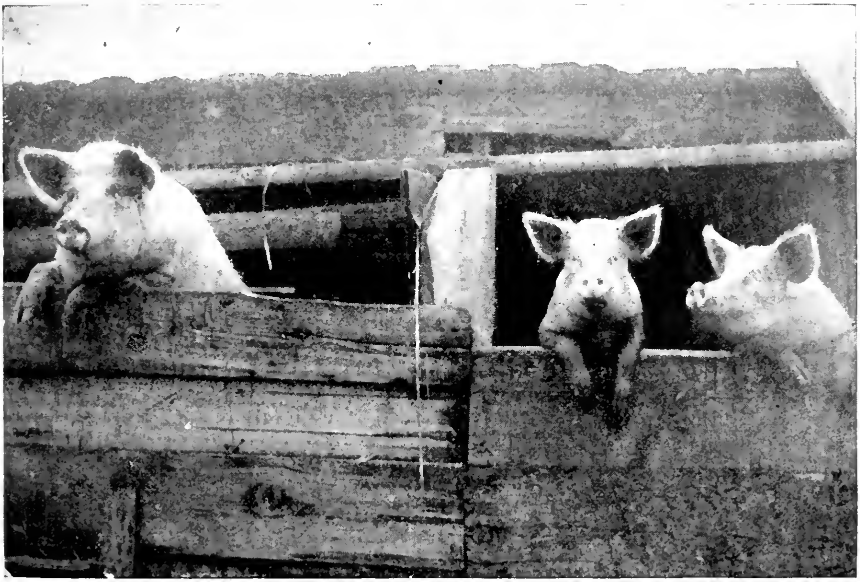


FIG. 77.— *Looking for company*

Value to the farmer of the undigested food of animals

1 Necessity that the food of animals should have sufficient bulk to insure healthful intestinal action.

2 The high value of such undigested food as fertilizer when it is properly kept and then returned to the soil.

3 Wastefulness of the American farmer in not properly caring for the manure produced by his animals.

GENERAL REFERENCES

Bailey, L. H. Manual of gardening. The Macmillan Company, New York. $2.00

Nursery book. The Macmillan Company, New York. $1.50

Pruning book. The Macmillan Company, New York. $1.25

Horticulturist's rule book. Orange Judd Company, New York. $2.00

Fletcher, S. W. Soils. Doubleday, Page & Co., New York. $2.00

Henry, W. A. Feeds and feedings. The Author, Madison, Wis. $2.25

Hunn, C. E., and Bailey, L. H. Amateur's practical garden book. The Macmillan Company, New York. $1.00

Mann, A. R. Beginnings in Agriculture. The Macmillan Company, New York. $.75

Plumb, C. S. Types and breeds of farm animals. Ginn & Co., Boston, Mass. $2.00

Vivian, Alfred. First principles of soil fertility. Orange Judd Company, New York. $1.00

A much more extended list of reference books in connection with the garden, soils, and poultry is given in the Cornell Reading-Course for the Farm Home, Lesson No. 9.

Seedsmen's catalogs are accurate, are well illustrated, and give full directions for raising plants.

Farmers' Bulletins, United States Department of Agriculture, Washington, D. C.:

No. 306 Dodder in relation to farm seeds
382 The adulteration of forage-plant seeds
400 A more profitable corn-planting method
406 Soil conservation
414 Corn culture
415 Seed corn
428 Testing farm seeds in the home and the rural school

Reprints from yearbooks:

Separate 287 Improvement of corn by seed selection
411 The present status of the nitrogen problem

HOW TO FORM A CLUB OR OTHER SOCIETY

MARY F. LEWIS

Chairman pro tem; secretary pro tem

First of all, after the meeting has been called (page 155) two officers must be chosen: one, a chairman for the time being (a chairman pro tem) to preside over the meeting; the other, a secretary for the time being (a secretary pro tem) to keep a record of what the meeting does.

Any person may call the meeting to order. Some one rises and moves that Mrs.. be made the temporary chairman.

The chairman may state why the meeting has been called; or she may ask some one else to do so.

What a "motion" is

After the reason for calling the meeting has been explained by the chairman or by another person at her request, some one should be ready to present a formal recommendation, a resolution (called a "motion"), intended to further the purpose of the meeting.

If that purpose is the formation of a Cornell study club, the motion may be worded thus:

Model for wording of motion

"Madam Chairman: I move the adoption of the following resolution:

Resolved: That a Cornell study club shall now be formed in ...."

Every motion, however, needs to be upheld by some other member of the meeting than the member originally making the motion, therefore it must be seconded.

How to "second" a motion

In order to second a motion, a member rises and merely says:

"Madam Chairman: I second the motion."

Restatement of motion by chairman

The motion, having been made by one member and seconded by another, is restated by the chairman somewhat in this way: "It has been moved and seconded that a Cornell study club shall now be formed in ...." The chairman then asks the meeting:

"Are you ready for the question (ready to vote on it)?"

The vote

If no discussion nor objection is made to the putting of the motion, the chairman says: "All in favor of the motion, say 'aye'; any opposed to it, 'no.'" This is the usual method of voting.

Various ways of voting

There are other ways of voting than by means of "aye" and "no." A raising of the right hand — first by those in favor of a motion, then by those opposed to it — may be asked for. The hands may then be counted by the chairman, who may ask some other member of the meeting also to count them. The result of the counting is announced by the chairman. Often, a written vote (a ballot) is cast. The written vote protects the voter, because the nature of his vote — whether "yes" or "no"— is known only to himself.

Announcement of the result of a vote

The chairman may appoint two persons as tellers to distribute and afterward collect and count slips of paper (ballots). The chairman notes whether the greater number vote "aye" or "no" and makes an announcement of the result of the voting in accordance with the facts; saying, for example, "The ayes have it" or "The noes have it," as the case may be.

"Minutes" of a meeting

The secretary, as soon as elected, begins to keep a record (called "minutes") of everything done by the meeting. On that record now stands the decree of the meeting that a Cornell study club shall be formed.

How to organize the club

What is next needed in order to insure the existence of the club, is to organize it by giving it a body (a Constitution) and By-Laws (rules by which to live).

The chairman may ask: "What is the further pleasure of the meeting?"

How to draft Constitution nd By-Laws

Some one present moves that a committee of three (or of any other number) be appointed by the Chair to draft a Constitution and By-Laws for the Cornell Study Club and that the committee be instructed to report as quickly as possible (at a specified time). The motion is seconded, restated by the chairman, and put to vote· if it is adopted, a committee is then appointed.

Preliminary meeting to draft Constitution and By-Laws

When it is desired to form a permanent society, those most interested in its organization usually meet beforehand to draft a Constitution and recommend such rules as will suit the society to be formed. If such a preliminary meeting has been held, the committee appointed at the next general meeting to draft a Constitution and By-Laws may be instructed to report as quickly as possible.

Model for report of committee

The form for its report may be as follows:

"Madam Chairman: Your committee appointed to draft a Constitution and By-Laws, begs to submit the following draft with the recommendation that it be adopted as the Constitution and By-Laws of this club.

"Respectfully submitted,
"Annie Jones, Chairman,
"Maria Lewis, Sarah Brown, Committee."

Motion of chairman of committee

The chairman of the committee, before she takes her seat, says:

"Madam Chairman: I move that the Constitution and By-Laws recommended by the committee be adopted."

Her motion is seconded; then the chairman of the club says:

"It has been moved and seconded that the Constitution and By-Laws recommended by the committee be adopted."

How to vote on the Constitution

The Constitution is open for amendments and discussion. Therefore, it is the duty of the chairman to read the first Article of the Constitution and ask if there are any amendments proposed to it. If there are none, she should not take the vote on the adoption of that first Article separately, for the reason that the Constitution, though made up of many parts, represents but one individual instrument; consequently, it would be as much out of order to adopt one of its Articles separately as it would be to adopt individually a paragraph of a resolution. Hence, the chairman should proceed to read the second Article, not forgetting to ask whether any amendments are to be made to it. If any amendments are proposed they should be voted on, and, if adopted, incorporated in the Article itself. But the Article, even after it is amended, is not voted on, for the reason that the Constitution forms one instrument and must be voted on as a whole.

After the chairman has read each Article separately and given opportunity for amendments to it, the Constitution is still open for further amendments before the final vote is taken. The chairman, before putting the final vote, should say:

Adoption of Constitution

"Are there any further amendments? If not, the question is now on the adoption of the Constitution as amended. All in favor say 'aye'; opposed, 'no.'" If the "ayes" outnumber the "noes," the Constitution as amended is adopted.

How to become a club member

The chairman next states that, the Constitution having been adopted, it will be necessary for those wishing to become members of the club to sign the Constitution, and also to pay the initiation fee if required by the Constitution to do so.

How to adopt By-Laws

After the Constitution has been signed, the chairman proceeds to read the By-Laws, reading each Article separately and asking for amendments. The By-Laws, like the Constitution, are a single instrument, and are, therefore, adopted as a whole.

Caution

The By-Laws must not conflict in any way with the Constitution.

What the Constitution states

The Constitution states the fundamental laws of the club. What shall be

1 Its name
2 Its object
3 Its membership
4 Its officers and directors (if any are desired)
5 Its executive committee, or board of directors
6 Its annual meeting
7 Its amendments

What By-Laws prescribe

The By-Laws prescribe the duties of officers, executive committee, and standing committees; they also provide for:

1 Regular and special meetings
2 Dues and fees
3 Quorum
4 Parliamentary rules to govern the society

AMENDMENTS

Each club will need to be governed in accordance with its own local conditions.

CONSTITUTION

The following Constitution is given as a guide for the Cornell study clubs to adopt:

Article I — Name

Model of Constitution for Cornell study club

This club shall be called the Cornell Study Club of ....

Article II— Object

The object of this club shall be to study the most scientific way of conducting home work in order to economize, strengthen, and preserve the health of the family; to discuss the best expenditure of money in order to secure the highest condition of home life; to broaden the outlook of the home and of the family by securing for the mother of the household opportunities for mental and spiritual growth; to encourage a social spirit while working together for the good of the home and of the family; to consider the home as a part of the community, therefore as having relations with church and social well-being; to elevate the character of farm life to the end that farm homes shall be the best homes in America and the most attractive to the rising generation.

The making of amendments

Note: The question, " Are there any amendments to this Article?" is asked by the chairman after the reading of each Article. If there are amendments, she proceeds as directed on page 233.

Article III — Membership

Section 1.— All who are in sympathy with the aims of this club shall be eligible to membership.

Section 2.—The club shall be under the Department of Home Economics of the College of Agriculture, Cornell University, and shall have as a basis of work the lessons of the Cornell Reading-Course for the Farm Home, with whatever related work may be deemed advisable. The club is to have correspondence with the Department of Home Economics on subjects that shall be of helpful interest to the club.

At least half of the members of the club shall answer the questions of the discussion papers in the Cornell Reading-Course, and the papers shall be forwarded regularly to that department, or the Secretary of the Club may report to the department for the entire club after the bulletins have been discussed at a meeting.

Article IV — Officers

The officers of the club shall be a President, a Vice-President, a Secretary, a Treasurer, and a Corresponding Secretary, who shall be elected at the first regular meeting succeeding the adoption of this Constitution, to hold office until the next regular annual meeting, when their successors shall be elected, as prescribed in Article VI of this Constitution.

Article V — Executive council

The officers of this club shall constitute an executive council, which shall have general supervision of all the interests of the club. They shall fix the number of meetings (not fewer than ten), and the time and place of such meetings, except as provided for in Article VI. They shall fill all vacancies in office that may occur, except as otherwise provided for in Article I of the By-Laws. They shall arrange the year's program.

Article VI — Annual meeting

Section 1.— The annual meeting for the election of officers and the receiving of annual reports, and for any other business that may come regularly before the club, shall be held at.. The term of officers shall be for one year, or until their successors are elected and qualified.

Section 2.— Nominations shall be..

Nomination of candidates

Note: Each society determines its own method of nominating candidates for office. Some societies have nominations from the floor, which are public; others have nominations by an informal ballot, which is secret. A nomination is not an election; the election itself must be by a formal or regular ballot. Some societies prefer nominations by a committee, which prepares them in accordance with the Constitution of their organization. Some societies require only one ticket; others, two. The nominations by committee do not elect.

Section 3.— The election shall be by ballot, a majority vote constituting an election.

Note: The elections in voluntary assemblies are usually by ballot. Where there is but one candidate or one ticket, according to Roberts, the Secretary, by unanimous vote of the society, may be authorized to cast one ballot.

Article VII — Amendments

This Constitution may be amended at any regular meeting of the club by a two-thirds vote of the members present and voting, provided the amendment has been submitted in writing at a previous regular meeting.

BY-LAWS

Article I — Duties of officers

Section 1.— It shall be the duty of the President to preside at all meetings, and to perform all other duties appertaining to the office of president.

Section 2.— In the absence of the President, the Vice-President shall perform all the duties appertaining to the president's office. In case of a vacancy, the Vice-President shall succeed to the office of the President until the next regular election.

Section 3.— The Secretary shall keep a correct record of all transactions of the club.

Section 4.— The Treasurer shall receive all moneys of the club, collect all dues, and keep an accurate account of all receipts and disbursements. She shall pay no bills, except on orders of the Executive Council.

Section 5.— The Corresponding Secretary shall give notice of meetings, conduct the correspondence of the club, report the meetings to the Department of Home Economics of Cornell University, and write for state and government bulletins that shall aid in the study undertaken by the club.

Article II — Quorum

The majority of the members present at a meeting shall constitute a quorum.

Article III — Dues

The dues of this club shall be fifty cents per annum, payable two weeks before the annual meeting.

Note: When the chairman asks for any amendments to Article III, a member of the club may move to amend the Article by striking out "fifty cents" and inserting "twenty-five cents." If the motion is seconded, the Chair says:

Model for an amendment

"It has been moved and seconded to amend Article III by striking out 'fifty cents' and inserting 'twenty-five cents.' Are you ready for the question? All in favor say 'aye'; opposed, 'no.'" If the "ayes" are in the majority, the chairman states that the amendment is adopted and "twenty-five cents" is inserted in the Article in the place of "fifty cents." The Article as amended, however, is not voted on at this time. As has been stated before (page 233), all the Articles are voted on as a whole. Until the final vote on the Constitution as a whole is taken, further amendments may be adopted.

Article IV — Parliamentary rules

Roberts' Rules of Order shall be authority in all questions not covered by the Constitution and By-Laws.

Article V — Amendments

These By-Laws may be amended in the same way that the Constitution may be.

Model for conducting a regular meeting

At the first regular meeting after the adoption of the Constitution and By-Laws, the meeting is called to order by the chairman pro tem. Rising, she says: "The meeting will please come to order; the secretary will read the minutes of the previous meeting."

She takes her seat while the minutes are being read, then says: "You have heard the reading of the minutes. Are there any corrections?" After a brief pause, she continues: "If there are none, the minutes stand approved."

The chairman then announces that the next business in order will be the election of officers.

The first office to fill is that of President. Nominations for the office of President are now in order. The Constitution provides that nominations shall be from the floor. A member rises, and, addressing the chairman, says, perhaps:

"I nominate Mrs. Brown for President" (Mrs. Brown being the present presiding chairman pro tem). Another member nominates some one else. The chairman then says:

"Are there any other nominations? if not, nominations are closed."

Procedure when chairman is nominated for office

The chairman, not desiring to preside over her own election, asks some other member to take the chair and conduct the election. She herself vacates the chair. Her substitute as chairman pro tem appoints tellers, and asks them to distribute ballots. When the tellers collect the ballots, the Chair asks:

"Have all voted who desire to do so? If they have, the polls are closed."

The tellers retire to count the ballots and some one moves to take a recess until the tellers report the result of the counting. The chairman of the tellers, when they are ready to report, hands their report in writing to the presiding officer, who calls the club to order and announces the vote according to the facts and somewhat after the following form:

"Number of votes cast, 30; number necessary to elect, 16. Mrs. A received 20, Mrs. B 10. Mrs. A, having received a majority of all the votes cast, is duly elected President of this club."

The chairman announces that the next office to fill is that of Vice-President. Nominations are then in order. Mrs. G, it may be, nominates Miss Halleck; Mrs. D, Mrs. Young; and Mrs. S, Mrs. Grant. The Chair asks whether there are any other nominations. If there are not, nominations are closed. The teller counts the ballots when all who desire to do so have voted. When the tellers return, their chairman hands their report to the chairman of the club, who announces the vote:

"Number of votes cast, —; number necessary to elect, —; Miss Halleck received 9 votes; Mrs. Grant, 11; and Mrs. Young, 7."

When a vote fails to give a majority

A candidate may withdraw

No one having received a majority vote, there is no election, and the tellers have to prepare ballots again. One of the nominees — Mrs. Young, perhaps — says that she will withdraw in favor of Mrs. Grant. She may withdraw if she chooses to do so, but she cannot force the person who voted for her to vote for Mrs. Grant, and the chairman should so rule. Mrs. Young having withdrawn her name, only two candidates remain, and, unless there should be a tie, one of them should get a majority vote. The tellers report to the chairman the result of the vote. The Chair announces the number of votes cast as —; the number necessary to elect as —. Miss Halleck may have received 14 votes and Mrs. Grant 11; in that case Miss Halleck, having received a majority of all the votes cast, would be declared by the chairman as duly elected Vice-President.

Other officers are elected in a similar manner. Unless there is a rule to the contrary, the officers of the club assume their duties at once.

The plurality vote

A plurality vote is the highest number of votes over the other candidates for the same office. A plurality vote does not elect unless there is a rule allowing it to do so.

The tie vote

A tie vote does not elect; it necessitates balloting again.

When to decline nominations

When a member is nominated for office, if she really does not wish the office she should decline the nomination.

Order of business

The order of business for regular meetings of ordinary societies is:

1 Reading minutes of previous meeting

Disposing of Treasurer's report

2 Report of Treasurer. After it is read the President asks what disposition shall be made of the report. A member moves that it be accepted. The motion seconded is stated by the Chair and put to vote

3 Report of Corresponding Secretary

4 Report of Standing Committees

5 Report of Special Committee

6 Unfinished business

7 New business

8 Program

9 Adjournment

Taking up unfinished business; a model

When "unfinished business" is taken up, the Chair may have occasion to say something like this:

"We will consider the following resolution: Resolved: That we give a picnic on the Fourth of July at Ontario Beach."

A member may move to amend the motion by adding, after "Ontario Beach," "and that the club furnish ice cream." If her motion is seconded, the Chair says:

"It has been moved and seconded to amend the resolution read, by adding after 'Ontario Beach,' 'and that the club furnish ice cream.'" Are you ready for the question? All in favor of adopting the amendment say 'aye'; opposed, 'no.'" If the "ayes" are in the majority the amendment is adopted. The amendment is then incorporated in the original motion, but the word "Resolved" has not been voted on; therefore, another vote is required to adopt the resolution as amended. The Chair says:

"The question now is on the adoption of the resolution as amended: Resolved: That we give a picnic on the Fourth of July at Ontario Beach and that the club furnish ice cream. All in favor say 'aye'; opposed, 'no.'" If the "ayes" have a majority of votes, the resolution as amended is adopted.

Taking up the program

After the unfinished business has been disposed of, the Chair asks whether there is any new business. If there is not, she says, "We will now proceed to the program."

The motion to adjourn

After the program is finished, a motion to adjourn is in order.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 13 | ITHACA, N. Y. APRIL 1, 1912 | RURAL LIFE SERIES No. 2

CORNELL STUDY CLUBS

DISCUSSION PAPER

Emerson says: "Nor knoweth thou what argument thy life to thy neighbor hath lent." This bulletin is intended to stimulate social and intellectual life in rural communities. May we hear from you what is being done in this respect where you live?

1. Do you belong to a rural study club? If not, is there an opportunity to form a club in your neighborhood?

2. What has been the discussion of most interest in your study club?

3. What further assistance can the Department of Home Economics at Cornell University give to your study club or in the community?

4. Has your club adopted a constitution? If not, will the assistance furnished in the bulletin make it possible for the club to do so?

5. What is your plan for music at the club meetings?

6. How many times during the year are refreshments served at your club meetings? Are they simple? Give here the usual bill of fare.

7. Are men studying with the women at these meetings? Do they prefer a separate session?

8. Will the pastor and the teacher in the neighborhood unite with you in club study?

Name....................................

Address....................................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 15 | ITHACA, N. Y. MAY 1, 1912 | FOOD SERIES No. 3

PRINCIPLES OF JELLY-MAKING

N. E. GOLDTHWAITE

(University of Illinois)

The process of jelly-making appears to be simple enough, merely a matter of cooking fruit juice and sugar together until the whole mass "jells" on cooling. However, as ordinarily practiced, this process may be attended by uncertain results, because so little is known generally concerning the *why* of jelly-making.

In the hope of learning more concerning the *why* of the process, and in the hope also of determining as exactly as possible the conditions necessary for the making of fruit jellies and hence of being able to lay down rules that would always work, the Department of Household Science of the University of Illinois undertook in its research laboratory, some two years since, a series of systematic experiments in jelly-making.* By courtesy of that department the Cornell Reading-Course for the Farm Home at the New York State College of Agriculture is now reprinting this bulletin for circulation in New York State.

As results of these experiments, it has been shown, first, that in the making of fruit jellies there are several factors to be considered; second, that it is the understanding or misunderstanding of these factors which leads to success or failure; and third, that, whereas no hard and fast rules can be laid down for jelly-making as practiced in the home because of the variableness of fruit juices, yet these experiments have developed some principles, which, if intelligently grasped and applied, should lead to the making of ideal fruit jellies.

* The scientific data determined in connection with these experiments have been published in two articles which may be found in the Journal of Industrial and Engineering Chemistry, Vol. I, pp. 333-344, and Vol. II, pp. 457-462.

DESCRIPTION OF FRUIT JELLY

Before going further, a description of the substance aimed for — that elusive substance, a good fruit jelly — should be given. Ideal fruit jelly is a beautifully colored, transparent, palatable product obtained by so treating fruit juice that the resulting mass will quiver, not flow, when removed from its mold; a product with texture so tender that it cuts easily with a spoon, and yet so firm that the angles thus produced retain their shape; a clear product that is neither sirupy, gummy, sticky, nor tough; neither is it brittle, and yet it will break, doing this with a distinct, beautiful cleavage that leaves sparkling, characteristic faces. This is that delicious, appetizing substance, a good fruit jelly.

CONSTITUENTS OF FRUIT JUICE

Fruit juice consists largely of water in which are dissolved small amounts of flavoring materials, sugar, vegetable acids, and a substance called *pectin*. Now the vegetable acids, as we shall see further on, take part in the process of jelly-making, but it is the last-named body, *pectin*, which is the essential jelly-making substance. If pectin be present in a fruit juice it is possible to make jelly from that juice, otherwise it is impossible. Whether or not pectin is present in a juice one can readily ascertain by adding to a given volume of the juice (say one or two tablespoonfuls in a glass) an equal volume of grain (ethyl) alcohol (90 to 95 per cent), mixing thoroughly, and cooling; if pectin is present a gelatinous mass will appear in the liquid, which may be gathered up on a spoon. The housekeeper, using this test, will soon discover that, apparently, different juices contain different proportions of pectin; hence, probably, one reason for the wide difference in various fruits for making jellies. Curiously enough, this pectin frequently is not found in the juices of raw fruits, or, if found, it is likely to be in small quantity. For example, in our experiments, we found little pectin in the juice of *raw* apples, *raw* grapes, and none at all in that of *raw* quince, yet the juices extracted from these fruits by *cooking* were full of the substance. In this connection it should also be explained that the raw juices of other fruits, such as currants, blackberries, and the like, often contain considerable pectin, yet the juices obtained by cooking these fruits are apparently far richer in this fundamental jelly-making material. Furthermore, even though the juices of raw fruits may contain a fair amount of pectin, yet in general the jelly therefrom is often less clear than that from corresponding juices that have been cooked out of the fruits.

EXTRACTION OF JUICES FROM FRUITS

Then the best and also most economical method for extracting juices from fruits has already been indicated: cook them out.

Very juicy fruits

If a very juicy fruit, such as currants, raspberries, and the like, is being used, place the clean fruit (washed if necessary) in an enameled preserving kettle, add just enough water to prevent burning (perhaps 1 cup to 4 or 5 quarts of fruit), cover, and place where the fruit will cook rather slowly, stirring occasionally with a wooden or a silver spoon. When the simmering point is reached, crush the fruit further with a well-soaked wooden masher, then continue heating until the whole mass is cooked through. Transfer the hot mass to a sufficiently large piece of cheesecloth (double if desired) wrung out of hot water, tie the opposite corners together and let the juice drain into an earthenware or enameled receptacle. This juice is Extraction I. When Extraction I is fairly well drained out (usually within a half hour) do not squeeze the pulp for a second quality of jelly, as usually directed, but instead make another juice extraction. To do this, untie the cheesecloth, transfer the pulp to the preserving kettle, cover with water, stir until thoroughly mixed, then cover, bring slowly to boil as before, and drain again. The result is Extraction II. The aforesaid alcohol test will indicate whether much or little pectin has been obtained. If the former, repeat the process for Extraction III. Some fruits will show an appreciable proportion of pectin even up to the fifth extraction, but usually a third extraction sufficiently exhausts the pectin from the fruit.

Less juicy fruits

If, instead of such very juicy fruits as those considered, the juice is to be extracted from a less juicy fruit, such as apple, quince, and the like, wash the fruit, discard any unsound parts, cut into small pieces (skins and seeds included), cover with water, then proceed just as in the case of very juicy fruits. Relying on the alcohol test for pectin, make as many extractions from the pulp as seem profitable.

In making jelly from these extractions the writer generally prefers to handle Extraction I by itself, since this is the more normal form of the various extractions. But time will be saved if Extractions II and III are mixed together for working up.

THE JELLY TEST

Although each housekeeper doubtless has her own satisfactory jelly test, yet for reasons stated below it may be well to describe the one that has given best results in our work. Our jelly test is one probably used by many, and is that point at which the boiling mass "jells," sheets off, or breaks off, as a portion of it is allowed to drop from the stirring spoon. This is a quick test, and hence much better than the time-honored one of taking out a portion of the hot jelly and allowing it to cool to see if it "jells"; for, while this cooling process is going on, unfortunate things may be happening in the saucepan. Time is too precious at this point to wait for any cooling of samples; when the jelly is just right to be taken off the fire, no time should be lost in removing it.

THE PROPORTION OF SUGAR TO JUICE

Extraction I

In making jelly from these various extractions, let us first consider Extraction I. Assuming that this juice has been obtained from a naturally good jelly-making fruit, that is, one rich in pectin and also acidic (sour) — for example, currants, sour apples, unripe grapes, and the like — then the process of making jelly is comparatively simple. Under such conditions, success or failure depends almost entirely on the proportion of sugar used; the correct proportion of sugar to the juice in hand means success, while an underproportion means a tough jelly, and an overproportion means more or less of a failure, depending on how great that overproportion is. Probably more good jelly-making material is spoiled through the use of an overproportion of sugar than from all other causes combined — and this because the would-be jelly-maker blindly follows the old rule of a measure of juice to a measure of sugar.

This exceedingly important point, then, the correct proportion of sugar to juice, needs to be very thoroughly understood. In studying it, let us first consider the result of making jelly from fruit juice alone, that is, without sugar. If a certain volume (say 1 cup, 1 pint, 1 quart) of good jelly-making fruit juice is boiled down until a jelly test is observed, we find on cooling the very small product that it is jelly-like, but it is not an ideal jelly. It is a tough, opaque, unpalatable mass, consisting of the pectin, more or less impure, which was contained in the original volume of juice.

Second, let us consider the results of boiling sugar in varying proportions with a volume of juice equal to that used above. If this volume of juice is boiled with, say, one fourth its volume of sugar until the jelly test is observed, we find, on cooling, a larger product than the preceding — one more like jelly, one less opaque, though still tough. Continuing this process and taking successive equal volumes of juice as that taken first, and boiling each successively with an increasing proportion of sugar (one half volume, two thirds, three fourths, one, one and one fourth, and so on), what are the final results? Examination of them shows that with increasing proportion of sugar each product increases in volume, and each is more tender, more transparent, more palatable, than its predecessor, until one is reached that approximates a perfect jelly. Beyond this, with increasing proportion of sugar the product continues to increase in volume, but in texture it becomes softer and softer until finally the pectin appears in lumps in the mass, or a mere sirup results.

What is the lesson of this succession of products? Simply this: the given volume of juice used for each jelly sample contains a certain quantity of pectin in solution, and this quantity of pectin is capable of utilizing profitably a definite proportion of sugar, only. Up to this definite proportion of sugar, the jelly produced from the given volume of juice is decreasingly tough and increasingly palatable, until finally a jelly of ideal texture and appearance is formed; but beyond that definite proportion of sugar, the jelly produced is increasingly soft until finally it fails to hold together at all — it fails to "jell." The error is self-evident: too much sugar has been used for the pectin present in the juice taken. No amount of cooking after this will rectify the error; continued cooking will produce a gummy mass. Adding more sugar and cooking will but make the jelly more sirupy. The remedy is to boil up the product with more juice — perhaps even with as much as was used in the first place; but the amount of juice added must depend, of course, on how great the over-proportion of sugar has been. Evidently this addition of juice is for the purpose of supplying sufficient pectin to take care of the surplus of sugar. Needless to say, this made-over jelly, though it may come out fairly well, will not equal in quality a corresponding jelly made originally with the proper proportion of sugar to juice.

For most juices of such fruits as those already indicated — that is, those that are rich in pectin and are fairly acidic (sour) — it is found that for Extraction I the correct proportion of sugar to juice by volume usually varies from $\frac{3}{4}:1$ to $1:1$.* Currants and partially ripened grapes yield a juice so well adapted to jelly-making that they will usually demand the proportion $1:1$; while $\frac{3}{4}:1$ is likely to be the correct proportion for red raspberries and blackberries, and for juices from fruits to which much water must be added even to make the first juice extraction — such as sour apples, crab apples, cranberries, and the like. But in any case the jelly-maker must be wary when proportioning sugar to juice. Doubtless, much depends on the condition of the fruit itself; if the juice seems unusually watery (as currants just after a rain), and the alcohol test does not indicate pectin in plenty, then lessen the proportion of sugar. Better err on the side of too little rather than too much sugar if a jelly that "will

* It is probably unnecessary to explain that the expression $\frac{3}{4}:1$ means three fourths of a volume of sugar to one volume of juice, while the expression $1:1$ means one whole volume of sugar to one of juice. Bearing this explanation in mind, the expressions $\frac{1}{8}:1$, $\frac{1}{2}:1$, and so on, are readily understood.

stand alone" is desired; if a softer and sweeter jelly is called for, then of course a larger proportion of sugar should be used. Interesting in this connection is the illustration (Fig. 78) showing samples of apple jelly: No. 1 having the proportion of sugar to juice, $\frac{3}{4}$: 1; No. 5, 1 : 1; and No. 6, 2 : 1. The relatively much larger volume of jelly (from the same amount of juice) in No. 6 is not shown, since only a part of the product was photographed. Evidently in these cases the proportion $\frac{3}{4}$: 1 was the correct one.

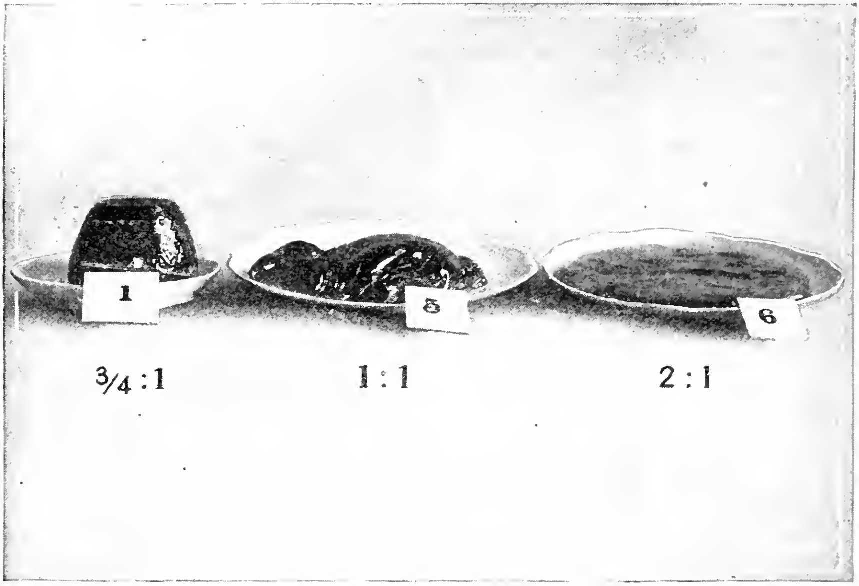


FIG. 78.—*Samples of apple jelly showing effects of different proportions of sugar to juice*

Extractions II, III, etc.

Let us now turn our attention to a consideration of Extractions II, III, etc. Although it is well worth while to work up these extractions into jelly, yet great care must be exercised in doing so. From what has gone before, it is evident that since much water has been used in their preparation, and since each is correspondingly less acidic and less rich in pectin than its predecessor, these mixtures will utilize a much less proportion of sugar than will Extraction I. However, if these facts are kept in mind, and the sugar carefully proportioned, an excellent quality of jelly can be made from these dilute juices.

A good method for proportioning sugar to juice in dealing with these dilute extractions is to concentrate (boil down) their mixture rapidly until the resulting juice approximates the richness of Extraction I (which may be judged by the alcohol test, by appearance, by taste, and by other methods), then to measure the resulting juice and add the proportion of sugar already used for Extraction I. If treated otherwise, the jelly-maker may be merely proportioning sugar to water, since, as already emphasized, these later extractions are so largely made up of water.

However, if the jelly-maker wishes to treat these extractions on the same general plan as Extraction I, let her make a trial sample of jelly from their mixture, proportioning the sugar, say $\frac{1}{8}:1$ or at most $\frac{1}{4}:1$, then, according to the quality of the jelly produced, let the proportion of sugar be increased or decreased in working up the remainder of the dilute juice.

The jelly from these dilute extractions will be quite as clear, and the texture quite as good, as that already made from Extraction I. In other words, there is absolutely no need of the second quality of jelly that some housekeepers have been accustomed to make from the juice " squeezed out " of a drained fruit-pulp. If the fruit is properly handled, all the jelly therefrom will be of first quality. The practice of making " fruit-butter " from the pulp remaining after juice Extraction I is good. In this case, of course, there would be no juice Extractions II and III.

Interesting in this connection from an economic standpoint, however, are the results obtained by two experienced housekeepers in working up nearly like quantities of partially ripened grapes. Housekeeper No. 1 had more than half of the five quarts of stemmed grapes that the two had gathered in common; from her portion she made something over two glasses of jelly and five glasses of " butter." Housekeeper No. 2, on the other hand, from her portion of the fruit, by preparing two juice-extractions, made seven glasses of an excellent quality of jelly. (The writer's experience indicates that the grape pulp which Housekeeper No. 2 had left, would have yielded at least one more extraction of juice.)

After the winter's supply of grape-juice has been extracted (which is best done by cooking the fruit, covered with water, in a double boiler), further juice extractions should be made from the pulp, as already described, and used for jelly. This is a good plan, since jelly made from these later extractions rarely shows the cream-of-tartar crystals so likely to appear in grape jelly that has stood for a length of time.

TIME NECESSARY FOR JELLY-MAKING PROCESS

In discussing the proportion of sugar to juice, nothing has been said to indicate the time necessary for the jelly-making process. As a matter of fact, this time varies with several factors — with the proportion of sugar to juice (the time decreasing as the proportion of sugar is increased), with the proportion of pectin in the juice (a thin juice demanding more time for concentration), and possibly to some extent also with the proportion of acid in the juice. Of course there is an interdependence among these factors that may either lessen or lengthen the necessary time of boiling in the case of any particular juice. In currant juice, for example, these factors are so nicely adjusted that 8 to 10 minutes is sufficient time for making jelly from Extraction I, while the corresponding juice from raspberries, blackberries, apples, and the like, may demand 20 to 30 minutes. But in any case, any jelly, when the process is once begun, should be made as quickly as possible; no simmering for hours should be allowed, since long action of the acid in the juice transforms the pectin into substances that have no jelly-making power. An example of this sort did come to the writer's attention through the failure of one home-jelly-maker to make her grape jelly "jell." Hours of simmering on the back of the stove had destroyed the pectin; also, too much sugar had been used; and between the two errors, a dark, gummy, unpalatable mass had resulted.

TIME NECESSARY FOR BOILING SUGAR WITH JUICE

Directly connected with the total time necessary for the jelly-making process, is the question of when the sugar shall be added to the juice. Shall it be at the beginning of the process, according to the old method? or (hot) near the end of the process, according to the newer method? or (hot) midway between these extremes? Let us designate these three methods, respectively, as long-boiling, short-boiling, and mean-boiling.

Very elaborate and careful experiments (the details of which need not be described here) have been made in this laboratory in order to answer these questions. The results, so far as they yet indicate a choice in the methods, show that the mean-boiling method is probably the best, all things considered. The chemist knows that the longer sugar is boiled with a weak acid (as fruit juice suitable for jelly-making is), the more this sugar is inverted (split) into two simpler sugars each less sweet than the original sugar. Although this loss of sweetening power may be disregarded, yet the extent of the inversion that has taken place does affect the texture of the jelly. For example, if little inversion has occurred (short-boiling method), the original sugar used is likely to crystallize out; if much inversion has occurred (long-boiling method), one of the simpler sugars formed may appear in crystalline masses. However, it should be said that neither of these crystallizations is likely to occur if the sugar has been originally properly proportioned to the juice and if the resulting jelly has been properly sealed up. Illustrative of this statement is the fact that from seven different fruits a series of three jellies each (long-, short-, and mean-boiling) were carefully made and sealed two years ago, but as yet no one of them shows any signs of crystals. Repeated experiments, however, show that an overproportion of sugar to juice is fairly certain to lead finally to a crystallization of sugar from the jelly.

Perhaps it should be explained that the object of adding the sugar hot (heated through, not scorched) is that the total cooking process may not be prolonged by a partial cooling, as is the case if the sugar is added cold to the hot juice. In any case the mass should be stirred fairly constantly after the adding of sugar, in order to prevent burning.

Experiments prove further that it is economy not to make jelly by the long-boiling method, inasmuch as so much sugar is lost thereby in the skimmings. The more thoroughly the juice is clarified by skimming before the addition of the sugar, the better is the method from an economical standpoint.

ACIDITY OF THE FRUIT JUICE

The absolute necessity of the presence of pectin in juices to be used for fruit jellies has been made as emphatic as possible. Simultaneously, attention has been repeatedly drawn to the fact that good jelly-making juices are also acidic. The juices that are ideal for jellies are both rich in pectin and fairly acid — for example, currant, partially ripened grape, crab apple, and the like. However, many fruit juices contain the first requisite, pectin, in greater or less quantity, but are deficient in acid; for example, quince, pear, peach, sweet apple, and the like. With these juices, if we choose to do so, we can supplement nature by adding a little acid of vegetable origin (tartaric or citric acid) to the juice. It is difficult to state the exact amount to be added, since juices vary much in acidity even in the same kind of fruit. A fair rule, however, is to add enough of the tartaric or citric acid powder to make the juice about as acid to taste as good tart apples; but before deciding about the taste, care must be taken to see that the powdered acid is *entirely* dissolved and the juice well stirred. By way of suggestion, add one level teaspoonful of acid powder to a quart of juice; and if examination, as above indicated, shows this amount of acid to be insufficient, increase the amount by small additions until the juice seems satisfactory. Great care, however, must be exercised in any addition of acid (even though it may be the same as that already in the fruit), since such addition invariably affects the flavor of a delicate fruit. By this method, however, it is possible to make jelly from any pectin-bearing fruit juice; that is, peach and pear jellies may be so made, but the fine flavor of the fruit is invariably impaired. Thus, also, the texture of strawberry jelly is improved by a slight addition of acid, but the same cannot be said of its flavor. Sweet apple and quince, both of which are rich in pectin — the latter remarkably so — yield jellies improved not only in texture, but also in taste, by an addition of acid to the juice.

Doubtless it is unnecessary to warn the housewife that if juice Extractions II, III, etc., are to be acidified, they should be concentrated before adding the acid, in order to prevent an excess of the same.

In general, with the exception of sweet apple or quince, it seems better for the inexperienced jelly-maker to learn to manipulate successfully the ideally good jelly-making fruit juices (currant, sour apple, crab apple, raspberry, blackberry, partially ripened grape, and the like) before she attempts to make jellies of juices not well adapted by nature for jelly-making, as peach, pear, strawberry, cherry, and the like. Speaking of strawberry and cherry jellies, it may be stated here that it has been found possible to make fair samples of these, without the addition of acid, if an overproportion of sugar is avoided, and if the boiling is carried somewhat beyond the point at which the jelly test is first observed; however, this must be done with great care lest a gummy mass finally result.

A method of making jellies that has something to commend it, is to take sour-apple juice as a basis for the jellies, using sufficient other fruit juice to supply flavor. This method has apparently been used by manufacturers, but it may be used by the housewife advantageously in some cases. By means of the sour-apple juice, both pectin and acid are supplied to a fruit juice that may be deficient in one or both these essentials for jelly-making, and a very palatable article of food may be the result.

QUANTITIES OF JUICE USED

The question has frequently been asked, how much juice can be made into jelly at one time? Simultaneously with the question several housekeepers have stated that they never attempt more than one glass, or two at most. The writer has found no difficulty in handling juice sufficient for four to six glasses at one time. But in order to do this, everything must be ready for the completed process before the juice is put on to boil — a pan with the glasses, boiling water for sterilizing them, and the dry measured sugar already hot. On boiling, the juice must be rapidly and thoroughly skimmed, the hot sugar added at the proper time, and more skimming; then, the instant the jelly test is observed, the glasses must be sterilized with the boiling water and the hot jelly poured into them until each is completely full. With some jellies there is danger of the mass jellying in the kettle before it can be removed, hence the necessity for rapid action and a cool head.

In this connection it may be stated that many good housekeepers prefer to can their fruit juices in season, making up the jellies as needed. This plan has much to commend it. Frequently time is precious in the fruit season and if the juice extractions are properly heated to boiling, and sealed in well-sterilized cans just as is canned fruit, they will keep quite as well as the latter, and jelly can be made when desired.

SEALING UP JELLIES

If jellies are to stand any length of time before using they should be properly sealed from the air. The glasses, having been filled completely with the hot jellies, should be set in a cool place for the contents to harden. It is well to cover jellies that are slightly undercooked with panes of glass and harden them in the sun. In either case, when the jellies are well set the glasses should be filled with hot paraffin (the jelly will have shrunken, leaving space for this) — not merely melted paraffin, but *hot*, in order that all germs which may have fallen on the surface of the jelly will be killed and future trouble from them obviated. Close with hot, clean tin covers and keep in a dry, cool place.

A JELLY FAILURE

A very interesting and instructive jelly failure was brought to the writer's attention. This failure was a thin jelly full of transparent cubical crystals. Examination proved these to be uninverted sugar, that is, the original sugar used. Further examination showed that the original juice had been but slightly acidic, and also that it was not rich in pectin. Questioning the maker disclosed the fact that the sugar had been added near the end of the jelly-making process (short-boiling). Now, at least three errors were evident: (1) an overproportion of sugar, (2) a weakly acidic juice, and (3) one not rich in pectin. Consequently the jelly had never "jelled"; a mere sirup had resulted, from which the uninverted sugar had subsequently crystallized out. The total result was much the same as though a thick sirup from sugar had been merely colored and flavored by fruit juice and allowed to stand until crystallization of the sugar had occurred.

GENUINE ORANGE AND LEMON JELLIES

The writer had frequently noticed that well-made orange marmalade always showed a jelly-like appearance, denoting that there must be pectin in the fruit. The alcohol test applied to the squeezed-out raw juice showed its entire absence. Subsequent experiments finally located the pectin in the white inner skin of the fruit. Similar examinations of the lemon showed its presence there also in the white inner skin, but none in the raw juice. After many experiments it was found that excellent genuine orange or lemon jellies could be made by careful extraction of this pectin, adding a sufficient quantity of the natural juice of the fruit for flavoring and acidity, then proceeding to make jelly as with any fruit. The process is approximately as follows: The yellow outer skin of the fruit being carefully and entirely peeled off, the white inner skin is removed from the inner juicy portion; this white inner skin is passed through a fine meat-grinder, soaked two to twenty-four hours in sufficient water to cover, then cooked slowly for some hours and drained. This Extraction I is particularly rich in pectin. Subsequent extractions all show pectin, but in constantly decreasing amounts. These extractions may be concentrated and mixed with the first extraction if desired. To the whole, a sufficient amount of the natural juice is added to give a pronounced flavor, and it is then made into jelly the same as any other juice, due care being taken not to use an excess of sugar. If the thin yellow outer skin of the fruit has been carefully removed, there will be little, if any, bitter taste to these jellies.

If desired, the white inner skin of oranges and lemons may be used as a source of pectin to add to other fruits that are more or less deficient in this important substance. For example, some excellent rhubarb jelly was made in the kitchen of this department by adding to the cooked-out rhubarb juice a pectin extraction obtained as indicated from lemons.

For such purposes in general, it is suggested that the white inner skins of oranges and lemons be saved from time to time, cut into fine pieces and dried, then later soaked up and used as desired. Hence, what is usually a waste product, but what has been found to be an abundant source of pectin, may be used by the thrifty housewife in numberless ways to help out in her jelly-making.

It may be worth while to note in this connection that the thicker-skinned the oranges, the greater the yield of pectin that can be obtained from them.

BLUEBERRY JELLY

Mention should be made of blueberry jelly — certainly not a common jelly, so far as the writer knows. Examination of the blueberry shows a pulp exceedingly rich in pectin, one that will stand several extractions. Although the juice is fairly sweet to taste, yet it is sufficiently acidic to yield jelly of excellent texture even when the proportion of sugar to juice (Extraction I) is 1 : 1. With this proportion of sugar, the total time of making the jelly need not exceed 10 minutes.

The blueberry as a jelly fruit seems quite equal to the currant, with this difference in the jellies: whereas each is delicious, currant jelly is tart to the taste, while blueberry jelly is sweet; hence, they may be used for different purposes in the menu.

BEET SUGAR VERSUS ORDINARY CANE SUGAR

A question concerning the relative merits of beet sugar and cane sugar in jelly-making has occasionally been asked. Our experiments showed that when the two sugars were equally pure, there was no difference in the texture, taste, or appearance of jellies made therefrom. The only difference observed was that the volume of jelly produced from a given amount of juice and sugar was slightly less when beet sugar was used than when cane sugar was used. This difference being considered negligible, the two sugars may be used interchangeably.

NATURE OF PECTIN

Perhaps it may be interesting to explain that pectin, the fundamental jelly-making substance of fruit juices, the gelatinizing material that makes these juices " jell," is a substance that is apparently akin to starch chemically; it has no relationship whatever to gelatin. Like starch, it is made up of the elements carbon, hydrogen, and oxygen; while gelatin, in addition to these elements, contains nitrogen. Moreover, pectin is of vegetable origin, while gelatin is of animal origin.

SUMMARY

The principal points made in the foregoing may be briefly summarized as follows:

1. Fruit juice to be used for jelly-making must contain pectin. It must also be acidic.

2. Juices that are to be used for jelly-making should be extracted by cooking them out of the fruit.

3. The most common cause of failure in jelly-making is an overproportion of sugar to juice — that is, to the pectin in the juice.

4. A short, quick test in jelly-making is preferable to a test that involves a waste of time.

5. There need be no " second " quality of jelly. All may be of first quality if the juice is properly extracted and handled.

6. Experiments, thus far, indicate that the mean-boiling process in jelly-making is preferable to the long-boiling or the short-boiling process.

7. Any juice, when once the boiling is begun, should be transformed into jelly as rapidly as possible.

8. The time necessary for the boiling of a quantity of jelly apparently varies with several factors: the proportion of sugar to juice, the proportion of pectin in the juice, and possibly, too, with the acidity of the juice.

9. The hot jellies should be poured at once into hot sterilized glasses, and after having " set " should be carefully sealed.

10. Jellies from fruits but slightly acid may be made by adding a vegetable acid to the juice, but this process is not recommended except in the case of sweet apple or quince juices.

11. Cherry and strawberry jellies are possibilities if the hot mass is boiled somewhat beyond the first jelly test observed.

12. The white inner skins of oranges and lemons are prolific sources of pectin. Hence, genuine jellies from these fruits may be made. The pectin from these skins may also be used for strengthening other fruit juices.

13. Apple juice may be made a basis for other fruit jellies.

14. Blueberries are recommended as an excellent fruit for jelly-making.

15. Beet sugar and cane sugar may be used interchangeably in jelly-making.

16. Pectin is probably akin to starch in its chemical nature. It has no relationship to gelatin.

17. Good jellies cannot be made from all juices by "rule o' thumb." Jelly-making, as practiced in the home, is an art. It consists in so controlling conditions by means of sugar (and acid) and by boiling, as to cause the pectin to "set" in a continuous mass throughout the volume allotted to it.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. I. No. 15 | ITHACA, N. Y. MAY 1, 1912 | FOOD SERIES No. 3

PRINCIPLES OF JELLY-MAKING

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist in your study of scientific home-making. We want your assistance as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the Home Economics Department in its efforts for scientific housekeeping.

Will you please send your opinions on the following points to the Supervisor of the Cornell Reading-Course for the Farm Home?

1. What are the results of too much or too little sugar in jelly-making?

2. After reading this bulletin, what, in your opinion, is the chief cause of failure to make good jelly?

3. Which fruits are most successfully used for jelly-making? Why?

4. Why should apple juice require longer boiling than currant juice before adding sugar to make jelly?

5. If a jelly is spoiled this year by being made with too much sugar, can anything be done with it?

6. If you have had failures in jelly-making, wherein will this bulletin assist you to avoid them in the future?

Name..

Address...

Date..

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 17 | ITHACA, N. Y. JUNE 1, 1912 | FOOD SERIES No. 4

THE PRESERVATION OF FOOD IN THE HOME.—PART I

FLORA ROSE

In the days of the French Commune, when food was scarce and hunger common, a small boy was given a birthday party. For the first time in weeks there was food enough and a little to spare even after the last

FIG. 79.—*A prospect for well-filled shelves*

greedy child had been "filled" to the limit of his capacity. When all the guests had gone and there was no longer any need of keeping up appearances the boy wept bitterly, because there was still food and no place in the boy to store it away.

It is a natural impulse in the time of plenty to linger on the memory or on the prospect of a time of need, and from the discomfort of such reflection has sprung, phœnix-like, thrifty thought of the future. In no way is man's effort to be provident better exemplified than by his adaptation of scientific knowledge to the improvement of food conditions. Winter's dietary is no longer distinguished by scarcity of eggs and lack of vegetables and fruits. Not only has Nature been persuaded to prolong her period of production, but also ways have been perfected of protecting and preserving perishable crops of summer. Industries for preserving foods have become of enormous commercial importance, and preservation of food in the home, particularly in the farm home, is a very important part of the housekeeper's responsibility.

If foods are to be kept successfully from one season to another, it is necessary to have as nearly as possible exact knowledge of the conditions that interfere with their preservation. This statement refers not only to fruits and vegetables that we pickle, preserve with sugar, or put up in cans, but to other foods, such as apples, winter vegetables, and eggs — foods that we are not trying to keep indefinitely but to give a longer season of usefulness. Many of the important practical factors in food preservation were known even to primitive man: that dried foods keep for a long time; that salt water and smoke have specific properties which aid in food preservation; that foods last better if they are kept cold. It has been left to civilization and to the advance of science to give reasons and to perfect methods.

Our grandmothers believed that air or oxygen caused foods to spoil, for they learned by experience that when fruits or vegetables were cooked and put away in sealed cans or jars from which all air was excluded they seemed to keep fairly well. If canned food spoiled after such careful treatment it was believed to be owing to some failure to exclude or remove air. Frequent visits of inspection were made to pantry and storeroom in order to ascertain whether any fruit had begun to work; and great praise was given that housekeeper whose canned goods kept well and did not need occasional sorting.

We know now that merely removing air will not secure the keeping of foods, nor will merely adding air cause them to spoil; we have learned, too, why drying, salting, pickling, and canning are efficient methods of food preservation.

WHY FOODS SPOIL

There are two main reasons why foods spoil: first, because of the presence, in or on foods, of small living organisms which feed on them and change them so that they may cease to be desirable and may even become harmful to us; second, because normally there occur in such foods as fruits and vegetables, eggs, meat, and seeds of all plants, certain substances which, although not alive, are the products of living things and have the power of causing fruit to ripen, seeds to start growing, meat to soften, and final decay in all. Any food that is still alive, or that may some day give rise to life, is subject to those changes that may be called, for lack of a better term, life processes.

When the canned food of olden times kept, it was not because air had been removed but because all life processes, both in the food and in those small organisms that may have been on it or in it, had been destroyed in the cooking process and further entrance of more organisms had been prevented by keeping the food in air-tight cans. The presence of air in a can will not cause food to spoil, provided the air is sterile — that is, provided it has been freed from all living organisms. A half-filled can of fruit will keep perfectly if the fruit, can, rubber, and cover are sterile, if the air space above the fruit is sterile, and if micro-organisms cannot enter the can. The precaution sometimes taken to run a knife or a spoon down the sides of a can to remove the few bubbles that may be there, is therefore not necessary. Unless the spoon or knife has been boiled, its use in removing air may even endanger the keeping qualities of a can of food, for the spoon or knife may hold organisms that thus find their way into the can.

It is small wonder that our grandmothers believed the oxygen theory, for in those days little was known about the processes that cause fruits to ripen and decay and nothing at all was known concerning the minute living organisms that cause food to spoil — organisms so small that they cannot be seen by the naked eye, but must be magnified many times by a powerful microscope before they become visible. The microscope had not been developed in the days of our grandmothers; it is only since the advance of science has perfected it that we have had knowledge of the organisms called micro-organisms.

Although we are unable to see a single one of the mold plants, yeast plants, or bacteria that may live on our foods and cause them to spoil, yet we are very familiar with products of their growth and in some cases with the colonies that they form when many millions of them have grown and accumulated in one place. The gas produced from a can of fruit that is working, the odor of meat that is decaying, the mold on bread or meat or fruit, the rot and mold on eggs, all are typical results of the activity of micro-organisms and are indeed well known to the housekeeper. Bacteria, yeasts, and molds grow everywhere — on ground, in water, and in air. They are very light and are easily blown about, alighting on the surface of furniture, on our hands and faces, on our utensils, on unprotected and exposed food. Like all other forms of life they are in search of a living, and the clothes that we wear (as when mildewed), the foods that we eat, and even our bodies (when diseased) may all become foods for them. Sometimes we intentionally encourage their activity and provide a living for them, as when we add yeast to dough and for a while coax the yeast into quick growth by giving it a warm corner to live in;

usually, however, our efforts are concentrated on getting rid of the troublesome micro-organisms. In bread-making yeast is desirable, but the yeast that finds its way from the air into a can of fruit and causes it to ferment, or work, is a pest.

HOW TO PREVENT FOODS FROM SPOILING

If food is to be kept for any length of time, then, it is necessary to retard or prevent natural ripening or developing processes and to protect the food from invasion by invisible as well as visible enemies. If we know what conditions favor life processes, either in the food or in the micro-organisms that may be on it, we can prevent to a certain extent the occurrence of those conditions.

All micro-organisms need the conditions of warmth, moisture, food, and oxygen to make them grow. Warmth, moisture, light, and oxygen also favor the maturing, ripening, and decay changes occurring in eggs, meat, fresh fruits, and vegetables. From an understanding of the few simple facts, it has been possible to develop large and successful systems of food preservation, some of which are mainly commercial but most of which may find a practical household illustration.

The following convenient grouping of systems of food preservation may be made, according to the conditions that they furnish to oppose the development of micro-organisms and the natural changes occurring in such foods as eggs, fruits, and vegetables:

1. By means of low temperatures.
2. By means of high temperatures.
3. By means of preservatives.
4. By means of the removal of moisture.

Preservation of food by means of high temperatures

Although warmth directly stimulates growth in micro-organisms and causes fruits and vegetables to ripen more rapidly than when they are kept in a cool or cold place, great heat is not favorable to life processes. A temperature as high as that of boiling water is very destructive to the vitality of both micro-organisms and the food on which they may occur. That destructive effect of heat is the corner stone of the method of food preservation which we know as canning. Successful canning depends on two things: first, the complete destruction by heat of all life in or on the food, and on all parts of the can that are to come in contact with the food; second, subsequent treatment of the can by sealing or by other methods to prevent further entrance of micro-organisms. The process of heating a food as just described is known as sterilization.

When canned foods spoil, the misfortune may be laid at the door of one thing — the presence of some tiny invisible form of life, or micro-organism, which, having escaped in some way the destructive action of heat, feeds on the food and causes it to mold, ferment, or decay. We may ponder on this problem and wonder how, with all our care, our failure could have occurred. We may say, "Why, last year I canned a hundred quarts of tomatoes and lost only one or two cans and I do not believe I was so careful in preparing them as I was this year; and just look at the results, nearly half the tomatoes are spoiled already." But the failure has come, nevertheless, and it is not our part to bemoan this year's "spoils" but to prepare for next year's success by finding the cause of failure. One thing we know, and we know it absolutely, and that is that it is the presence of some living thing which has caused the food to spoil — that in some way we have failed to destroy, in the food or in the can or on something that has come in contact with either, every persistent, annoying micro-organism.

The housekeeper is not the only person who has suffered, from a temporarily unexplainable reason, because of spoiled food. She owes a great debt to the commercial canner, who has suffered similarly, for the solution of some of her problems. The commercial canning problem was large enough financially to urge immediate solution, when a few years ago a man found his carefully canned peas, distributed in different towns, returned with complaint. They certainly had spoiled in the cans, thus involving financial loss, some damage to a good firm's reputation, and much annoyance. But what was the cause of this state of things? The scientist began to investigate and it was found that the peas grown that year were infected with a type of micro-organism that was able to resist the heating which in previous years had been sufficient to insure the keeping qualities of the peas. The investigations led to much experimenting in behalf of the home as well as of the commercial industry, so that at the present time the home canning of foods has been brought to a point where nearly all foods may be successfully canned.

Factors involved in canning fruit.— The present status of the best methods of canning foods in the home may be explained briefly. It is now known that some micro-organisms which cause foods to spoil may assume two forms, the spore and the vegetative forms. When conditions are unfavorable to their growth they go into the spore form, cease growing and reproducing, and become inactive and very resistant to outside influences. It is their method of tiding over a hard time. In the spore form micro-organisms are much more difficult to destroy and some of them are able to resist a temperature even as high as the boiling point of water, for an hour or more. During a dry season the spores occur much more frequently than usual on fruits and vegetables, and the difficulties of successful canning may, therefore, be greater. As soon as growth conditions become favorable — that is, when warmth, moisture, and food are supplied —

spores begin changing over to the active, growing, vegetative type of organism and in their greater " liveliness " they lose much of their power to resist heat and cold and other unfavorable influence.

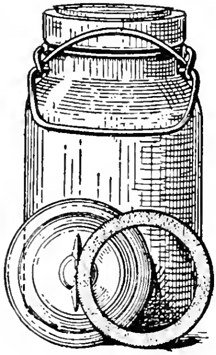


FIG. 80.—*Spring-top jar*

If spores had found their way to some food that was to be preserved by canning, the amount of heat applied in the old way of canning foods might not have been sufficient to destroy them. Then, after the jars containing the food were sealed and set away, ample food and moisture and possible warmth being supplied, the spores changed over to the active growing form and, as a result, the food began to work, mold, or decay, according to the kind of organism present.

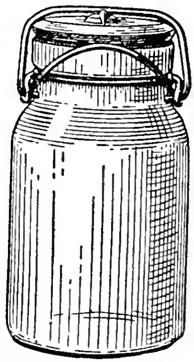


FIG. 81.—*Position of spring during sterilization*

If a reasonable time of cooking serves to destroy micro-organisms only in the vegetative form and leaves spores alive, then food canned by such cooking is always in danger of spoiling. If, after sealing, all conditions of growth are favorable, the spores present begin to change over to the vegetative form. Twenty-four hours will accomplish the change from spore to vegetative form. If the food is cooked again, however, micro-organisms in the vegetative form will be destroyed. A few spores, more resistant than all the others, may still linger. Therefore, it is wise to make assurance doubly sure by letting the food stand twenty-four hours longer, in order to permit the development of the remaining spores into the vegetative form, afterward cooking the food a third time. The best methods for obtaining good results are described on page 267 of this lesson.

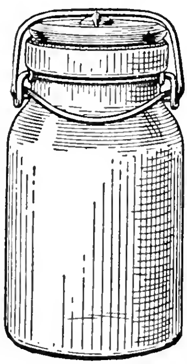


FIG. 82.—*Position of spring after sterilizing*

The commercial canner has solved the problem of sterilization in another way. A temperature higher than the boiling point of water is more destructive than is that of boiling water, and when the temperature is high enough a relatively short time of cooking is sufficient to sterilize all foods subjected to such a temperature. As a result, canning factories are equipped with mechanical devices for cooking foods at high temperatures. By careful experimenting, the manufacturers have worked out the best temperatures and lengths of time for the cooking of foods put on the market. There are a few mechanical devices to be purchased for use in the household, which will enable the housekeeper to obtain the high temperature required for this quicker method of food canning, but they are expensive and require more care to insure good results than does the ordinary use of the steamer, hot-water bath, or open kettle.

A piece of apparatus called the autoclave has come into use in some households where an effort is made to realize a profit on the fruit by selling food canned in glass jars. The autoclave is a utensil in which steam is under pressure and by which a temperature higher than that of boiling water may be obtained. It requires careful handling to obtain correct temperatures and to prevent serious accidents from high steam pressure with the attendant danger of the blowing up of the apparatus. A relatively inexpensive autoclave may be purchased, which has a capacity of about four hundred two-pound cans. As the high-temperature cooking for certain vegetables does away with the necessity of intermittent cooking, the use of the autoclave is, under some circumstances, an economy.

While the process of sterilization by heating foods intermittently for several days may be used for all foods, it is not necessary to take so much trouble with all. Fruits and tomatoes are much easier to sterilize than are the general run of vegetables, because they contain acids; hot acid, even if dilute, aids materially in destroying micro-organisms, both in the spore and the vegetable stage, during the cooking process. One day's cooking for a moderate time is therefore usually sufficient for acid-containing foods.

Details of canning.— Good results in canning are more nearly certain if environment, food, and receptacles are clean; the danger of reinfecting carefully sterilized material with destructive organisms is then lessened. It must not be assumed that hands, dishcloths, and such utensils as have not been boiled or have not come in direct contact with a flame are clean in the sense of the cleanliness needed in canning foods. The grit and sand that are left on fruits and vegetables and that we ordinarily regard as dirt will not interfere with the keeping of canned foods; but the invisible dirt in the form of micro-organisms which is found on even well-washed hands, dishcloths, towels, and any other article likely to be used in the work, may interfere seriously with good results. If, therefore, food and containers have been thoroughly freed from destructive micro-organisms by the action of heat, they must not be reinfected by coming in contact with hands that have not been so treated. A careful housewife, following directions, boiled the jars that were to contain her canned tomatoes. Then, because the water was hard and lime was deposited in the jars, she as carefully used a dish-towel to wipe them out. One may imagine what probably resulted.

Types of jars or cans for home use.— There are many kinds of fruit jars on the market. The question is frequently asked, " Which jar is the best to choose? " The answer is, choose the jar which is simplest in construction, which will seal perfectly and wash easily, which protects the contained food against contact with metals, which has the fewest parts to lose or misplace, which fits the shelves and receptacles planned to hold it. The type of can that seems to give the most general satisfaction is one having a glass cover clamped on with some metal device. Several jars of that kind are shown in the appended illustration. If possible, tin cans should be avoided in home canning; for food may have some action

FIG. 83.—*Types of jars for home use*

on the tin, and it is now believed that the tin salts resulting from such action may be harmful.

Rubbers.— Use new can-rubbers with each year's product of canned food. Old rubber loses its elasticity and its use may cause imperfect sealing and thus endanger the keeping quality of the food. Care should be given to the selection of good rubber, for even new rubber may be stiff, inelastic, and hard.

To test a jar.— Before using a jar for canning food, it should be tested. The testing is accomplished by partly filling the jar with water, adjusting cover and rubber, sealing, and inverting the jar. If it leaks, examine to find whether the leakage is owing to an imperfect jar or to a poor rubber. If the jar is imperfect, reserve it for use in canning pickles or some food that does not require sealing.

Other utensils.— The utensils needed for canning vary with the method of canning to be followed. If foods are to be stewed, agateware or aluminum is best to use. Tin, iron, or copper should be avoided if acid foods are to be cooked. When the newer method of steaming foods in the glass jars that are to contain them, is followed, some large receptacle for holding the jars in an upright position is necessary. The clothes boiler is admirable for this purpose, as it will hold a number of jars of various sizes. To prevent bumping and cracking of the glass jars, a wooden rack is needed for the bottom of the boiler; the jars should not touch one another. The accompanying illustration shows a rack simple enough to be made by even the inexpert woman. If the clothes boiler is an impossibility, a large flat-bottomed kettle will do, although its capacity is limited. The steam cooker is valuable in place of the boiler or as an adjunct to it, when much food is being canned at one time.

The fireless cooker also is a useful utensil for preserving foods, and directions will be given for its use.

Canning materials.— Only good, sound materials should be used in canning. Coarse-grained sugar should be chosen for canning fruits and for jelly-making, as it melts without so much frothing as is produced by fine-grained sugar.

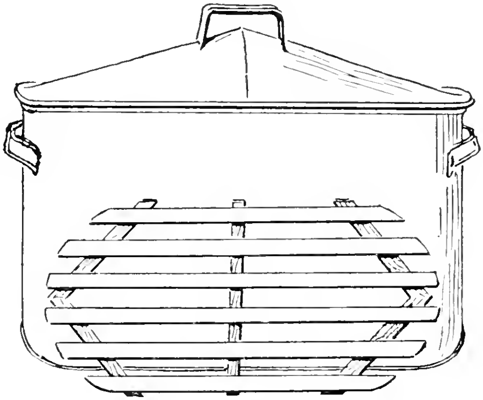


FIG. 84.—*Sterilizer showing false bottom as a rack*

Preparation of fruits and vegetables for canning.— The following procedure should be followed in the preparation of foods for canning:

1. Select well-grown, firm, and not overripe fruit.
2. Choose vegetables that are young and have made a quick growth.
3. Avoid very dirty fruit or vegetables.
4. If possible, can vegetables and fruit on the day they are picked.
5. Prepare fruits and vegetables as for cooking, in the following manner:
    a. Clean thoroughly.
    b. Pare, peel, or scrape, as the kind of fruit or vegetable requires.
    c. Remove all bruised or decayed parts.
    d. Wash and halve, quarter, or slice, as desired, before putting into cans or cooking utensil.
    e. If the fruit or vegetable is of a kind that discolors after being pared, cover with cold water until ready for use.

Methods of canning.—

METHOD I. To be used when sterilization by intermittent heat is necessary, a natural flavor is the object, and a rich, highly sweetened product is not desired:

1. Pack the prepared fruit or vegetable firmly in the can to within one half inch of top. Care should be taken not to bruise, injure, nor crush soft fruits.

2. Add sugar or salt according to the food canned.

   For vegetables, add $\frac{1}{2}$ to 1 teaspoon salt to each quart of vegetables; if sugar is desired, as in beets and peas, add 1 to 2 teaspoons.

   For each quart can of fruit use:

   To make very sweet, 1 cup, or 8 ounces, of sugar.
   To make moderately sweet, $\frac{1}{2}$ cup, or 4 ounces, of sugar.
   To make slightly sweet, $\frac{1}{4}$ cup, or 2 ounces, of sugar.

   (Fruits may be canned without any sugar.)

   The sugar may be sprinkled over the fruit after the fruit is placed in the can; but a better method is to make a sirup by cooking the sugar with water for 1 to 2 minutes, using $2\frac{1}{2}$ to 3 cups of water for each quart can of fruit.
3. For vegetables, fill the can, packed as directed, completely full of clean, cold water. For fruits, if the sugar has been sprinkled over the fruit, fill the can full of clean, cold water; if the sugar has been made into a sirup, fill the can completely full of sirup.
4. Place a new rubber on the can and adjust the top of the can, but *do not seal it*.
5. Place cans on slats of wood or other perforated support in the bottom of the boiler or cooking vessel.
6. Pour enough cold water into the vessel to cover jars to a depth of two to three inches.
7. Bring the water to the boiling point and boil 5 to 20 minutes, according to the kind of fruit or vegetable, then seal the can.
8. After the cans are sealed, boil 10 to 45 minutes, according to the kind of food canned.
9. Remove cans from the vessel, set them aside out of any draught, and let them cool. Let them stand 24 hours in a warm room.
10. On the second day, return the cans to the boiler, prepared as previously directed with perforated rack and water, and, without loosening the seal of the can, bring the water to the boiling point and boil 5 to 60 minutes, according to the food to be cooked.
11. Remove cans from the boiler, cool, and let stand as before.
12. On the third day, cook as on the previous day 10 to 60 minutes, according to the food to be prepared.
13. Remove from the boiler, cool, wash outside of can thoroughly, label, and set away.

TABLE OF DIRECTIONS FOR CANNING FOOD BY METHOD I

Food	Special preparation before canning	Time of cooking (minutes)		
		Before sealing	After sealing	Second and third days
Apples	Peel, quarter, and core	10	15	25
Blackberries	Remove stem, leaves, trash, and imperfect berries	5	5	10
Cherries	Seed or leave whole	10	10	20
Grapes	Pick from stem	10	10	20
Huckleberries	Remove leaves, trash, and imperfect berries	5	10	15
Plums	Leave whole or cut in halves	10	10	20
Peaches	Peel, can whole, in halves, or in quarters	10	10	20
Pears	Peel, cut in halves or quarters, and core	10	15	25
Quinces	Peel, quarter, and core	10	20	30
Raspberries	Remove stems	5	5	10
Rhubarb	Cut in $1\frac{1}{2}$-inch pieces	10	10	20
Strawberries	Stem	5	5	10
Asparagus*	Cut in lengths to fit jar, parboil 5 minutes, and drain	15	45	60
Beets*	Boil until skin is easily removed. Can whole, in slices, or in quarters	15	45	60
Beans, Lima*	Hull by hand	15	45	60
Beans, string*	Remove strings, cut into 1-inch pieces. Boil 5 minutes and drain before putting into cans	15	45	60
Corn*	Cut grains from cob and scrape cob, or score grains before cutting from the cob	15	45	60
Eggplant	Cut in thin slices, drop in boiling water, and let stand 15 to 20 minutes. Drain and pack in jar	15	45	60
Peas*	Shell. Boil 5 minutes. Remove wrinkled peas. Put into cans	15	45	60
Pumpkin*	Peel, cut into small blocks	15	45	60
Spinach	Wash free from all sand and grit. Remove discolored leaves. Boil 5 minutes. Drain and pack in jars	10	30	40
Succotash Corn $\frac{2}{3}$ Beans $\frac{1}{3}$	Prepare corn and beans as directed	15	45	75
Sweet potatoes	Boil until skins will peel off. Cut in convenient sizes to fit cans	15	45	60
Tomatoes	Scald for 5 minutes. Remove skins. Save any juice escaping	10	20	30
Tomato mixture Corn $\frac{1}{3}$ Tomatoes $\frac{2}{3}$	Prepare each as directed above and mix	15	45	60

* To insure success, those foods that are starred require the three-day cooking, or should be steamed one day only for 2 to 4 hours. The intermittent cooking is not only more likely to be safe but it will give a better product.

For apples, cherries, grapes, plums, peaches, pears, quinces, raspberries, rhubarb, and tomatoes, a one-day cooking is generally safe; 30 to 40 minutes on the first day, and the second- and third-day cooking to be omitted.

A steam cooker may be used in place of a boiler in the above method of preparation.

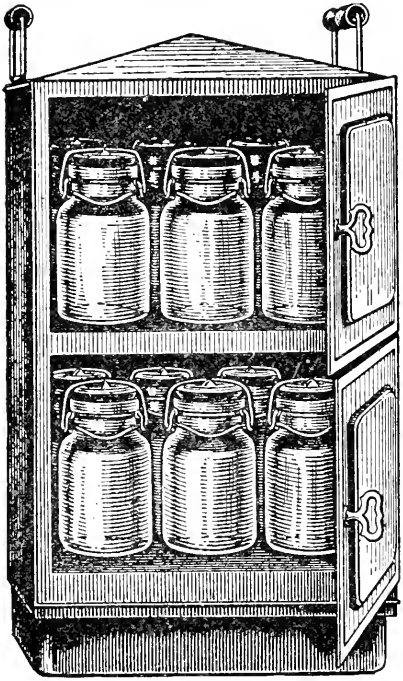


FIG. 85.—*Steam cooker*

NOTE.— The above directions are for pint and quart jars. If half-gallon jars are used, increase the time one third.

METHOD II. This method is best with watery foods that are easy to sterilize, when concentration is desired, or when the richness of sugar-soaked fruit is an object:

1. Sterilize cans, tops, and rubbers by covering with cold water, heating gradually, and boiling 20 minutes. Old cans, carelessly cleaned, are a frequent cause of spoiled food, hence the precaution of boiling the cans is wise.
2. For each pound of fruit use:
   For preserves, $\frac{3}{4}$ pound of sugar.
   To make very sweet, $\frac{1}{2}$ pound of sugar.
   To make moderately sweet, $\frac{1}{4}$ pound of sugar.
   To make slightly sweet, $\frac{1}{16}$ to $\frac{1}{8}$ pound of sugar.
3. The amount of water required for cooking fruit by this method will vary with the juiciness of the fruit and the amount of sirup desired with it.
   For each pound of fruit use:
   If very juicy, $\frac{1}{8}$ to $\frac{1}{4}$ cup of water.
   If moderately juicy, $\frac{1}{4}$ to $\frac{1}{2}$ cup of water.
   If slightly juicy, $\frac{1}{2}$ to 1 cup of water.
4. Cook the material to be canned.
   a. For tomatoes, stew or steam until tender, 20 to 60 minutes.
   b. For fruits:

(1) Cook in a light sirup until tender. If fruits are tough, steam until tender, then cook in a light sirup until slightly clear.
(2) If juicy, tender fruits are used, they may be covered with sugar until the juices begin to draw and then may be stewed until tender.
(3). If fruits cook to pieces readily, cook in a moderately heavy sirup.

5. Adjust rubber, and fill hot, sterile jar completely full with hot cooked fruit or vegetable.
6. Cover and seal at once.
7. Invert can and let it stand until cool.

METHOD III. Canning by the fireless cooker. This method of canning is good only for fruits:

1. Pack prepared fruit in jar.
2. Adjust rubber and cover.
3. Fill completely full with hot sirup.
4. Seal at once.
5. Set in fireless-cooker kettle (the kettle should be warmed in order to prevent jars from breaking) and cover completely with boiling water.
6. Cover kettle at once and set away in cooker over night or until cold.

NOTE.— This method is particularly good for raspberries, plums, and peaches.

METHOD IV. A modification of Method I:

1. Prepare fruit as in Method I.
2. Adjust rubber, cover, and clamp, but do not seal.
3. Set the jars on a board cut to fit the bottom of the oven and placed on it.
4. Cook slowly in a moderate oven for 20 minutes to 3 hours, according to the kind of fruit preserved.

NOTE.— Fruits require the short time of cooking. Vegetables, except tomatoes, require the long time of cooking.

Storing canned food.— Canned food should be stored carefully, as light has a chemical action on some foods and destroys color, leaving the food unattractive in appearance.

Cause of the spoiling of food in the can.— If the contents of the can and the can itself have been made absolutely sterile, and the can is entirely air-tight, the food will not spoil if held in a warm place. The spoiling of food under such conditions must be owing to one of three things:

1. Some flaw in the can, which makes it a so-called "slow-leaker."

2. The presence of some micro-organisms that have survived the cooking process, in spite of all care.

3. A drying-out of the rubber, and hence the breaking of the seal.

FIG. 86.—*Manner of testing*

In some factories where foods are canned in glass jars, racks are made for holding the jars upside down in an inclined position, keeping the liquid constantly in the top of the can and preventing the rapid drying of the rubber.

To test canned food.— Canned food should be set aside for two or three days before storing, and then should be tested as follows: Loosen the clamp and grasp the can by the edges of the glass top. If sterilization has not been complete, if the can leaks, or if decomposition has set in, the top will come off. If the top stays on, tighten the clamp again and the food is ready for storage. If the top comes off, reject that can of food.

To open the jar.— Run a knife blade under the rubber and press firmly; if the top resists, pour a stream of hot water over it.

Preservation of food by means of preservatives

The word "preservative" is used to cover a wide range of substances that are used in food preservation to prevent or retard the growth of micro-organisms. The use of preservatives is as old as the use of food. Even primitive peoples were familiar with the preserving effects of salt and smoke. With the growth of the food-preservation industry and the development of new preservative substances has come the question, "Are food preservatives harmful?" There has been a world-wide discussion as to the legality of the use of certain of the preservatives since the claim has been made that they endanger the health of the consumer.

In regard to the action of preservatives it may be said, in a general way, that any substance sufficiently active to destroy or check the growth of micro-organisms should be at least thoroughly questioned before it is admitted to the ranks of our daily food supply. If a substance is active enough to destroy life in micro-organisms, may it not have a similar effect on the living tissue that lines the digestive tract? May it not be detrimental when it reaches the blood system? Surely, only those preservatives should be used that are harmless and that permit the retention of desirable tastes and flavors.

Preservative substances may be divided into three classes: first, those known to be harmless, such as sugar, salt, vinegar, and spices; second, those about which there is doubt, as saltpeter, smoke, and liquid smoke; third, those known to be harmful, as boric acid and the borates, salicylic acid and the salicylates, benzoic acid and the benzoates, sulfurous acid and the sulfites, and formaldehyde.

Sugar.— Sugar in a concentrated form is a very effective preservative. Even in a dilute form when used with other preservatives, such as vinegar and spice, it aids in preventing putrefactive changes in foods.

One of the first household methods of keeping perishable fruits was by cooking them with a large quantity of sugar until the rich, thick preserve, jelly, jam, or marmalade was obtained. Being of good flavor, effective as a preservative, and wholesome as a food, sugar is deservedly popular. Since the scientific knowledge of preserving fruits without the use of any or of much sugar has developed, the old-fashioned preserve has been largely crowded out of the family dietary. As a substitute for fresh fruit, preserves certainly are unsatisfactory. Used as a modified form of sugar to increase the sweets in the dietary they are excellent, and some simple form of preserve might well replace a part of the candy or less wholesome sweet foods now appearing on the family table.

(a) Preserves.— Preserves as made at the present time are only " first cousins " to the preserves of former days, as they are now less sweet, less thick, and therefore less easily kept than formerly. Therefore, it was believed wise to include the method of making so-called preserves under canning directions, since preserves as now made must be sealed in sterile air-tight jars to insure their keeping. All that is necessary to obtain the old-fashioned preserve is to follow directions for making preserves and further concentrate the mixture.

(b) Jams and marmalades.— If in directions for making jams and marmalades the jelly-making property of fruits were given greater consideration than it is commonly, the product resulting from following such directions would be improved in both taste and wholesomeness. The object sought in making jams and marmalades is a rich, sweet product which will keep easily, which is not so crisp as jelly and yet has something of the body of jelly, which is not so soft and tough as is the so-called preserve and yet has something of its softness and stickiness. In short, jams and marmalades should be skillfully produced combinations or "crosses" between jellies and preserves.

The jelly-making substance in fruit is obtained by cooking the fruit with water and thus extracting its juices. The amount of water and the time required to extract the jelly-making substance depend on the dryness and kind of fruit. Juicy fruits, such as currants, berries, plums, and grapes, require little water and are quickly softened and extracted by heat.

Dry fruits, such as apples and quinces, require more water and longer cooking than do juicy fruits.

As has been explained in a previous bulletin in this series, entitled "Principles of Jelly-making," the white inner skin of oranges, lemons, and grape fruit will, if cooked in water for a long time, yield the jelly-making substance. That fact has an important bearing on the manufacture of orange and grapefruit marmalades.

Methods of mcking jams and marmalades:

METHOD I. The new method:

1. Wash fruit and prepare according to kind.
2. If large fruits are used, core and halve, quarter, slice, or chop.
3. If berries or grapes are used, crush.
4. For each quart of fruit use:

   For dry fruits, $\frac{1}{2}$ to 2 cups of water.

   For juicy fruits, $\frac{1}{8}$ to $\frac{1}{4}$ cup of water.

   Common sense must ultimately regulate the amount of water. The least amount that is possible should be used.
5. Simmer the fruit until it is tender and the juice is extracted.
6. If seeds are to be removed, rub cooked fruit through a colander.
7. To 1 quart of cooked fruit add $\frac{3}{4}$ to 1 quart of sugar. Acid juicy fruits require the larger amount of sugar.
8. Cook until thick, stir continuously in order to prevent burning, then pour into sterilized glasses or small jars. If a jelly-like consistency is desired, cook until the mixture jellies from the spoon. If a richer mixture is desired, cook 5 to 10 minutes longer.

METHOD II. The old method, when a tough, sticky jam is desired:

1. Prepare as in Method I.
2. If seeds are to be removed from grapes or berries, rub through a sieve.
3. For each quart of fruit use 1 pint of sugar.
4. Place a layer of fruit in the preserving kettle, then add alternate layers of sugar and fruit.
5. Heat slowly; stir frequently so as to prevent burning.
6. Cook until thick, then pour into sterilized glasses or small jars.

(c) Conserves.— A conserve is a kind of preserve made from a mixture of fruits with or without the addition of some other material, such as nuts. Various combinations of fruits may be made into toothsome relishes under the name " conserve." For example, strawberries may be combined with orange pulp, pineapple, or rhubarb, in various proportions, to make conserves of delicious taste and beautiful color.

Salt and vinegar.— These are preservatives that materially aid in keeping foods, not because they destroy or prevent the growth of all kinds of micro-organisms, but because they protect food more or less effectively against the action of those micro-organisms that cause putrefaction and decomposition. Their moderate use as condiments in the dietary is normal; hence, their use as preservatives is regarded as harmless.

The action of acid in preventing putrefaction is interestingly illustrated in two natural food-products. Under conditions favoring putrefaction, sweet milk may spoil in two or three days. If milk sours, however, the acid may aid in protecting it against putrefaction for many weeks. Sauerkraut is the acid product of cabbage and, like milk, it is protected against decay by its acid content.

Spices.— Some spices have a decidedly preservative action. Recent investigations in the bacteriological laboratory at the Wisconsin Agricultural College indicate that all spices are not equally effective: pepper and ginger exerting slight, if any, power to prevent decomposition of food; cinnamon and cloves, on the other hand, being very effective preservatives. The materials are condiments, that is, digestive stimulants; used in any large quantity in the dietary, they affect the powers of digestion unfavorably. Foods preserved by the action of spices should therefore have a limited use in the dietary and should be used rather as condiments than to supply the body of the meal.

Typical foods preserved by the action of spices, or of spices with some other preservative such as cider or salt, are mincemeat, fruit cake, spiced fruit, meats, and pickles.

Doubtful preservatives: saltpeter, smoke, and liquid smoke.— Saltpeter has an astringent action on food. It is used generally where meat is being pickled in brine, as salt removes the color of meat and the presence of saltpeter prevents that removal. It is still a question whether the effects of saltpeter are harmful; if it is used only for æsthetic purposes, it might well be eliminated.

The antiseptic properties of smoke are owing to the formation of creosote and pyroligneous acid. It is a question whether those substances are harmful in the amount found in smoked meats. Liquid smoke, a liquid compound of creosote and pyroligneous acid, yielding as it does a larger amount of those substances to the food, is open to more serious objection than is smoke.

Harmful preservatives.— There are preservative substances, however, concerning the harmfulness of which there is no longer any doubt, and every effort should be made to eliminate them from the family dietary. There is no necessity for using them in food preservation, for it has been made entirely possible, by better adaptation of scientific methods, to preserve foods without their use. When those preservatives known to be harmful are used, it is in order to save labor and thus, by cheapening the product, increase profits; or it is in order to enable the manufacturer to use a poor grade of material or spoiled material.

Preserving powders.— Some housekeepers may use harmful preservatives through an ignorance of facts. There are a number of " preserving powders " on the market that claim to save the housekeeper's time and effort and to enable her to can foods more successfully than she could without their use. In all cases, if the powder is as effective as it claims to be, the reason is that some substance is present which is harmful alike to micro-organisms and to human beings. For the sake of family welfare, therefore, such " aids " should never be used in home canning. The household use of an artificial sweetening agent, saccharin, is also too common. Saccharin is a coal-tar product and is known to be harmful.

Laws regulating the use of preservatives.— There are laws that regulate in part the commercial use of certain preservatives in the manufacture of preserved foods. There is great need of more general education of the public concerning the harmful effects of preservative substances, to the end that the laws preventing their use may not be perverted but instead may be upheld by intelligent public opinion. The change in the law which at one time forbade the use of sodium benzoate as a preservative substance shows the need of such education. That law has, in the face of Dr. Wiley's evidence, been changed so as to permit the use of sodium benzoate. The following quotations from Dr. Wiley's findings concerning the harmful effects of chemical preservatives will put the reader in touch with some of the facts in the case:

Concerning the use of benzoic acid and the benzoates.—" Results of these investigations have shown that there is not a single article of food which has been commonly preserved by means of benzoic acid or benzoate of soda which cannot be preserved and offered to the consumer in perfect condition without the aid of any chemical preservative. This fact has been completely demonstrated in the case of cider and grape juice, mincemeat, jelly, jams, catsups, preserves, and other articles of the same character.

" The greater care which is required in the manufacture of food products without the use of benzoic acid or benzoate of soda, necessitating the use of a higher quality of raw material, will place the industries which would otherwise use these preservatives in foods on a better plane, and secure for their products a greater consumption.

"From a careful study of the data in the individual cases and of the summaries of the results, it is evident that the administration of benzoic acid, either as such or in the form of benzoate of soda, is highly objectionable and produces a very serious disturbance of the metabolic functions, attended with injury to digestion and health.

"As in the case of boric acid, salicylic acid, and sulphurous acid, this injury manifests itself in a number of different ways, both in the production of unfavorable symptoms and in the disturbance of metabolism. These injurious effects are evident in the medical and clinical data which show grave disturbances of digestion, attended by phenomena which are clearly indicative of irritation, nausea, headache, and in a few cases vomiting. These symptoms were not only well marked, but they were produced upon healthy individuals receiving good and nourishing food and living under proper sanitary conditions. It is only fair to conclude, therefore, that under similar conditions of administration of benzoic acid or benzoate of soda in the case of weaker systems, or less resistant conditions of health, much more serious and lasting injury would be produced.

"It was also noticed that the administration of benzoic acid and benzoate of soda was attended with a distinct loss of weight, indicative of either a disturbance of assimilation or an increased activity in those processes of the body which result in destruction of tissue. The production of a loss of weight in cases of this kind must be regarded as indicative of injurious effects.

"Coming to the final consideration of all these different phases of the subject, there is only one conclusion to be drawn from the data which have been presented, and that is that in the interests of health both benzoic acid and benzoate of soda should be excluded from food products. This conclusion is reached independently of any consideration of the conditions which it is alleged surround the processes of manufacture and which result in the demands of manufacturers to be allowed to continue the use of these substances. This is a subject which must be discussed from an entirely different point of view and has no bearing whatever upon the general conclusions which have been reached, namely, that both benzoic acid and benzoate of soda are bodies which, when added to foods, are injurious to health.

"In the majority of cases the labor of freeing the system from added preservatives falls principally upon the kidneys. In the method of life in vogue in this country the kindeys are already hard-worked organs. Americans probably eat more freely than the citizens of almost any other country, with the possible exception of England. Large quantities of nitrogenous foods are consumed. In the breaking down of the nitrogenous tissues the kidneys are the chief organs for the excretion of the debris. The addition of any further burden, therefore, no matter how minute, is to be deplored."

Concerning boric acid and borax.— "The medical symptoms of the cases, in long-continued exhibitions of small doses or in large doses extending over a shorter period, show in many instances a manifest tendency to diminish the appetite and to produce a feeling of fullness and uneasiness in the stomach which in some cases results in nausea, with a very general tendency to produce a sense of fullness in the head, which is often manifested as a dull and persistent headache. In addition to the uneasiness produced in the region of the stomach there appear in some instances sharp and well-located pains, which, however, are not persistent. Although the depression in the weight of the body and some of the other symptoms produced persist in the after periods, there is a uniform tendency manifested after the withdrawal of the preservative toward the removal of the unpleasant sensations in the stomach and head above mentioned.

"It appears, therefore, that both boric acid and borax, when continually administered in small doses for a long period or when given in large quantities for a brief period, create disturbances of appetite, of digestion, and of health."

Concerning the use of sulfurous acid and the sulfites.— "The use of sulphurous acid and sulphites never adds anything to the flavor or quality of a food, but renders it both less palatable and less healthful. The use of sulphurous acid in foods should be suppressed.

"From a careful consideration of the data in the individual cases, and the summaries of the results, it appears that the administration of sulphurous acid in the food, either in the form of sulphurous-acid gas in solution or in the form of sulphites, is objectionable and produces serious disturbances of the metabolic functions and injury to digestion and health.

'An immense burden has been added to the already over-worked kidneys.

"It is reasonable to suppose that the continued use of a body which produces such results would cause lesions of a histological character that eventually would develop conditions which would give serious apprehension.

"The verdict which must be pronounced in this case is decidedly unfavorable to the use of this preservative in any quantity or for any period of time, and shows the desirability of avoiding the addition of any form of sulphurous acid to products intended for human food.

"Sulphurous acid in some form is extensively employed in many technical operations in the preparation of foods. This is especially true in the production of wine, in the preparation of evaporated or desiccated fruits, and in the manufacture of molasses. In every low-grade molasses the sulphur naturally occurs in extraordinarily large quantities.

" In the preparation of evaporated apricots, peaches, pears, and mandarins, sulphuring is practiced for the following reasons:

" 1. To produce as clear and intense a yellow color as possible.

" 2. To conceal decayed portions of the fruit which have been overlooked in trimming.

" 3. To prevent fermentation and decay during the drying of the fruit.

" 4. To protect the fruit during drying from flies and other insects, the larvæ of which would otherwise develop after the fruit was stored.

" 5. To kill the cells of the fruit and thus make the texture more porous, which expedites drying.

" That excessive quantities of sulphur are not necessary for the production of evaporated fruits of pleasing appearance is well attested by analytical data obtained by the examination of fruits purchased in the open market having a light and pleasing color and at the same time containing only a small quantity of sulphurous acid.

" In all such cases, however, it will be found not only possible and desirable to make the food product in question without the use of the deleterious substance, but there is evidence to show that the products thus manufactured will be more palatable, more wholesome, and more valuable than those made according to the methods commonly used at present. Practical experiments have shown, for instance, the possibility of producing a high-grade sirup from cane juice and other saccharine saps without the use of fumes of burning sulphur. Analytical data show the presence on the market of considerable quantities of desiccated fruits of good appearance in which the quantity of sulphur is so small as to be ascribed rather to the conversion of the natural sulphur content of the product than to the addition of the sulphur in its manufacture."

Concerning the use of formaldehyde.— " Inasmuch as milk, of all ordinary foods, is the most prone to deterioration and requires the most careful treatment, the temptation to use such an efficient preservative as formaldehyde is proportionately greater, especially during the summer months.

" It seems not out of place to call attention to the fact that apart from the injurious effects of formaldehyde itself its use as a preservative would be especially inadvisable in milk or cream, because its addition in dilute solution prevents the growth of acid-forming bacteria, but has no effect in retarding the action of many harmful organisms; in other words, the milk is prevented from becoming sour, and thus indicating its age, and the danger signal is thus removed; while the other organisms which are capable of producing disease continue to multiply in the milk with practically the same degree of rapidity as if the formaldehyde were not present.

"A general study of all the data leads to the conclusion that the admixture of the formaldehyde with food is injurious to health, even in the case of healthy young men. It is fair to conclude, therefore, that in the case of infants and children the deleterious effects would be more pronounced. The metabolic functions are disturbed in a notable way.

" The medical data indicate plainly that formaldehyde, even when given in small quantities, is an irritating substance to the mucous membrane.

" The final conclusion, therefore, is that the addition of formaldehyde to foods tends to derange metabolism, disturb the normal functions, and produce irritation and undue stimulation of the secretory activities, and therefore it is never justifiable."

Concerning the use of salicylic acid and the salicylates.— " Salicylic acid and the salicylates added to food even in small quantities exert a depressing and harmful influence on digestion and health and upon the metabolic activities of the body."

The law governing the use of colors and preservatives.— The following quotations are made from Circular 21, United States Department of Agriculture, Office of the Secretary, " Rules and Regulations for the Enforcement of the Food and Drugs Act ":

" Regulation 15. Wholesomeness of Colors and Preservatives

"(a) Respecting the wholesomeness of colors, preservatives, and other substances which are added to foods, the Secretary of Agriculture shall determine from chemical or other examination, under the authority of the agricultural appropriation act, Public 382, approved June 30, 1906, the names of those substances which are permitted or inhibited in food products; and such findings, when approved by the Secretary of the Treasury and the Secretary of Commerce and Labor, shall become a part of these regulations.

"(b) The Secretary of Agriculture shall determine from time to time, in accordance with the authority conferred by the agricultural appropriation act, Public 382, approved June 30, 1906, the principles which shall guide the use of colors, preservatives, and other substances added to foods; and when concurred in by the Secretary of the Treasury and the Secretary of Commerce and Labor, the principles so established shall become a part of these regulations.

" (c) It having been determined that benzoate of soda mixed with food is not deleterious or poisonous and is not injurious to health, no objection will be raised under the food and drugs act to the use in food of benzoate of soda, provided that each container or package of such food is plainly labeled to show the presence and amount of benzoate of soda. Food Inspection Decisions 76 and 89 are amended accordingly.

"(d) It having been determined that saccharine mixed with food is an added poisonous and deleterious ingredient such as is contemplated by the act, and also that the substitution of saccharine for sugar in foods reduces and lowers their quality, the Secretary of Agriculture will regard as adulterated under the food and drugs act foods containing saccharine which, on or after January 1, 1912, are manufactured or offered for sale in the District of Columbia or Territories, or shipped in interstate or foreign commerce, or offered for importation into the U. S. (F. I. D. 135 and 138, dated April 26 and June 20, 1911, respectively)."

"Regulation 16. Character of the Raw Materials

"(a) The Secretary of Agriculture, when he deems it necessary, shall examine the raw materials used in the manufacture of food and drug products, and determine whether any filthy, decomposed, or putrid substance is used in their preparation.

"(b) The Secretary of Agriculture shall make such inspections as often as he may deem necessary."

REFERENCES

Farmers' Bulletins, United States Department of Agriculture, Washington, D. C.

Bigelow, W. D. Fruits and fruit products. Bulletin 66, Bureau of Chemistry

Breazeale, J. F. Canning vegetables in the home. Bulletin 359

Gould, H. P., and Fletcher, W. F. Canning peaches on the farm. Bulletin 426

Husman, G. C. Home manufacture and use of unfermented grape juice. Bulletin 175

Parloa, Maria. Canned fruits, preserves, and jellies. Bulletin 203

Wiley, H. W. Influence of food preservatives and artificial colors

Cornell Reading-Course for the Farm Home. Preservation of food in the home (in three parts)

North Carolina Department of Agriculture, Raleigh, N. C.

Shaw, S. B. The home canning of fruits and vegetables. Vol. XXXI, No. 5

University of Wisconsin, Madison, Wis.

Adams, Mrs. L. H., and Sandsten, E. P. Practical directions for preserving native fruits and vegetables. Bulletin 136

For outline of club study on preservation of food, see Cornell Reading-Course for the Farm Home, Vol. I, No. 13, Cornell Study Clubs, p. 182

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL 1. No. 17 | ITHACA, N. Y. JUNE 1, 1912 | FOOD SERIES No. 4

THE PRESERVATION OF FOOD IN THE HOME.—PART I

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist in your study of scientific home-making. We want your assistance as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the Home Economics Department in its efforts for scientific housekeeping.

Will you please send your opinions on the following points to the Supervisor of the Cornell Reading-Course for the Farm Home?

1. What causes food to spoil?

2. Which foods are most easily preserved by canning, and why?

3. Why should the use of preservative substances be carefully considered?

4. Discuss the question, shall we can our food at home or buy the commercial product?

Name..................................

Address..................................

Date..................................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 19 | ITHACA, N. Y. JULY 1, 1912 | FOOD SERIES No. 5

THE PRESERVATION OF FOOD IN THE HOME.—PART II

FLORA ROSE

In many homes the only practical method of preserving a quantity of food is by canning or preserving it.

That is not true in the case of the farm home, which, although in the very center of production, is often isolated from the centers of distribution. All methods of preserving foods must be carefully considered, in order that a part of to-day's abundant supply of fresh food may be kept for to-morrow. There is no convenient and accessible corner grocery or great market fed from all parts of the country, which may be drawn upon day by day to supply farm home needs. The farm home must be its own market, its own warehouse, its own source of supply.

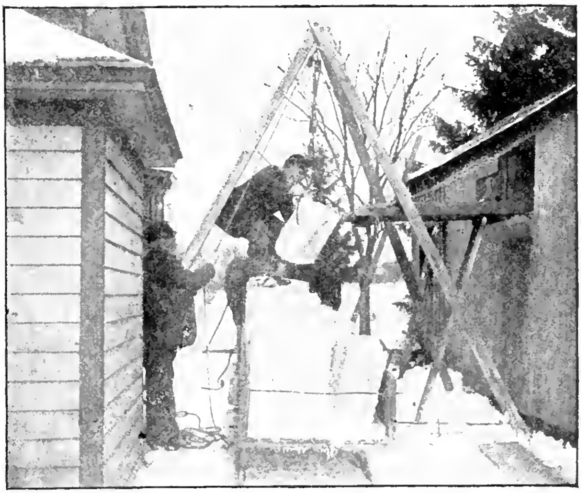


FIG. 87.—*Putting in ice for home supply*

PRESERVATION OF FOOD BY MEANS OF LOW TEMPERATURES

A temperature even as low as the freezing point of water may not kill micro-organisms nor destroy in such foods as fruits and vegetables the substances that ripen and mature them. Such a temperature does, however, retard or check all life processes, and therefore its use is a highly efficient method of keeping foods during limited periods of time.

Simple household methods of keeping foods cold have long been in use. The cold cellar, the pit, the cave or wellhole, a stream of running water or a water bath, wet leaves and cloths, the cold box or refrigerator kept cold in winter with cold air and in summer by a circulation of cold water or by the use of ice, a stream of cool, clean water diverted to run through the cold box and thus keep the daily supplies of butter, eggs, meat, and the like, wholesome and cool, is indeed a blessing to the country home. In the city or large town the refrigerator problem is solved commercially, all having an opportunity to hail the iceman and get a daily ice supply. The problem of the smaller town or the rural community is more individual and its successful solution often lies in the owning and operating of an ice house by each individual or by a small group of individuals. The question of the effect on the family welfare of having some good method of preserving the daily supply of perishable food is of sufficient importance to warrant a careful study of the best means of procuring ice for home purposes and storing it on the farm.

To make a refrigerator.— An excellent little pamphlet — " Ice Houses," by L. C. Corbett, Farmers' Bulletin 475, United States Department of Agriculture, Washington, D. C. — describes methods of harvesting ice and of securing refrigeration on the farm. The following quotation is made from that bulletin:

" The construction of a farm refrigerator large enough to meet the requirements of a well-equipped farm for the storage of eggs, butter, and fresh meat and for chilling or precooling fruits in small quantities is shown in Fig. 88. This refrigerator can be constructed in a cellar, in the lean-to of an ice house, or in any other farm building where convenient and suitable protection can be provided. If none of these alternatives is possible, the refrigerator may be constructed as an independent building. If built as a separate structure, the same care in the choice of a site should be exercised as in choosing the location of an ice house. The construction is shown in detail in Fig. 88. The essential feature is a well-insulated room containing an ice rack, drip pan, and drain. This refrigerator is 8 by 10 feet and has a floor space 6 by 8 feet available for the storage of produce.

" Such an arrangement will require about 100 tons of ice during the year, but it can be used to hold eggs and butter over the season of abundant production. A supply of fresh meat can be kept by such means in localities where distributing wagons are not run, and even where a local supply is available the producer can arrange to supply his table at wholesale rather than retail prices by killing his own sheep, pigs, or veal. Instances are known where an equipment of this sort has paid for itself in a single season through the advance secured by holding the egg output for only 60 days. Dealers purchase and store eggs while they are most abundant and cheapest and dispose of them during the season of less

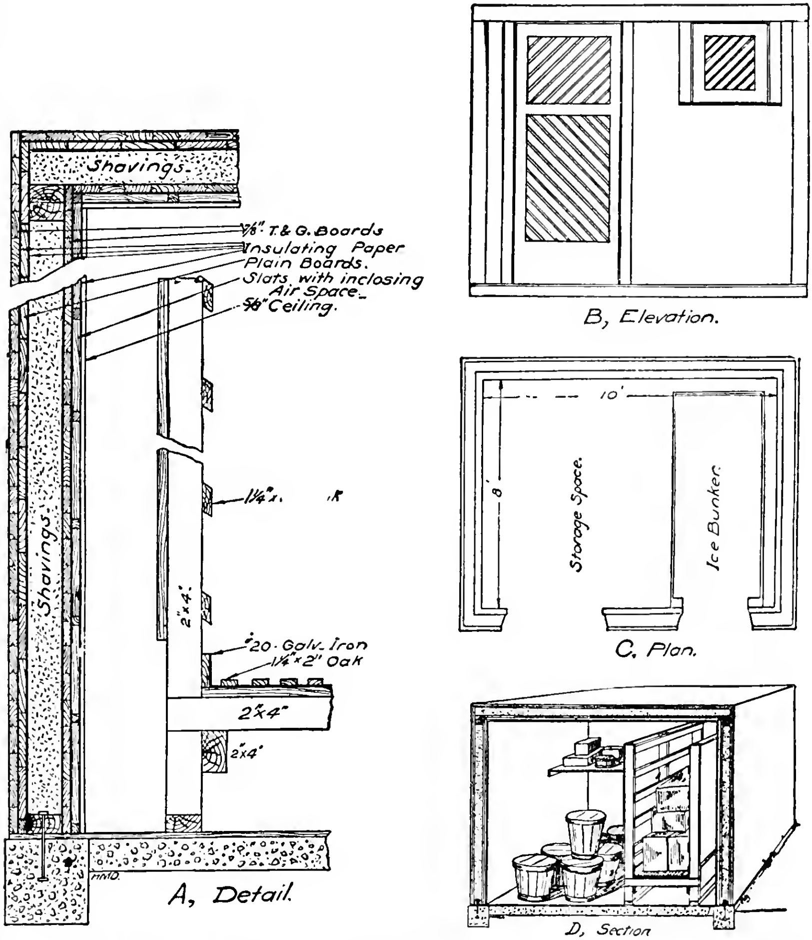


FIG. 88.—*Diagrams showing cross section and details of construction of a farm refrigerator. A, detail of wall construction and ice bunker; B, front elevation; C, floor plan; D, sectional view*

(From Farmers' Bulletin 475, United States Department of Agriculture, Washington, D. C.)

abundant production at an advanced price. A well-constructed and well-handled refrigerator of this kind on the farm will enable the producer to keep this profit at home."

To make an ice box.— Every farm should be equipped with an ice box. A good one may be made at small expense by the "handy man" of the family. Two boxes must be made, one of which should be 12 inches longer, wider, and deeper than the other. If the inner box is 3 feet long, 2 feet wide, and 2 feet deep, the outer box should be 4 feet long, 3 feet wide, and 3 feet deep.

The inner box should be:

a. Made of matched white pine or cypress.
b. Lined with zinc.
c. Provided with a drip pipe in the bottom near one end and a metal grating across the box one foot from the drip-pipe end, to make a cage for holding the ice.
d. Enclosed by two thicknesses of waterproof building-paper tacked around the outside.

The outer box should be:

a. Made of matched lumber.
b. Lined with two thicknesses of waterproof building-paper.
c. Covered on the bottom with six inches of cork dust or dry white pine shavings.
d. Made to connect with the drip pipe provided in the inner box.

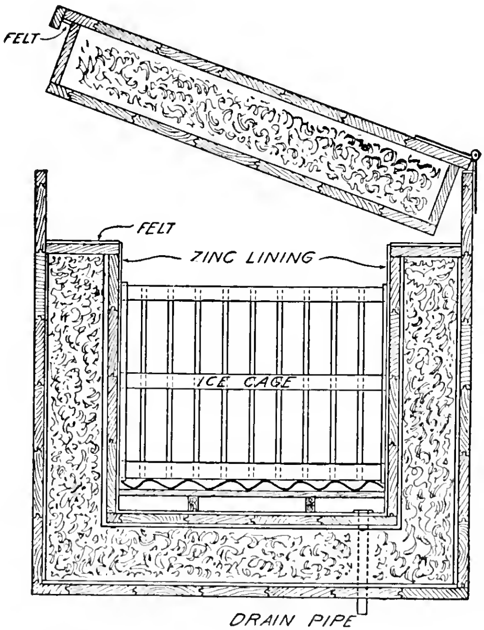


FIG. 89.—*An inexpensive homemade ice box*

To make the ice box, place the smaller box on the layer of insulation so that the drainpipe will pass from the inner to the outer box. Pack the insulating material (cork dust or shavings) tightly in the space between the inner and outer boxes. Fit a board over the packing between the boxes so as to make a tight joint; if possible, zinc should cover the joint. Hinge a thick, well-insulated cover to the outer box and make joints tight with weather strips and felt.

For the cover procure a piece of matched board to cover completely the outer box, and a second piece of matched board to cover completely the inner box plus the layer of packing, allowance being made for sticking of the cover. Put the two boards together, with a layer of insulating material between them.

Cold storage.— Cold storage, where refrigeration is obtained on a large scale, has had a far-reaching influence on the food industry. Fruit production has become a stable and important business only since the development of practical cold-storage methods. Cold storage has led to the increased production of fruits and vegetables in large quantities, because by careful management their distribution may be regulated over a season of nonproduction. The egg and poultry business has received a permanent impetus, now that eggs produced in spring and summer may be stored for six or eight months and remain sound and in good salable condition. Small cold-storage plants on the farm, large cold-storage warehouses, and refrigerator cars for transportation have become a necessity to the present food industry.

While cold storage is an exceedingly valuable way of preserving foods, it is undoubtedly subject to abuse. A low temperature checks the harmful changes produced by ripening processes or bacterial action, but it does not check them either entirely or indefinitely. Gradually, disintegrating changes take place even in those foods most easily kept in cold storage; and if foods are held overlong they are undoubtedly in a condition that makes them unwholesome, if not dangerous, to the consumer.

After foods have been frozen or held in cold storage it is important to remember that even though the foods are in good condition they spoil much more rapidly than do fresh foods; they should therefore not be removed from cold storage nor thawed until they are to be used, and they should then be used quickly.

A series of interesting investigations has been conducted in order to learn how long various foods may be held in storage and remain wholesome. In accordance with results of those investigations laws have come, which regulate the time that food may thus be stored.

Law of New York State governing cold storage.— The following law concerning cold storage in New York State went into effect in the winter of 1911:

" Cold storage is storage of food for more than 30 days at or below 40° F.

" Articles intended for cold storage shall be placed in boxes, barrels, crates strong enough to protect them from injury, unless impracticable because of the character of the goods.

" Each package shall be marked in black or purple ink as follows: Name of storage company and location; second, cold storage; third, received, followed by date when articles were placed in storage.

" The word *delivered* followed by date when articles are taken from storage shall be stamped upon foods or packages before being removed.

" When articles are not contained in packages each article must be marked in plain type not less than three eighths of an inch in height. When tags are used they must be securely fastened to the article. The rooms, furniture, receptacles, and machinery should be kept in sanitary condition, which means away from flies, dust, dirt, insects, or other contamination. Toilet rooms shall be separate and apart from the rooms in which food is stored. Cuspidors must be washed daily with disinfectant solution. The term food as defined in cold-storage law shall include any article except nuts, fruit, cheese, and vegetables used for food by man or animal, and every ingredient of such article.

" It is unlawful for any person to receive any kind of food unless it is in wholesome condition and proved according to the law.

" It is unlawful for any person engaged in cold-storage business to keep in storage any goods for longer than 10 calendar months, excepting butter products which may be kept 12 months.

" The State Commissioner of Health has authority to inspect and supervise all places used for cold storage. He must have free access to all parts of the places at any time for inspection. All persons engaged in cold-storage business shall submit reports to the State Department of Health upon printed forms showing the quantity of food in storage. These reports shall be filed before the 25th day of January, May, and September and show conditions existing upon the first day of the month in which report is filed.

" Transfer of any food from one cold-storage house to another to evade provisions of the law is prohibited.

" The law prohibits the return of food to cold storage when once released to be placed upon the market.

" The law prohibits the sale of food which has been in cold storage without representing it as such.

" The person breaking this law is held guilty of a misdemeanor."

PRESERVATION OF FOOD BY MEANS OF THE REMOVAL OF MOISTURE

When foods are dried until their water content is reduced below 25 to 30 per cent, micro-organisms can no longer develop in them. The knowledge of the fact that dried foods keep well is as old as man; drying was perhaps used earlier than any other method of food preservation. When foods are dried the micro-organisms originally present are not destroyed, but their growth and multiplication are checked. If moisture is supplied, active micro-organism life quickly begins again. The dry yeast-cake is an interesting illustration of the way man at first unconsciously, and later consciously, adapted the principles governing the characteristics of micro-organisms to his own use.

Drying and evaporating fruits are no longer important household processes. The perfection of cans and canning methods, with the ability to secure a product better than the evaporated product, has made it no longer necessary for the housekeeper to depend on dried foods for winter variety. Hence, drying has become a commercial enterprise and we rarely see strings of apples drying before the fire or trays of corn drying in the sun. Dried fruit is an important farm product, however; many farms in New York State own and operate evaporators and send quantities of dried fruit to market.

SUGGESTIVE RECIPES OR METHODS OF PROCEDURE

No effort is made here to give an extended list of recipes, as the canning and preserving of foods is not a matter of following a man-made rule but of adapting scientific principles to processes of food preparation. If the principles are clearly in mind and proper methods of making are followed, nearly all foods may be successfully canned or preserved without recipes. The following recipes are included, therefore, because they illustrate certain principles or because they may be suggestive to the housekeeper. For further recipes the reader is referred to any good cookbook.

Grape juice

The ordinary way of crushing and stewing grapes in order to obtain their juice does not yield a product that does full justice to the grape. A better method is to crush the grapes, add 1 quart of water for each 16 quarts of grapes, and place the kettle containing them over a second kettle containing hot water. The grapes are thus steamed, instead of stewed, until tender; their juice is extracted in the usual way, by pouring the cooked fruit into a jelly bag and allowing it to drip over night. Holding the strained grape juice over night in this way permits it to settle; then the clear top can be poured from the sediment.

The following day the juice is strained into bottles or glass fruit jars, covers and rubbers are adjusted, and the bottles or jars are set on a rack in the boiler or kettle or on the shelf of the steam cooker. If the boiler or kettle is used, cold water is added until it comes up about two inches on the bottle or jar.

The water is then brought gradually to the boiling point and should boil 30 to 60 minutes, according to the size of the jar used. The jars or bottles are then sealed and the juice is ready for storing.

No sugar need be used in making grape juice; it will keep satisfactorily without sugar. If sugar is desired, add it to the juice before pouring it into the container, using $\frac{1}{8}$ to $\frac{1}{4}$ cup of sugar for each quart of juice.

Second-grade grape juice

A second-grade grape juice may be made by returning to the preserving kettle the pulp left after the juice has dripped from it, covering it with water, heating it gradually, and allowing it to simmer slowly for 20 to 30 minutes. Thereafter the method of procedure is that given under "Grape juice."

The second-grade grape juice is strong enough, after a little concentration, to make excellent jelly.

Third- and fourth-grade grape juice

The pulp may be extracted for juice a third and a fourth time. The yield of each successive extraction is smaller and more dilute than the preceding. If the second, third, and fourth extracts are mixed, a very pleasing grape juice results.

Canned fruit juices

The juice of all fruits may be extracted and canned as directed above, the main differences in the process used with various fruits being the amount of water and the length of time needed to extract the juice. Dry fruits, of course, require more water and a longer time of cooking than do juicy fruits. Fruit juices may be canned in the rich fruit-months and made into jelly during the winter months.

Canned baked apples

Wash and core good, sound, tart baking-apples.

Fill cavities with sugar.

Bake until tender in pan containing a little water.

Pack the baked apples into hot sterile jars.

Fill the jars completely full of a sirup made by boiling together 2 minutes, 1 part water and 1 part sugar.

Seal the can.

Canned plums

Prepare fruit and pack in cans as directed in Method I under "Methods of canning," in the preceding lesson of this reading-course.

Without adding water or sirup, steam the fruit in the can until the juice flows.

Drain off the juice and reserve for jelly.

Use some of the cans of steamed plums to fill the others.

Fill completely with sirup and finish the cooking.

This method of canning plums not only gives a jelly product, but modifies the tartness of the fruit.

Mint jelly

The best fruit juice for making mint jelly is the juice of green, slightly unripe apples.

Wash fresh mint leaves thoroughly. To 1 cup mint leaves (packed solid) add 1 cup boiling water, set on back of stove, and let steep 1 hour. Lay a piece of cheesecloth over a bowl, pour the steeped mint leaves into it, twist the ends of the cheesecloth, and press out all moisture.

To 1 cup apple juice add 1 to 2 tablespoons mint juice.

Color green with vegetable coloring matter.

Make as for any fruit jelly.

Orange marmalade

12 thin-skinned oranges
3 lemons

Wash and slice as thin as paper or grind fine.

For every quart of fruit add 1½ quart of water and let stand over night.

In the morning cook slowly until tender, about 2 to 2½ hours.

Measure cooked fruit and add equal amount of sugar.

Cook until mixture jellies from a spoon, about 30 to 60 minutes.

Grapefruit marmalade

Wash thoroughly, remove seeds, and run through a chopper.

Barely cover with water and let stand over night.

In the morning, boil 30 minutes and let stand over night.

On the third morning boil 30 to 40 minutes or until the white part of the fruit is very tender.

Measure the fruit, add an equal quantity of sugar, and boil until the mixture jellies from the spoon, about 30 to 60 minutes. Pour into hot sterilized glasses or small jars and cover with paraffin.

The reason for such extended preparation previous to cooking the fruit with sugar, is to soften the white of the fruit and extract from it the jelly-making substance.

Grape conserve

3 lbs. seeded grapes
3 lbs. sugar
1 lb. English walnuts, broken into small pieces

Mix and cook together as for jam.

Mincemeat

4 lbs. raisins
4 lbs. apples, chopped
½ fresh ox tongue, boiled and chopped
½ lb. candied orange peel, cut fine
4 lbs. currants
2 lbs. suet
½ lb. candied lemon peel
¼ lb. citron
Juice of 3 oranges and 3 lemons
Grated rind of 2 lemons
½ lb. moist sugar
1 nutmeg, grated
1 teaspoon cinnamon
1½ qts. cider
1 tablespoon salt

Add more cider to the mixture when making the pies. Cook slowly 1 hour, pour into sterilized jars, and seal.

Sun preserves

I. Fruits that lend themselves especially well to this method of preservation are strawberries, cherries, white currants, and raspberries.

1 lb. fresh fruit
1 lb. sugar

Put a layer of fruit in the bottom of a preserving kettle and add 1 or 2 tablespoons of water.

Alternate the layers of sugar and fruit.

Heat carefully until the sugar is melted, avoiding if possible the breaking up or crushing of the fruit.

Boil 5 to 7 minutes, then pour the mixture in thin layers onto large platters and set in the sun for a day.

The mixture should thicken or jelly on the platter.

After the mixture has cooled and thickened, transfer it from the platter to sterilized jars and seal or cover with paraffin.

II. Fruits that lend themselves especially well to this method of preserving are peaches, apricots, raspberries, and plums.

Carefully wipe or pick over fruit to be preserved.

Cut peaches, plums, or apricots in half and remove the pit.

Spread fruit on racks or boards and set in the sun to dry for 1 or 2 days. The fruit should not be left out over night to gather moisture.

1 lb. brown sugar (white sugar may be used if preferred)
1 lb. fruit

Pack alternate layers of fruit and sugar in jars, being careful to have the top layer of sugar.

The sugar will dissolve gradually and form a thick, rich sirup around the fruit. The mixture should be kept covered, but need not be sealed.

Strawberries preserved in cranberry juice

If strawberries are canned or preserved in a sirup made with cranberry juice instead of with water, they retain much of their natural flavor and the product has the color of fresh strawberries.

Pickles

It is the custom with vegetables such as tomatoes and cucumbers to soak them in brine before putting them through the regular pickling process. The brine is probably used because it withdraws moisture from the tissue of the vegetable and makes it possible to obtain a firmer result, renders a milder flavor, gives the desired salt taste, and adds to the keeping quality of the pickle.

The strength of brine required depends on the length of time the vegetable to be pickled is to remain in the brine.

Too strong a brine softens and spoils the vegetable.

To make brine.— To 1 quart water add $\frac{1}{3}$ to $\frac{1}{2}$ cup salt. The brine should be strong enough to float a fresh egg.

To keep pickles green.— Grape leaves and cabbage leaves are said to help in retaining the natural green color of cucumbers and unripe tomatoes. The bottom and sides of the kettle are lined with leaves, the kettle is then filled with the mixture to be pickled, and a layer of leaves is added to cover the top of the mixture. The mixture is then brought slowly to the boiling point. The practice of "greening" vegetables by cooking them in copper kettles is a dangerous one. If copper is used at all it must be with the utmost care and the utensil must be scrupulously clean.

Vinegar mixtures for pickles.—

I. To each quart of vinegar add

- $1\frac{1}{2}$ teaspoon whole black peppers
- $1\frac{1}{2}$ teaspoon celery seed
- $1\frac{1}{2}$ teaspoon allspice
- 1 tablespoon sugar
- $\frac{3}{4}$ teaspoon whole cloves
- $\frac{3}{4}$ teaspoon mustard seed
- $1\frac{1}{2}$ tablespoon cinnamon bark
- $\frac{3}{4}$ teaspoon grated horse-radish

II. To each quart of vinegar add

- $\frac{1}{2}$ ounce ginger
- 1 teaspoon mace
- 1 ounce small onions
- $\frac{1}{3}$ ounce mustard seed

If pickles have not been soaked in brine use 2 ounces of salt

Cucumber pickles.—

Soak cucumbers in brine 24 hours. Rinse and drain.

Cover pickles with vinegar or vinegar mixture to which has been added 1 tablespoon of brown sugar for each quart of vinegar.

Bring slowly to boiling point.

Pack pickles in jar, cover with vinegar.

Sweet cucumber pickles.—

Soak cucumbers in brine for 24 hours. Rinse, drain, and wipe dry.

Place in kettle and cover with the following vinegar mixture:

To each quart of vinegar add

1 cup sugar	6 blades mace
8 whole cloves	8 whole black peppers
6 allspice	

Heat slowly to boiling point. Pack at once.

Quick pickles.—

Put pickles in strong brine (½ to ¾ cup salt to 1 quart water).

Bring slowly to boiling point. Simmer 5 minutes. Drain.

Cover pickles with cold water. Change water as it gets warm. Keep changing water until pickles are crisp and cold.

Make as for other pickles.

Very hot chutney

¼ lb. garlic	½ lb. salt
½ lb. onions	1 lb. sugar
½ lb. raisins	½ oz. cayenne
13 large sour apples	3 pts. vinegar
13 ripe tomatoes	¼ lb. mustard

Chop garlic, onions, and raisins together.

Boil vinegar until reduced one half.

Chop apples and tomatoes, and boil in vinegar until soft.

Mix all ingredients except mustard and boil until thick—about two to three hours; adding mustard just before the boiling is finished.

Pour into hot sterile jars and seal.

Mustard pickle

2 qts. cucumbers	2 qts. cauliflower
2 qts. green tomatoes	2 qts. small onions

Cut up ingredients and scald in salt and water (1 quart water to ¼ cup salt), then drain well.

½ lb. mustard
½ cup flour
2 qts. good vinegar
6 cups brown sugar
1 green pepper, cut fine

Mix mustard, flour, sugar, and pepper, and boil in vinegar 10 minutes. Pour over chopped pickles while boiling hot.

Pepper relish

12 red peppers
12 green peppers
12 onions

Chop all and mix. Cover with boiling water and let stand 5 minutes. Drain.

Add 1 pint vinegar, 2 cups sugar, 3 tablespoons salt.

Boil 5 minutes and put in sterile cans.

Tomato preserves

1 pk. tomatoes, chopped
6 lbs. sugar
4 or 6 lemons

Cook until thick.

Chili sauce

12 large tomatoes, chopped
2 medium onions, chopped fine
3 green peppers, chopped fine
2 tablespoons salt
3 cups vinegar
1 tablespoon mustard
1 teaspoon cinnamon
1 teaspoon nutmeg
2 tablespoons sugar

Cook until of right consistency (about 1½ hour). Bottle.

Good cider vinegar

The following directions are quoted from Bulletin 258, New York Agricultural Experiment Station, Geneva, N. Y., "Making Cider Vinegar at Home":

"Briefly summarized, the method to be employed for the manufacture of good vinegar at home, without the use of generators, is this: Use sound, ripe apples, picked, or picked up before they have become dirty if possible, otherwise washed. Observe the ordinary precautions to secure cleanliness in grinding and pressing, and discard all juice from second pressings.

"If possible let the juice stand in some large receptacle for a few days to settle, then draw off the clear portion into well-cleaned barrels which have been treated with steam or boiling water, filling them only two thirds or three fourths full. Leave the bung out, but put in a loose plug of cotton to decrease evaporation and to prevent the entrance of dirt. If these barrels are stored in ordinary cellars, where the temperature does not go below 50 or 45° F., the alcoholic fermentation will be complete in about six months; but by having the storage room at a temperature of 65 or 70° the time can be considerably shortened, and the addition of Fleischmann's compressed yeast or its equivalent at the rate of one cake to five gallons of juice may reduce the time to three months or less. Use a little water to thoroughly disintegrate the yeast cake before adding it to the juice. The temperature should not go above 70° for any length of time, to avoid loss of the alcohol by evaporation.

"After the sugar has all disappeared from the juice, that is, when the cider has entirely ceased 'working' as revealed by the absence of gas bubbles, draw off the clear portion of the cider, rinse out the barrel, replace the liquid and add two to four quarts of good vinegar containing some 'mother,' and place at a temperature of 65 to 75° F. The acetic fermentation may be complete in three months or may take 18 months according to the conditions under which it is carried on; or if stored in cool cellars may take two years or more. If the alcoholic fermentation be carried on in the cool cellar and the barrel then be taken to a warmer place, as outdoors during the summer, the time of vinegar formation may be reduced from that given above to 15 or 18 months. Where the alcoholic fermentation is hastened by warm temperature storage and the use of yeast and the acetic fermentation favored by warmth and a good vinegar 'start,' it is possible to produce good merchantable vinegar in casks in 6 to 12 months.

"When the acetic fermentation has gone far enough to produce 4.5 to 5 per cent of acetic acid, the barrels should be made as full as possible and tightly corked in order to prevent destructive changes and consequent deterioration of the vinegar."

FOOD PRESERVATION

(Outline for club study)

Reasons for the spoiling of food

Methods of retarding or preventing the spoiling of food

- 1 Packing methods
    - a Trenching vegetables
    - b Packing fruit in paper

- 2 Low temperature maintained by
  - a Cold storage
  - b Use of refrigerators
  - c Ice houses
  - d Cellars
  - e Cold water
- 3 High temperature: canned food
- 4 Removal of moisture
  - a Drying
  - b Evaporating
- 5 Use of preserving substances
  - a Harmful
    - (1) Borax and boracic acid
    - (2) Salicylic acid and the salicylates
    - (3) Benzoic acid and the benzoates
    - (4) Formaldehyde
    - (5) Sulfur and the sulfates
    - (6) Copper
  - b Harmless
    - (1) Sugar
    - (2) Salt
    - (3) Vinegar
    - (4) Some spices
  - c Doubtful
    - (1) Saltpeter
    - (2) Smoke

Full discussion of reasons for each of the methods named, their effectiveness, and conditions indicating their use

Laws governing the use of preservatives and government reports concerning the preservatives

Canned food

- 1 Underlying principle of canning foods
- 2 Methods of canning foods
  - a By use of hot water bath
    - (1) On the stove
      - Single process
      - Intermittent process
    - (2) In the oven
    - (3) In the fireless cooker, or a modification of it
  - b Stewing
  - c Baking
  - d The autoclave

3 Reasons for intermittent process in canning vegetables
4 Types of cans best for household use
5 Amounts of sugar or salt, water, etc., to use and best method to follow in canning typical foods such as peaches, pears, plums, strawberries, tomatoes, beets, carrots, corn, beans, cherries, meat, asparagus
6 Are recipes necessary in canning fruit if the principle of canning is understood?
7 Causes for spoiling or deterioration of canned foods
8 Discussion of the cost of home-canned food as compared with the cost of the commercial product
9 Discussion: May fruits and vegetables be canned profitably on a commercial scale in the home or on the farm?
    a What is the cost of an outfit?
    b Where is a market for home-canned goods?
    c Should such canning be done in glass?
10 The effect of foods on the tin cans containing them, and the effect of tin salts on health

Preserving foods
1 Food preserved in sugar
    a Methods of making preserves, marmalades, and jams
    b Reasons for their keeping
2 Use of vinegar
3 Smoking, salting, and pickling foods
4 Discussion of home-dried foods
5 Use of water glass for preserving eggs

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 19 — ITHACA, N. Y. JULY 1, 1912 — FOOD SERIES No. 5

THE PRESERVATION OF FOOD IN THE HOME.—PART II

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist in your study of scientific home-making. We want your assistance as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the Home Economics Department in its efforts for scientific housekeeping.

Will you please send your opinions on the following points to the Supervisor of the Cornell Reading-Course for the Farm Home?

1. What is your experience as to the best way to keep food at a low temperature?

2. Is there a recipe for preservation of food which you have not been able to procure?

3. Have you a method or a recipe for food preservation not given in the bulletin, which you will send to The Cornell Reading-Course for the Farm Home?

Name. . . . .

Address. . . . .

Date. . . . .

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL 1. No. 21 | ITHACA, N. Y. AUGUST 1, 1912 | FOOD SERIES No. 6

THE PRESERVATION OF FOOD IN THE HOME.—PART III

The preservation of food in the home has an important bearing on the cost of living. The city housekeeper who lives in an apartment, or in a small house with furnace-heated cellar and little yard area, through

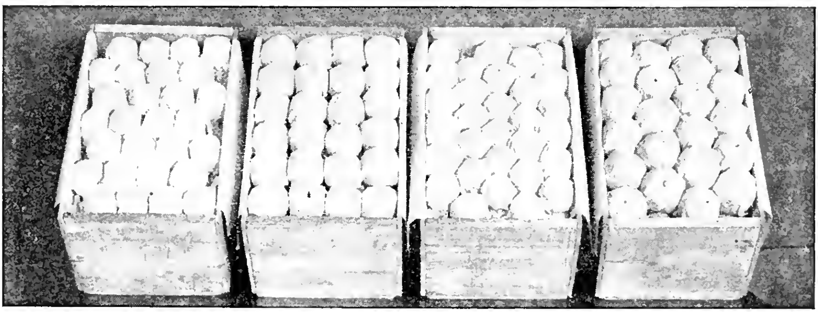


FIG. 90.—*Apples packed for winter use*

lack of space or right conditions for storage meets a really serious problem in buying and storing food in economically large quantities. She depends on the commercial warehouse to store her supplies and she pays the middleman—butcher or grocer—to handle them and to deliver them to her. For fresh fruits and vegetables, for eggs and butter that have been thus held over from summer's abundant supply, she must pay winter prices.

The housekeeper who lives in the small town or in the country has not the convenience of the city market nor the variety afforded by it; but she has instead an excellent opportunity of furnishing an economical, reasonably varied, and wholesome winter dietary by careful storage, in time of plenty, of such fresh foods as lend themselves to this method of preservation. It may mean reorganization of the cellar, the addition to the commissary department of a few inexpensive containers, racks, shelves, bins, or some digging in the garden — all processes that are simple and easy to accomplish. When we realize the gain in health and efficiency of having a liberal quantity of fresh fruits, vegetables, and eggs in the dietary, any trouble-cost in making storage conditions right is liberally repaid.

In spring and summer eggs may be " put down " in sufficient quantity to serve until the season of plenty returns. The winter vegetables, cabbage, onions, turnips, carrots, parsnips, beets — all of them wholesome foods — may be buried or trenched or stored away, and then brought out for nearly every meal during the cold months when the tendency is often so strong to serve meals that lack succulent foods. Fruits should be given special consideration, and liberal quantities of apples should be stored so carefully that far into spring a housekeeper can proudly boast that the last apples are just going and are still in excellent condition. She will probably add that the family has been well all winter, for is it not said that " an apple a day will keep the doctor away "? Thus, with the apple, and the onion a day which " keeps every one away," the family has secured health and blessed solitude.

PRESERVATION OF EGGS

EARL W. BENJAMIN

Eggs form an essential element of our food supply. As the result of a search through some of the best modern cookbooks, the writer found that eggs are included in over 80 per cent of the baking and cooking recipes, not including recipes for preparing fish or other flesh. Eggs are required in a larger number of recipes than is milk. This does not mean, however, that the consumption of eggs is greater than that of milk; on the contrary, the use of milk and cream for drinking purposes, with cereals, and the like, makes its total consumption considerably greater than that of eggs. Eggs sometimes constitute the entire diet, especially in the case of invalids. There are listed over thirty ways in which eggs may be served, and this gives them a place in nearly every person's diet and insures their demand by almost every household.

The price of eggs probably fluctuates more during the year than does that of any other stock product. The fact that eggs are a perishable product places them in a class with milk. The latter, however, is supplied much more steadily throughout the year than eggs can be. This regularity in the milk supply has been brought about gradually by the development of winter herds, thus offsetting the natural increase in milk production that occurs during the summer. The poultrymen have been trying to accomplish a like result with their flocks, but as yet no radical change has been effected in the hen's natural period of heaviest production.

Of course, during that season of the year when the egg production is greatest—that is, during the months of March, April, and May—the price of eggs is at the lowest point, 20 to 25 cents a dozen wholesale; during November, December, and January, when few eggs are produced, the price reaches its highest point, 50 to 60 cents a dozen wholesale. Manifestly, some method of equalizing the market must be found.

COLD STORAGE FOR EGGS

The practice of placing eggs in cold storage has been developed rapidly during the last few years and has proved itself beneficial to a limited extent in aiding in the equalization of prices. Now that cold storage methods are being scientifically studied and controlled, commercial cold storage is beginning to fill a great need in our market egg business. By means of cold storage the price of eggs is held a little higher during the spring months when eggs are cheapest; and during the winter, city people of moderate means are able to buy eggs of good quality at a greatly reduced price. The management of cold storage plants naturally lies in the hands of the capitalists, because a large investment is required for the installation of necessary machinery and expensive insulation.

HOME PRESERVATION OF EGGS

As a matter of safety as well as of economy, it is very desirable for the household to obtain a surplus of eggs during the season when they are of good quality and plentiful, place them in some good homemade preservative, and have them for use during the winter months. Many methods of preservation have been tried, especially in recent years—that is, since about 1898. Some of those methods are: packing eggs in dry table salt, bran, oats, or sawdust; preserving them in dry wood ashes, powdered sulfur, potassium permanganate, powdered gypsum, salt brine, slaked lime and salt brine, salicylic acid, limewater, various solutions of water glass, gum arabic and formalin, or gum arabic and salicylic acid; dipping in sulfuric acid and sealing up in glass cans; covering with vaseline, paraffin, patented preparations, butter, or lard. Of all these methods of preservation, the limewater and salt brine and the water-glass solution seem to give the best results. The water glass gives the better results of the two, because of the chalky taste that can be detected in eggs preserved in limewater and salt brine.

Limewater and salt brine preservative

Slake four pounds of good quicklime in a small amount of water, then mix with four gallons of pure water and add two pounds of salt. Stir the mixture thoroughly several times, then allow it to settle. Pour off the clear liquid. The clear liquid is the part in which the eggs are to be preserved. There is about enough of this mixture to preserve 30 dozen eggs, the number depending somewhat on the shape of the vessel.

Water-glass solution

The commercial water-glass solution may be obtained from any drug store at a cost of about 20 cents a quart. Mix $1\frac{1}{2}$ quart of this solution with 18 quarts of pure water; water that has been boiled is preferable. Stir the mixture until the ingredients are thoroughly mixed. A stone jar is the most suitable vessel for the mixture. Two eight-gallon jars are sufficient for 30 dozen eggs, using the amount of solution prescribed above. After the water glass is thoroughly mixed, pour it into the different vessels to be used, being sure that the vessels are absolutely clean. Place the eggs in the water glass, see that those at the top are covered by at least two inches of the liquid, and cover the jars in order to prevent evaporation. Put the jars in a cool place where they will be undisturbed during the year.

Suggestions

Preserve only absolutely fresh eggs; stale eggs will not keep in any preservative. Have your preservative ready to receive the fresh eggs as you get them. If you are in doubt as to the freshness of the eggs, candle them, or see whether they sink when placed in a dish of fresh water. If an egg sinks, it is reasonably fresh.

Do not preserve dirty eggs or eggs that have been washed. Washed eggs will not keep because the shell has been moistened; and dirty eggs will become tainted in flavor.

Do not use the same liquid preservative more than one year.

Spring eggs will keep better than summer or fall eggs.

Infertile eggs are better than fertile eggs for preserving.

Do not leave eggs in the preservative longer than one year.

Rinse the eggs with water, after removing them from the preservative.

Eggs that are in good condition when removed from water-glass solution will usually remain good for at least two weeks.

Water-glass eggs are practically as good as fresh eggs for all cooking purposes. If it is desired to boil them, prick a small hole through the large end of the shell before placing them in the water. The pores of the shell have been sealed by the water-glass solution, and without the pinhole the expanding air within the shell would burst it.

SUGGESTIONS FOR KEEPING FRUIT IN THE CELLAR

CHARLES S. WILSON

A supply of good fruit is produced on most farms. This fruit is enjoyed in the fall when it is fresh, and usually an amount sufficient for winter is stored in the cellar. In some cases it keeps satisfactorily, and often one or two varieties are in good condition when consumed in the spring. In many cases, however, the fruit does not keep well; it either shrivels or becomes spongy and decays. The fault, which often lies in the storage room, may be corrected wholly or in part. A few suggestions about the construction and care of the cellar and the keeping of the fruit may be helpful here.

CONSTRUCTION OF THE CELLAR

Although each cellar differs more or less from every other, the principles of its proper construction are the same. A knowledge of those principles, therefore, will enable one to work out the details in almost every case. There are three important factors to consider: (a) ventilation, (b) temperature, (c) humidity.

Ventilation

A fruit cellar should be well ventilated. That principle of physics to the effect that warm air rises and cool air settles, is applicable here. It means that warm air should be permitted to pass out at the top of the room through ventilators, and that cool air from outside should be admitted to the room at the bottom. When the storage room is a cellar, this can be accomplished by means of a shaft leading from a window down the wall and opening near the floor.

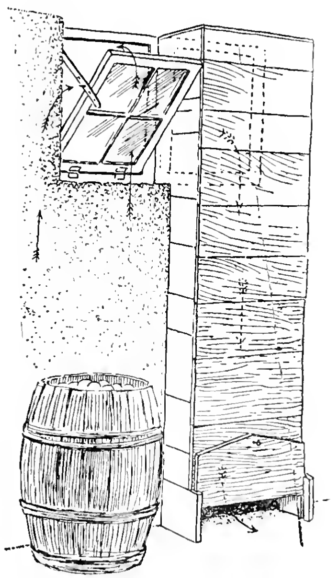


FIG. 91.—*Cellar ventilation*

A few windows at the top of the wall constitute the system of ventilation for most farm cellars. Although this arrangement is accepted as sufficient and in many cases gives fairly good satisfaction, the temperature cannot be kept so nearly uniform and correct as when intake shafts are used.

Temperature

Two points must be considered under this heading: (a) correct temperature, (b) uniform temperature.

Correct temperature.— The best temperature for fruit is considered to be about 33° F., or a little above. It will differ somewhat with the fruit and also with the variety. Generally, fruits and varieties that mature quickly and are the most perishable keep better at a temperature higher than 33° F., whereas the less perishable fruits are held at a temperature lower than 33° F. Professor F. A. Waugh* gives the temperatures for different fruits as follows:

APPROXIMATE TEMPERATURES FOR STORING FRUITS

Fruit	Degrees Fahrenheit
Apples, summer	36–42
Apples, winter	32–35
Pears, summer	36–44
Pears, winter	33–38
Peaches	36–38
Plums	36–42
Cherries	38–40
Grapes	32–36
Strawberries	36–44

Even though it is impossible to regulate the temperature of a farm cellar to definite degrees as thus given, the table may be helpful in approximating the correct temperature.

Uniform temperature.— Equally as important as a correct temperature is uniformity of temperature. The temperature should not be permitted to fluctuate. Fruit that is kept at 34° F. during the night and at 60° F. during the day will soon decay. A temperature of 50° F. that is uniform will keep fruit in good condition for months. In the farm cellar uniformity of temperature is maintained by means of the ventilation, which should be watched very closely.

Humidity

A high percentage of humidity is desirable. The exact percentage that is best has not been definitely determined; our present knowledge of the subject indicates that it is as high as 90 or 95. In a cellar that is too dry the fruit gives off much carbon dioxid and water, and as a result becomes shriveled and spongy. This condition occurs in a much less degree when the humidity is higher. When considerable fruit is kept in a cellar for a long time, it should be the aim of the farmer to maintain a high percentage of humidity. A cellar with a dirt floor is much better in this respect than one in which the floor is sealed with cement.

* "Fruit Harvesting, Storing, Marketing," by F. A. Waugh, p. 111.

TREATMENT OF THE FRUIT

The fruit should receive some attention when put in the cellar. It is understood, of course, that the fruit should be picked carefully and without bruising, and there should be little delay between the time of picking and the time of storing. The fruit may be packed in barrels or boxes, or placed in open trays. When open trays are used and it is desired to keep the fruit particularly fine, the specimens should not be allowed to touch one another. In the case of apples that are to be kept for a considerable time, whether exposed or in packages, it is best to wrap each specimen. Light manila wrappers, 10 by 10 inches, may be used for this purpose.

Examination of the principles discussed above shows that the apple should be kept cool and moist. In cellars where it is impossible to control the temperature and humidity as desired, the proper conditions may be obtained by packing the fruit in some medium. Apples, for example, may be packed in moist sand in boxes. The moisture of the sand prevents serious evaporation, which keeps the fruit firm and crisp. Another practice of a similar nature is to pack the apples in layers of leaves in boxes or barrels. The leaves, which may be taken from the tree at the time of picking, supply the moisture.

Favorable conditions of moisture and temperature are secured by burying the fruit in pits. This method is described by Director Bailey * as follows:

"Many apples, particularly russets and other firm varieties, keep well when buried after the manner of pitting potatoes. Sometimes, however, they taste of the earth. This may be prevented by setting a ridge-pole over the pile of apples in forked sticks, and making a roof of boards in such a way that there will be an air space over the fruit. Then cover the boards with straw and earth. Apples seldom keep well after removal from a pit in spring."

PRESERVATION OF VEGETABLES

PAUL WORK

One who does not store vegetables for winter use fails to realize the full return from the home garden. Storage requirements for different vegetables vary widely. Some vegetables are easily kept. Merely leave the parsnip in the ground, and oncoming spring will find it not only well preserved but actually improved in quality. On the other hand, the sweet potato and the squash are kept successfully only when the temperature is high and constant and the humidity is low.

* "The Farm and Garden Rule-Book," by L. H. Bailey, p. 142.

Certain fundamental principles apply to the storage of all sorts of vegetables under a variety of conditions. The important factors to consider are temperature, moisture, and ventilation. A temperature too high favors decomposition; if it is too low, freezing occurs, with the subsequent breaking down of vegetable tissue. A dry atmosphere results in drying out and shriveling of fruits and vegetables; while undue moisture, especially when combined with high temperature, favors the growth of destructive fungous and mold organisms on them. Ventilation is not only a means of regulating these conditions, but it is also important in itself in removing gaseous products that may be more or less injurious.

No factor is more potent in favoring successful storage than proper condition of the produce when it is stored. A reasonable degree of maturity is necessary, but overripeness is to be avoided, as it favors early decay. Ripening processes continue, though slowly, after storage, and due allowances must be made for these in determining the maturity of the vegetable to be stored.

Only the very finest specimens should be selected — those that are firm and of good size and shape. It is at injured spots that decay begins, and even bruises that can be found only by careful examination are serious: hence the necessity for the greatest care in selecting and handling the material that is to be stored.

There are wide differences among varieties of vegetables in their adaptability to storage. In general, the late-maturing sorts are the most suitable.

STORAGE IN THE HOUSE CELLAR

Many methods of providing the conditions necessary for successful storage have been devised. The first place to suggest itself is the basement of house, barn, or outbuilding. The house cellar may be open to serious objection; it is likely to be too warm and dry, particularly if the house is heated by a furnace. It is likewise undesirable to have a large amount of vegetable matter beneath the dwelling. However, in a measure these objections may be overcome. Small quantities of fruits or vegetables may be stored in a corner of the cellar away from the furnace, and may be protected from drying out by moss or by soil, preferably of sandy type. If a large quantity is to be kept, a separate compartment may be boarded off by a double partition, the space between the partition walls being filled with some nonconducting material. This compartment should be ceiled, and should be provided with ventilating openings or flues so that it may be quite independent of the rest of the house. Vents should be arranged at both ceiling and floor. Remembering that warm air rises and cold air falls, it is possible to control the temperature by means of these vents. While the weather remains warm in the fall, the flues are closed by day and opened by night. When the weather becomes more severe, the plan is reversed, the warmer air of midday being admitted.

STORAGE IN THE SPECIAL PIT

Special cellars and pits for storage of vegetables may be constructed at small cost and are very satisfactory. A simple type is shown in Fig. 92. A pit one or two feet deep is dug in a well-drained spot and a foundation wall of stakes and boards, or, better, of concrete, is built around it. On this wall rafters are erected for the support of roof

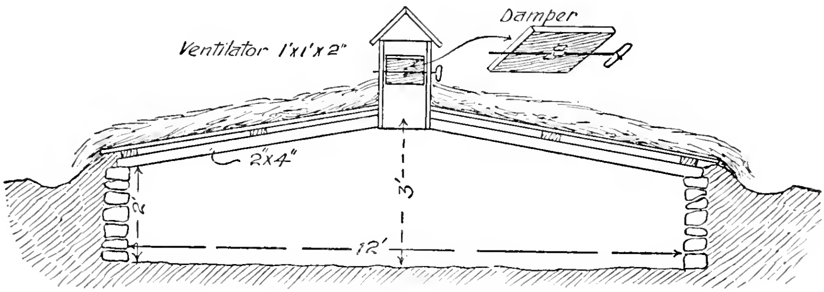


FIG. 92.—*The storage pit*

boards, care being taken not to have too steep a roof. The roof is covered with soil and sod, or with straw and a light covering of earth, or with manure. Such a pit will last several years, especially if a rot-resistant wood, as the so-called "pecky" cypress, be used in its construction. With the specific directions that are furnished by cement manufacturers, concrete work is within range of any handy man and a permanent concrete cave or pit may be built with little expense and trouble. No matter what the form of construction, be sure to provide one or two small ventilators at the top of the cave, and one at the bottom of the door. These should be arranged to open and close at will.

STORAGE BY BURYING

Burying is one of the easiest, as well as one of the most successful, methods of storing vegetables. It keeps the produce in good condition and involves no expense. The method is open to the objection that it is often difficult or impossible to remove the contents at certain times during the winter. However, a considerable quantity may be taken out at once and kept in the house cellar for a week or two. Choose a bit of ground, preferably sandy, that is well drained and well protected from surface wash. Make an oblong pit of the required size, about a foot deep. Line the bottom of the pit with straw and carefully place the vegetables in a heap on the straw, apply a layer of leaves and straw to protect the vegetables and to make their removal easier, then add soil to a depth of four to eight inches. A wisp of straw may be set at intervals in the peak for ventilation. Great care must be taken early in the season not to cover the vegetables too closely, as speedy decay will result from heating and sweating. As the weather becomes severe, manure may be piled on to give additional protection.

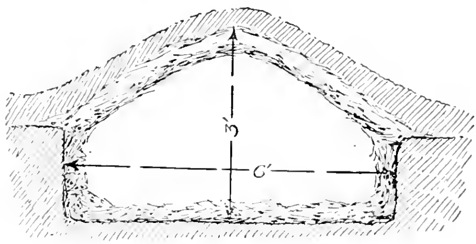


FIG. 93.—*The storage trench*

When several vegetables are to be stored, or when they are to be removed at different times during the winter, it is well to make the pit very long and narrow. Earth partitions may then be built in as the work progresses. The different compartments may be marked with stakes. One compartment can be opened without disturbing the others.

TREATMENT OF MATERIAL

Several of our best storage crops require special treatment and special precautions in their storage. The root crops are very simple in their requirements. Tops should be removed, and the crops may be stored by any of the general methods described.

Cabbage also may be handled by any of the plans described. Cabbage heads should not be overmature and should remain in the garden as long as there is no serious danger of severe freezing. For storage they should be cut near the ground, with most of the leaves about them. When a quantity of cabbage is to be stored, the trench may be made by throwing furrows on both sides and finishing with the shovel. The heads are then laid in order, perhaps two or three wide and two deep. The plow may be used to begin the covering, but the work should be completed by hand. If the heads are not mature at storing time, lift them, with the roots, and place them in a trench, roots down, as close as they will stand. Pack a little sand about them as the work goes on. In this way they will continue growth and become thoroughly solid. Danish Ball Head is best for winter storage under most New York conditions.

Celery should be lifted entire and set erect in trenches or pits, bringing loose soil about the roots. In storing this crop, great care must be taken to avoid covering too heavily at first. Giant Pascal and Winter Queen are good sorts for winter use.

Squash requires a warm place for storage. A temperature of 50° F. or more is good. Shelves or bins in a house or dry cellar are preferable to burying for storing squash.

THE KEEPING OF MEATS*

ANDREW BOSS

(*University of Minnesota*)

While it is almost impossible to get the best conditions for handling meat on the farm, a knowledge of the best principles may aid in getting a better quality of meat. It is very important that the carcasses be cooled soon after slaughtering, and yet that they be not allowed to freeze. While the temperature cannot well be controlled on the farm, it is possible to slaughter when the weather is favorable to the proper cooling of the carcass. If during the winter season, choose a day when there is a prospect for cooling the carcass before the surface freezes. The most desirable temperature for cooling meat is 34° to 40° F., and an approach to these temperatures will give good results.

In summer seasons it is best to dress the animal in the evening, leaving the carcass in the open air over night and carrying it to a cool, dark cellar before the flies are out in the morning. Very often a cool room in the barn can be used for the purpose if made dark. There should be no fresh paint, tar, kerosene, or like substance around, however, as freshly killed meat absorbs such flavors readily. Cooling is often hastened by splitting the carcasses into halves or even into small pieces. It is best, however, not to divide the carcass until the meat is firmly set unless absolutely necessary to prevent it from souring. Stripping out the leaf lard materially aids in quickly cooling the hog carcass. For the best results in cooling meat, the air should be dry, as well as of a low temperature; and free circulation aids greatly in carrying away foul odors and mold spores.

It is also important that flies and insects be kept away from the meat. If it is flyblown, maggots will soon appear and it will be very difficult to save the meat.

KEEPING FRESH MEAT

Cold storage

Meat used while fresh is more nutritious and palatable than salted or cured meats. It is therefore desirable to use as much of it uncured as possible. It is very difficult to keep meat fresh during the summer months without the use of ice, and even then but little can

* The material on the keeping of meats is from Farmers' Bulletin 183, United States Department of Agriculture, and is here printed by courtesy of the Department and of the author.

be handled at one time on the ordinary farm. Where a room or a family refrigerator can be kept at a temperature of 40° or less, with good ventilation and circulation of air, fresh meat can be kept for a week or ten days. It is very important that the circulation be free and the air dry. Moisture in a refrigerator tends to develop wet mold or slime, and a little decay soon contaminates the whole piece. Less difficulty will be experienced in keeping fresh meat if it is kept in a room where the temperature is high and the air dry than where the temperature is low and the air damp.

Where an ice house is filled each year a small portion of it may be partitioned off as a cold-storage room. With the ice properly packed on three sides of it, and with good drainage, this makes a very satisfactory place for keeping meat, and it may also be used for storing butter and other perishable products.

In the North, meat is kept during the cold season by freezing. A carcass is cut up into quarters, or even smaller pieces, and hung in an outbuilding, where it will remain frozen solid. When a portion is wanted it may be cut off with a saw. If the meat is taken into a cold room and slowly thawed out the flavor is only slightly injured. No more should be taken in at one time than is wanted for immediate use. Repeated freezing and thawing are injurious to the flavor and quality of the meat; hence the importance of keeping it where the temperature will remain sufficiently low to prevent thawing.

Insects should not be allowed to get at the meat. For this reason a dark, cool cellar is the best place for keeping fresh meat on the farm. The cellar should be clean and free from odors or the meat will become tainted.

Snow packing

Freezing the pieces and packing them in snow is a better way of keeping meat than freezing the carcass and thawing to remove a portion as wanted. The carcass should be cut into steaks, roasts, and boiling meat. All trimming for table use should be done before allowing the meat to freeze. Lay each piece out to freeze separately, where it will not come in contact with other meat. Secure a box large enough to hold it all and put a layer of dry snow at the bottom. When the meat is frozen put in a layer, packing it so that no two pieces touch. Cover this with a layer of snow and lay alternate layers of snow and meat until the box is filled. Set the box in an outside shed where it will not be subject to sudden changes of temperature. For convenience in getting the meat when wanted it is well to pack the steaks in one section or end of the box and the roasts and stews in another. It will not then be necessary to disturb anything but the piece desired when a supply is needed. Use only dry snow in packing, be sure the meat is frozen solid, and it can then be kept through the winter unless there is a very warm spell. This method is applicable only to localities where snow and continued dry cold weather prevail during the winter months.

Cooking

Partial cooking and packing in jars is also resorted to as a means of preserving meat in some localities. This method is applicable to a larger territory than either of the methods already given. It will be the most satisfactory in the keeping of fresh pork in any instance. Slice the loin and side meat or any portion of the carcass desired and fry until a little more than half done. Pack the slices as closely as possible in a stone jar and cover with hot lard. As the meat is wanted for use it may be removed from the jar and warmed up. If the jar is to stand for any length of time after it has been opened without using from it, it will be best to cover the top over again with lard. It is better to use several small jars than one large one. They should be kept in a cool, dark cellar to insure safe keeping of the meat.

CURING MEATS

Meat must be properly and thoroughly cooled to insure good keeping qualities when cured. If salted before the animal heat is out, the shrinkage of the muscles causes the retention of injurious gases, giving an offensive odor to the meat. Neither should meat be frozen when salted, as the action of the frost will prevent the proper penetration of the salt and uneven curing will result. It is important, also, that curing should begin as soon as the meat is cooled and while it is still fresh. Tainted meat may be cured so that it will keep, but nothing in the line of preservatives can bring back the natural flavor when it is once lost. The safest rule to follow is to salt meat as soon as the animal heat is out, and before it freezes or starts to decay. Ordinarily twenty-four to thirty-six hours after slaughtering will allow sufficient time for cooling.

Vessels for curing

A clean hardwood barrel is a suitable vessel in which to cure meat. A barrel made for the purpose is best, but where it cannot be had a molasses or sirup barrel will answer.

A kerosene barrel that has been burned out and used for a water barrel for some time is often used for a meat barrel. The important point is to have it clean and tight enough to prevent leakage. A large stone jar is the best vessel that can be had. One holding 25 or 30 gallons is expensive, however, and must be carefully handled to prevent breakage.

The jar is more easily cleaned than a barrel, and is in every way preferable if the first cost can be afforded. A barrel or jar that has once held meat may be used again and again unless meat has spoiled in it. If used repeatedly it will be necessary to scald it out thoroughly each time before packing with fresh meat.

Preservatives

Salt and sugar or molasses are the preservatives most commonly used, and are considered the only ones necessary for perfect curing and the finest quality of cured meats. Borax, boracic acid. formalin, salicylic acid, and other chemicals are sometimes used in preserving meats, but they are considered by so many authorities to be harmful to the health of the consumer that their use should be avoided. The proprietary preparations put on the market are also dangerous to health. They are more active than salt, and the chief reason for their use is to hasten the curing process.

Salt is an astringent, and when applied alone to meat renders it very hard and dry. Its action is first to draw out the meat juices. In a few days it will contract and harden the muscle fibers, thus shrinking the volume of meat. Saltpeter is used to preserve the natural color of the flesh or to give a reddish color, but it is harmful to the health. It is even more astringent than salt. Sugar is not an astringent and its presence in the pickle softens the muscle fibers and improves the flavor of the meat. Saleratus (baking soda) is used in small quantities to sweeten the brine. In warm weather a small quantity will aid in preventing the brine from spoiling.

Curing in brine and dry curing compared

Brine-cured meats are best for farm use, for the reason that a suitable place for dry curing is not usually obtainable. It is also less trouble to pack the meat in a barrel and pour on a brine than to go over it three or four times to rub in the salt. The brining method also gives better protection from insects and vermin. Trouble is sometimes experienced in keeping brine, but if pure water is used and directions followed in making the brine there should be no difficulty in keeping it for a reasonable length of time. During warm weather brine should be closely watched. If it becomes "ropy," like sirup, it should be boiled or new brine made. A cool, moist cellar is the best place for brine curing. Dry curing may be done successfully in a cellar also, though even more moisture is needed to effect a thorough cure. The cellar should be dark and tight enough to prevent flies and vermin from damaging the meat.

*Recipes for curing**

Corned beef.— The pieces commonly used for corning are the plate, rump, cross ribs, and brisket, or in other words the cheaper cuts of meat. The loin, ribs, and other fancy cuts are more often used fresh, and, since there is more or less waste of nutrients in corning, this is well. The pieces for corning should be cut into convenient-sized joints, say 5 or 6 inches square. It should be the aim to cut them all about the same thickness so that they will make an even layer in the barrel.

Meat from fat animals makes choicer corned beef than that from poor animals. When the meat is thoroughly cooled it should be corned as soon as possible, as any decay in the meat is likely to spoil the brine during the corning process. Under no circumstances should the meat be brined while it is frozen. Weigh out the meat and allow 8 pounds of salt to each 100 pounds; sprinkle a layer of salt one quarter of an inch in depth over the bottom of the barrel; pack in as closely as possible the cuts of meat, making a layer 5 or 6 inches in thickness; then put on a layer of salt, following that with another layer of meat; repeat until the meat and salt have all been packed in the barrel, care being used to reserve salt enough for a good layer over the top. After the package has stood over night add, for every 100 pounds of meat, 4 pounds of sugar, 2 ounces of baking soda, and 4 ounces of saltpeter dissolved in a gallon of tepid water. Three gallons more of water should be sufficient to cover this quantity. In case more or less than 100 pounds of meat is to be corned, make the brine in the proportion given. A loose board cover, weighted down with a heavy stone or piece of iron, should be put on the meat to keep all of it under the brine. In case any should project, rust would start and the brine would spoil in a short time.

It is not necessary to boil the brine except in warm weather. If the meat has been corned during the winter and must be kept into the summer season, it would be well to watch the brine closely during the spring, as it is more likely to spoil at that time than at any other season. If the brine appears to be ropy or does not drip freely from the finger when immersed and lifted, it should be turned off and new brine added, after carefully washing the meat. The sugar or molasses in the brine has a tendency to ferment, and, unless the brine is kept in a cool place, there is sometimes trouble from this source. The meat should be kept in the brine twenty-eight to forty days to secure thorough corning.

Dried beef.— The round is commonly used for dried beef, the inside of the thigh being considered the choicest piece, as it is slightly more

* Saltpeter in small quantities is included in these recipes because its use has heretofore been customary. Inasmuch as it is objected to by some hygienists as being injurious to health, and is thought to be useful only for preserving or adding color, it is considered advisable to make experiments to see if this ingredient cannot be dispensed with.

tender than the outside of the round. The round should be cut lengthwise of the grain of the meat in preparing for dried beef, so that the muscle fibers may be cut crosswise when the dried beef is sliced for table use. A tight jar or cask is necessary for curing. The process is as follows: To each 100 pounds of meat weigh out 5 pounds of salt, 3 pounds of granulated sugar, and 2 ounces of saltpeter; mix thoroughly together. Rub the meat on all surfaces with a third of the mixture and pack it in the jar as tightly as possible. Allow it to remain three days, when it should be removed and rubbed again with another third of the mixture. In repacking put at the bottom the pieces that were on the top the first time. Let stand for three days, when they should be removed and rubbed with the remaining third of the mixture and allowed to stand for three days more. The meat is then ready to be removed from the pickle. The liquid forming in the jars should not be removed, but the meat should be repacked in the liquid each time. After being removed from the pickle the meat should be smoked and hung in a dry attic or near the kitchen fire where the water will evaporate from it. It may be used at any time after smoking, although the longer it hangs in the dry atmosphere the drier it will get. The drier the climate, in general, the more easily meats can be dried. In arid regions good dried meat can be made by exposing it fresh to the air, with protection from flies.

Plain salt pork.— Rub each piece of meat with fine common salt and pack closely in a barrel. Let stand over night. The next day weigh out 10 pounds of salt and 2 ounces of saltpeter to each 100 pounds of meat and dissolve in 4 gallons of boiling water. Pour this brine over the meat when cold, cover, and weight down to keep it under the brine. Meat will pack best if cut into pieces about 6 inches square. The pork should be kept in the brine till used.

Sugar-cured hams and bacon.— When the meat is cooled, rub each piece with salt and allow it to drain overnight. Then pack it in a barrel, with the hams and shoulders in the bottom, using the strips of bacon to fill in between or to put on top. Weigh out for each 100 pounds of meat, 8 pounds of salt, 2 pounds of brown sugar, and 2 ounces of saltpeter. Dissolve all in 4 gallons of water, and cover the meat with the brine. For summer use it will be safest to boil the brine before using. In that case it should be thoroughly cooled before it is used. For winter curing it is not necessary to boil the brine. Bacon strips should remain in this brine four to six weeks; hams six to eight weeks. This is a standard recipe and has given the best of satisfaction. Hams and bacon cured in the spring will keep right through the summer after they are smoked. The meat will be sweet and palatable if it is properly smoked, and the flavor will be good.

Dry-cured pork.— For each 100 pounds of meat weigh out 5 pounds of salt, 2 pounds of granulated sugar, and 2 ounces of saltpeter, and mix them thoroughly. Rub the meat once every three days with a third of the mixture. While the meat is curing it is best to have it packed in a barrel or tight box. For the sake of convenience it is advisable to have two barrels, and to transfer the meat from one to the other each time it is rubbed. For the last rubbing the meat should lie in the barrel for a week or ten days, when it will be cured and ready to smoke. To cure nicely it is desirable to have a cool and rather moist place in which to keep it.

This recipe should not be used where the meat must be kept in a warm and dry place, as the preservatives will not penetrate easily and uniformly.

Trying out lard.— Only the best of fat should be used for choice lard. Leaf fat is the best. The back strip of the side also makes nice lard, as do the ham, shoulder, and neck trimmings. Gut fat should never be mixed with the leaf and back fat. It makes a strong-smelling lard and should be kept separate. All scraps of lean meat should be cut out of the fat before trying out, as they are very likely to stick to the kettle and get scorched, giving an unpleasant flavor to the lard. When preparing the fat for trying cut it into pieces from 1 to 1½ inch square. They should be nearly equal in size, so that they will try out in about the same time. Fill a clean kettle about three fourths full and put in a quart of water, or, if convenient, a quart of hot lard. One or the other is necessary to prevent the fat from burning before the heat is sufficient to bring out the grease. Keep the kettle over a moderate fire until the cracklings are brown and light enough to float. Frequent stirring will be necessary to prevent burning. When done remove from the stove and allow to cool slightly, and then strain through a muslin cloth into a large jar. Stir it occasionally until it is cool enough to begin to solidify. If pails or smaller jars are to be filled the lard should be dipped out while just warm enough to be liquid. Stirring while the lard is cooling tends to whiten it and make it smoother. A quarter of a pound of saleratus added to each 100 pounds of fat has a like effect.

Sausage.— Pork sausage should be made only from clean, fresh pork. To each 3 pounds of lean pork add 1 pound of fat. As the pork usually used for sausage is the shoulder, neck, and lean trimmings, the sausage is quite likely to be too fat unless part of the fat is removed and used for lard. Mix the fat and lean meat together in chopping. Where a rotary cutter is used it is best to cut the meat twice. After it is cut the first time spread it out thinly and season. One ounce of pure, fine salt, one half ounce of ground black pepper, and one half ounce of pure leaf sage, rubbed fine, to each 4 pounds of meat, will suit the taste of most persons. The seasoning should be sprinkled thinly over the cut meat and the meat again run through the cutter to mix the seasoning thoroughly. This method will give a more even mixing of the spices than can be obtained by working it with the hands. For immediate use the sausage may be packed away in stone jars or crocks, to be sliced for frying. Many people stuff it into casings made from the small intestines of the hog. When this is done the intestines must be turned inside out and carefully cleaned.

Casings for sausage can be bought for about 3 cents a pound. At this price it will hardly pay to bother cleaning them for home use. The bought casings are more uniform in size and strength and will usually give better satisfaction. A good substitute for casings may be had in narrow muslin bags. These, when filled, should be $2\frac{1}{2}$ or 3 inches in diameter and 18 to 24 inches long. Stuff the sausage in tightly by hand and hang in a cool place. If the sausage is to be kept for some time, melted lard should be rubbed over the outside of the bag. This excludes the air. Sausage may be kept for some time in a large jar if a thin coat of lard is put over the top.

Mixed sausage may be made from a mixture of pork and beef in almost any proportion. It is the custom on many farms to kill three or four hogs and a beef during the winter for the year's supply of meat. When this plan is followed a nice supply of sausage can be made from the trimmings. Sausage should not contain too much fat. A good proportion is 2 pounds of lean pork, 1 pound of fat pork, and 1 pound of lean beef. Chop together fine and season the same as pork sausage. Pack in jars, muslin bags, or casings. Many people prefer this to clear pork sausage, as it is not so fat.

Bologna sausage.— To each 10 pounds of lean beef use 1 pound of fat pork, or bacon if preferred. Chop finely and season with 1 ounce of salt to each 4 pounds of meat, 1 ounce of the best black pepper (ground, pure) to each 6 pounds of meat, and a little ground coriander. Stuff into casings called beef "middles" or beef "rounds." If stuffed into middles, make the sausages 10 or 12 inches long, and allow them to hang straight. If stuffed into rounds make them 12 to 15 inches long, and tie the ends together so as to form rings. Smoke for ten or twelve hours. Cook in boiling water until the sausages float. Dry on clean hay or straw in the sun, and hang away in a cool place until wanted.

Casings.— Sausage casings are the intestines of hogs, cattle, or sheep, which have been emptied and cleaned. They are turned inside out and soaked in a solution of lye or limewater, thoroughly washed, and then salted down. When cleaned and put up by a reputable packer they are as good as when cleaned at home, and when they can be bought at a reasonable price it hardly pays to clean them for home use. The casings from different animals are used for the various kinds of sausages. Beef casings are of three kinds: "rounds," made from the small intestines; "bungs," made from the large intestines; and "middles," made from that part of the entrails leading from the bung to the rectum. The "rounds" are used for bologna, the "bungs" for bologna, ham, and blood sausage, and the "middles" for bologna and summer sausage. Hog casings are made from the small intestines of the hog, and are used mainly for pork link sausage. Sheep casings are made from the small intestines of sheep, and are commonly used for wiener-wurst and other small sausages.

SMOKING OF MEATS

Pickled and cured meats are smoked to aid in their preservation and to give flavor and palatability. The creosote formed by the combustion of the wood closes the pores to some extent, excluding the air, and is objectionable to insects.

House and fuel

The smokehouse should be 8 or 10 feet high to give the best results, and of a size suited to the amount of meat likely to be smoked. One 6 by 8 feet will be large enough for ordinary farm use. Ample ventilation should be provided to carry off the warm air in order to prevent overheating the meat. Small openings under the eaves or a chimney in the roof will be sufficient if arranged so as to be easily controlled. A fire pot outside of the house proper, with a flue through which the smoke may be conducted to the meat chamber, gives the best conditions for smoking. When this cannot well be arranged a fire may be built on the floor of the house and the meat shielded by a sheet of metal. Where the meat can be hung 6 or 7 feet above the fire this precaution need not be taken. The construction should be such as to allow the smoke to pass up freely over the meat and out of the house, though rapid circulation is at the expense of fuel.

Brick or stone houses are best, though the first cost is greater than if they are built of lumber. Large dry-goods boxes and even barrels may be made to serve as smokehouses where only small amounts of meat are to be smoked. The care of meat in such substitutes is so much more difficult and the results are so much less satisfactory that a permanent place should be provided if possible.

The best fuel for smoking meats is green hickory or maple wood smothered with sawdust of the same material. Hard wood of any kind is preferable to soft wood. Resinous woods should never be used, as they are likely to impart bad flavors to the product. Corn cobs are the best substitute for hard wood and may be used if desired. Soft wood and corn cobs give off large amounts of carbon in burning, and this is deposited on the meat, making it dark in color and rank-flavored Juniper berries and fragrant woods are sometimes added to the fire to flavor the meat.

Filling the house.— Meat that is to be smoked should be removed from the brine two or three days before being put in the smokehouse. If it has been cured in a strong brine, it will be best to soak the pieces in cold water overnight to prevent a crust of salt from forming on the outside when drained. Washing the meat in tepid water and scrubbing clean with a brush is a good practice. The pieces should then be hung up to drain for a day or two. When drained they may be hung in the house. All should be suspended below the ventilators and should hang so that no two pieces come in contact, as this would prevent uniform smoking.

Keeping up the fire.— A slow fire may then be started, warming up the meat gradually. During the winter months in cold climates it is best to keep the fire going continually until the smoking is complete, holding the temperature at about the same point. If the fire is allowed to die down, the meat becomes cold and the smoke does not penetrate readily. This results in heavy smoke on the outside and very little on the inner portions of the meat. During the spring months and in the summer a light fire may be started every second or third day for two weeks, the meat being allowed to hang in the smokehouse until sufficiently colored. When the fire is kept going steadily and an even temperature is maintained, twenty-four to thirty-six hours will be required to finish one lot of meat. Smoke will not penetrate frozen meat and it will be necessary to extract all frost from it before filling the house. The house should be kept dark at all times to prevent flies entering. As soon as smoked sufficiently the meat should be cooled by opening the ventilators or doors. When hard and firm it may be canvased or packed away for summer use.

Keeping smoked meats

Smoked meat may be left in the smokehouse for some time during moderate weather. The house should be kept perfectly dark and well enough ventilated to prevent dampness. A dry, cool cellar or an attic with free circulation will be a satisfactory place for smoked meats at all seasons if it is kept dark and flies are excluded.

If to be held only a short time, hams and bacon will need only to be hung out separately without covering. For longer keeping it will be necessary to wrap them first in paper and then in burlaps, canvas, or muslin and bury them in a grain bin or other suitable place, the object being to gain a uniform temperature and to keep away insects. A coat of ground pepper rubbed into the piece before wrapping will be distasteful to them. For absolute safe-keeping for an indefinite period of time, it is essential that the meat be thoroughly cured. After it is smoked and has become dry on the surface it should be wrapped in parchment paper; or old newspapers will do where parchment cannot be had. Then inclose in heavy muslin or canvas, and cover with yellow wash or ordinary lime whitewash, glue being added. Hang each piece out so that it does not come in contact with other pieces. Do not stack in piles.

Recipe for yellow wash.— For 100 pounds ham or bacon take —

3 pounds barytes (barium sulphate)
0.06 pound glue
0.08 pound chrome yellow (lead chromate)
0.40 pound flour

Half fill a pail with water and mix in the flour, dissolving all lumps thoroughly. Dissolve the chrome in a quart of water in a separate vessel and add the solution and the glue to the flour; bring the whole to a boil and add the barytes slowly, stirring constantly. Make the wash the day before it is required. Stir it frequently when using, and apply with a brush.

THE CARE OF MILK

W. A. STOCKING

Milk is one of our most valuable foods, as regards both its actual food value and its comparative cost. Very few of our common foods furnish a given amount of nourishment so cheaply as does milk. The fact that it is a liquid does not lessen its food value, since it actually contains more nourishment than do many of our solid foods, especially vegetables; indeed, it is really more valuable because of its liquid form, since the food elements, being in solution, are more easily and completely digested by both children and adults, while a considerable part of other foods is not digestible and cannot be made use of in the body.

While milk is such a valuable food, it is at the same time one of the most delicate and will spoil very quickly if not given proper care. It is therefore important that the housewife know how it should be treated so as to retain its full value as a food. It is in its most perfect condition just as it is drawn from a healthy cow, and any changes that may later take place in it injure its value as a food.

WHAT CAUSES MILK TO SPOIL

There are two kinds of changes that may injure or spoil milk: first, absorption of undesirable taints and odors; and second, changes caused by growth of micro-organisms in the milk. The first change may be brought about by foreign taints absorbed in the milk before it leaves the cow, in case she has eaten, especially if only a short time before milking, any strong feed such as onions, turnips, or cabbage. This can be avoided either by preventing the cow from eating these strong feeds or by giving them soon *after* milking; in the latter case, the strong gases in the feeds have time to work out of the cow's body before the next milking time. Most of the undesirable taints in milk, however, are caused after the milk has been drawn from the cow and are the result of exposure to the odor of some strong material. Frequently, milk is badly tainted during the milking process by silage in the stable, the atmosphere being filled with the odor. It is surprising how quickly milk will absorb such odors; it is often injured very seriously during its ten or fifteen minutes exposure to a stable atmosphere where there is either an odor of silage or a strong stable odor resulting from lack of ventilation. Milk is very frequently spoiled after it reaches the kitchen, by being placed in an ice chest with other strong-smelling foods. It is a curious fact that any absorbed odor in milk gives it a very disagreeable taste, even when the odor in itself is pleasant. This is shown when odors are absorbed from fresh strawberries or pineapple. Ofttimes, merely the odor from a close, poorly ventilated ice chest or pantry will spoil milk for use. If possible, milk should always be kept in closed receptacles and never exposed in an open dish or pan in an ice chest with other foods.

The changes under the second class mentioned above may vary greatly in nature, but all are caused by the growth of different kinds of micro-organisms that get into the milk after it has been drawn from the cow. These little organisms are everywhere present, especially where there is any dust or dirt: the surface of the cow's body is always covered with them, and frequently, also, they are numerous in the stable atmosphere; the dairy utensils, if not properly cleaned and scalded, may contain large numbers; the hands and clothing of the persons handling the milk may also have on them considerable numbers of these minute organisms. The length of time that milk will keep without spoiling, and the kind of undesirable changes that takes place in it, are directly dependent on the number and kinds of organisms therein. It will be seen, therefore, that it is desirable to keep the number of bacteria as small as possible. Under ordinary conditions the greater part of the organisms that get into milk come from the sources mentioned above during the milking and subsequent handling. The number that may get in depends on the conditions of cleanliness in the stable and the care used in handling the milk. The effect of the bacteria on the length of time that the milk will keep is shown by the following figures:

Bacteria per cc. in fresh milk	Bacteria at the end of 12 hours	Hours to time of curdling
187,000	432,000	45
3,000	14,000	99
325	1,712	121

All of the samples used were held at the same temperature under uniform conditions. The difference in the keeping time is the result of the difference in the number of bacteria in the fresh milk. Under ordinary conditions, the smaller the number of bacteria in the milk, the longer it will keep.

Some of the ordinary bacteria in milk do not cause any particular changes in it, but others produce bad flavors and odors that injure and sometimes entirely spoil the milk. Souring is caused by the group of organisms known as lactic acid bacteria. These act on the milk sugar and produce acid. When enough of the milk sugar has been broken down and has formed sufficient acid, the milk tastes sour and later curdles. If these special kinds of bacteria could be kept out of the milk it would not sour at all, but could be kept at ordinary room temperature for a number of days.

Many persons think that it is necessary to aerate milk in order to get rid of the so-called animal odor, but this is unnecessary if the milk has been handled properly. There is no disagreeable taste or odor to fresh milk unless it has absorbed it from some outside source. Under some conditions, aerating in a clean, pure atmosphere may help to remove bad odors; but if the milk has been produced under clean conditions, there are no bad odors to remove. The so-called animal odors are caused either by the milk absorbing some outside odor or by the growth of bacteria in the milk.

THE KEEPING OF MILK

Even when milk is produced and handled under the best conditions, there will be a certain number of bacteria in it. If these are allowed to grow rapidly they will produce decomposition changes in the milk, injuring its food value and causing disagreeable flavors and sometimes poisonous substances. It is therefore desirable to prevent the growth of these organisms in the milk as much as possible. Like all other plants, the bacteria do not grow in cold temperatures, and the milk should be kept cold enough to prevent their rapid increase. It has been found by experiments that if the milk is cooled and held at a temperature of 50° or lower, there will be very little increase in the number of bacteria in twenty-four or thirty-six hours. The lower the temperature, the more completely the bacteria will be held in check. The effect of temperature on the growth of bacteria and on the keeping quality of milk may be seen in the following table:

EFFECT OF DIFFERENT TEMPERATURES ON THE DEVELOPMENT OF BACTERIA IN MILK

Temperature maintained for 12 hours	Bacteria per cc. at end of 12 hours	Hours to curdling at 70°
40°	4,000	75
45	9,000	75
50	18,000	72
55	38,000	49
60	453,000	43
70	8,800,000	32
80	55,300,000	28

The above results were obtained by dividing a quantity of milk into seven parts and holding the samples at the temperatures indicated for twelve hours. The number of bacteria in each was then determined and all the samples were placed at a uniform temperature of 70° until they curdled. The difference in bacteria content and keeping quality, therefore, was due to the difference in temperature for the twelve-hour period. If the samples had been held continuously at the different temperatures, the effect on the bacteria and on the keeping quality would have been still greater. The practical point in this experiment is the fact that the samples held at 50° or below kept remarkably well, while those held at the higher temperatures spoiled more readily. This indicates that if milk is to be kept in good condition it should be held at a temperature not much above 50°.

It is not a difficult thing to keep milk in excellent condition for a sufficient length of time to allow its use in the household, if the necessary precautions are taken. The first essential is for the housewife to procure milk that has been produced and handled under reasonably clean conditions. It can then be kept in good condition if it is not exposed to foreign odors and is held at the temperatures found in a good ice chest or refrigerator.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. Bailey, *Director*

Course for the Farm Home, Martha Van Rensselaer, *Supervisor*

VOL 1. No. 21 | ITHACA, N. Y. AUGUST 1, 1912 | FOOD SERIES No. 6

THE PRESERVATION OF FOOD IN THE HOME.—PART III

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist in your study of scientific home-making. We want your assistance as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the Home Economics Department in its efforts for scientific housekeeping.

Will you please express your interest in the Reading-Course by answering the following questions and returning the discussion paper to the Supervisor of the Cornell Reading-Course for the Farm Home?

1. What has been your experience in preserving eggs?

2. Will you conduct an experiment, as described in this bulletin, with the preservation of some particular food and let us know the result of the experiment?

3. Which is the more economical plan for you: to store or preserve your products to sell later, or to send them to market as they are harvested?

4. Does the preservation of food as a small business offer any financial possibilities to the farm girl who would earn her living in the country rather than in the city?

Name..................................

Address...............................

Date..................................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL 1. No. 23 — ITHACA, N. Y. SEPTEMBER 1, 1912 — FARM HOUSE SERIES No. 4

RULES FOR CLEANING

MARY URIE WATSON

(Ontario Agricultural College, Guelph, Canada)

One of the first principles of scientific management is to systematize each piece of routine work so that it may be done in the shortest time with the least expenditure of energy. A record is made of the best method to accomplish the given piece of work and that record is put in a form that is available to the average worker. If systematic work saves time the house is the first place in which to begin the new campaign for scientific management, since the slogan of many housekeepers is, "So much to do, and so little time to do it."

The following "rules for work" will not furnish to the housekeeper new ways of cleaning and working. They do not even attempt to include all the ordinary work of the house. The purpose of the rules is to give directions for various household processes in a form that may aid the housekeeper in systematizing her own work and the work of those who are assisting her.

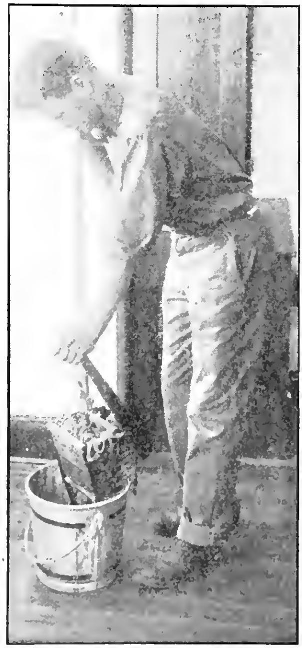


FIG. 94.—*A mop wringer*

THE CLEANING CLOSET

In every house there should be a cupboard or a closet set aside for cleaning purposes, "with a place for everything and everything in its place." The cleansing materials and apparatus listed under the following directions are not expensive and greatly simplify the cleaning problem. Shelves and racks should be provided for holding all apparatus and materials needed, and as far as possible labels should show where each brush, broom, pail, or bottle is to be returned.

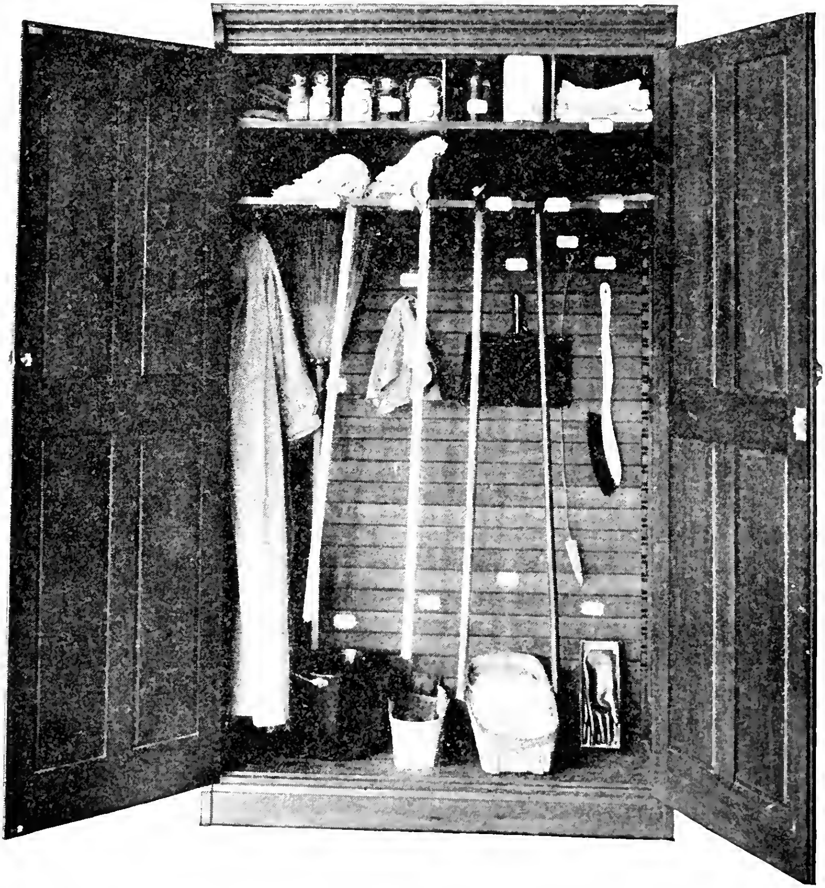


FIG. 95.—*An old wardrobe made over into a storage cupboard for cleaning utensils*

The following list of materials and utensils should be included in the housekeeper's cleaning kit:

Cleaning materials

Alcohol	Black lead
Alum	Borax
Ammonia	Furniture polish
Bath brick	Kerosene

Methylated spirit
Olive oil
Paraffin
Rottenstone
Salt
Separator oil
Soap
Turpentine
Vinegar
Washing soda
Wax (floor)
Whiting

Cleaning articles

Apron, stove
Carpet, piece old brussels
Chamois skin or leather
Cheesecloth
Cloth, scrub
Cloth, soft
Flannel, canton
Flannel, heavy
Flannel, waxing
Flannelette for dusters
Gloves, rubber
Mitt, for kerosene
Waste, cotton (cotton waste may be bought at any hardware store)

Cleaning utensils

Boiler, for clothes
Brush, closet
Brush, cornice
Brush, scrub
Brush, soft
Brush, trap
Brush, weighted
Brush, wire (for sink)
Carpet sweeper
Dauber
Dishpans
Funnels
Ironing tables, etc.
Irons
Monkey wrench
Mop, cloth
Mop, string
Saucepans (old)
Scissors (for lamp)
Stepladder
Tub
Tub, fiber
Washboard
Whisk broom
Wringer

THE BATHROOM

Apparatus:

Closet brush, scrub cloth, dry flannelette duster, and string mop.

Procedure:

1. Clean the bathtub. Let in a little very hot water, rub soap on the scrub cloth, and wash all scum deposits from the tub. Rinse out the tub and wash the taps. See that the outside is clean, and wipe everything dry with the duster.
2. Clean the closet. Raise the cover and the wooden seat. Wash the bowl thoroughly with the closet brush. If necessary scrub above the water line with soap, and see that the outside is clean. Flush the bowl. Wash the seat inside and out, also the inside of the cover. If necessary, wash the marble floor-slab. Wipe everything dry with the duster.
3. Dust the floor with the string mop. Take pains to get the dust out of the corners and from under the tub. Dust the chair and the woodwork.
4. Wash the closet brush with soap in the washbasin, rinse, shake thoroughly, and hang up. (This brush is usually kept in an inconspicuous corner of the bathroom.)

5. Wash and wipe the basin taps. Wipe off all pipes below the basin with the duster. If necessary, scrub the basin.
6. Wash and rinse the scrub cloth and the duster in the basin and wring as dry as possible. Rinse out the basin and wipe with the duster.
7. Hang up the cloths to dry.
8. If tubs and other appliances have been neglected and are very dirty, it may be necessary to scrub them with kerosene.

CUPBOARDS

Apparatus:

A dishpan, a scrub cloth, a clean fine duster, and a dry sink towel.

Procedure:

1. Fill the pan half full of soapy water, comfortably warm.
2. Clean the top shelf. Dust each article and place on a lower shelf or other convenient place. Wash the shelf and wipe dry with the sink towel. Replace each article belonging to the shelf.
3. Clean the remaining shelves, cleaning the bottom one last.

DAILY DUSTING

Apparatus:

A cheesecloth duster, a slightly damp flannelette duster, a string mop, and (if the room has a rug or a carpet) the carpet sweeper.

Procedure:

1. Air the room, if necessary.
2. Sweep the rug or carpet with the sweeper.
3. Dust any bare floor with the string mop.
4. Dust the window glass, window ledges, and all outstanding of wainscoting, cupboards, and the like, with the flannelette duster, and the chairs, tables, and smaller articles with the finer one.
5. Use the dusters to wipe up the dust, and do not shake them about. When one duster becomes dirty take another.
6. Wipe finger marks from electric-light-button plates.
7. When dusting stairways it may be necessary to use the long-handled cornice brush.
8. Avoid letting soiled dusters rest on beds, upholstered furniture, and like places.
9. Be careful to replace desk papers exactly as they were found.
10. Arrange the window shades before leaving the room.
11. Empty, dust, and put away the carpet sweeper. Put away the string mop, washing it if necessary. Wash the dusters and hang them up to dry.
12. Dustless dusters and mops may be used instead of dampened ones.

DISH WASHING

Apparatus:

Dishpan, rinsing pan, draining pan and basket, dishcloth, several clean, dry dish towels, boiling water, soap, and washing soda.

Procedure:

1. Put iron pots and pans to soak in strong soda-water, also put to soak any cooking dishes that need it. Pile one inside another so as to clean the outside also. This should be done the moment the contents are emptied, and before the meal goes to the table.
2. Clean the dining table, and leave the room in order.
3. Put the food away, scrape and stack the dishes at the washing end of the table, putting to soak any that need it.
4. Set out the pans, with the draining basket in the rinsing pan. Half fill the dishpan with hot soapy water, three quarters fill the rinsing pan with nearly boiling water.
5. Wash the glass, dropping each piece gently into the basket. Put flat silver into the dishwater to soak. Lift the basket of glass into the draining pan, dry the glass, and set it aside. Use the softest towels for this and see that the glass is left shining. (If you prefer the glass dried out of cold water, use it, and then fill the pan with boiling water.)
6. Return the basket to the rinsing pan. Wash, rinse, and dry the silver the same as the glass. The towels *must* be dry for the silver.
7. Wash, rinse, and dry the small china pieces the same as glass, and put away the basket.
8. Wash, rinse, and leave the rest of the china and crockery to drain, while the pots and pans are being washed.
9. Dry the china and crockery, rinse and dry the pots and pans. Scour the steel knives and forks.
10. Put away all the dishes.
11. Empty the dishpan, put rinsing water in it, wash the other pans, dry with the cloth wrung dry, and put them away.
12. If the rinsing water is still clean and warm, scrub the table and the sink with it; if not, get fresh water. Wash the teakettle, inside and out, once a day, when the water is soapy.
13. Put towels and dishcloth to soak in hot soapy water. This need be done but once a day, usually after the midday meal.
14. Rub off the stove. Sweep the kitchen floor. Empty the garbage pail.
15. Wash the towels and dishcloth. Rinse the pail out with the suds, and dry with the cloth wrung dry. Rinse the towels thoroughly in hot water and hang to dry, in fresh air if possible.
16. Dust the kitchen once a day.

NOTE.— The dishwater should be kept hot and soapy enough to prevent the formation of a grease ring on the pan, and should be changed when dirty. Keep the rinsing water very hot, thus requiring fewer towels.

THE FIREPLACE

Apparatus:

A stove apron, newspaper, dustpan, whisk, the blackleading implements, and a duster.

Procedure:

1. Spread the newspaper to protect the hearth.
2. Brush the ashes from the fire basket or andirons, and move the basket or irons out on the newspaper.
3. Brush the ashes down the ash hole.
4. Blacken the fire basket or andirons, and replace them.
5. Lay a fresh fire ready to light, using the newspaper on the hearth.
6. Brush up the hearth, dust the mantel and the fire irons.
7. Put away the blackleading implements, dustpan, and other apparatus, and get a basin of warm water, a small scrub brush, and some soap.
8. Wash the hearthstone and, if necessary, the fire irons.
9. A fireplace with red bricks may have the bricks reddened with the reddening mixture.

Reddening mixture

1 oz. common glue	$\frac{1}{2}$ lb. Venetian red
1 tablespoonful alum	1 lb. Spanish brown

1 gal. water

Dissolve the glue in the water over the fire. While hot, add the alum. Add the Venetian red and Spanish brown. If too light, add more red and brown; if too dark, add water, a little at a time until right. Mix well. Keep in a closely corked bottle. Apply with a paint brush.

FLOORS, FURNITURE, AND WOODWORK

To dust hardwood floors

Apparatus:

A string mop. (A dustless mop may be used.)

Procedure:

1. Dampen the string mop if the floor is not a waxed one. It may be sprinkled as clothes are for ironing, or may be held in the steam of a teakettle, but it must not be damp enough to show wet on the floor.
2. Go over the floor assigned, being careful that every board is rubbed. It is probably better to rub along the boards than across them.
3. Take especial pains to go under tables, desks, and like furniture, moving them when necessary.

4. Wash out the mop with soap and water when necessary. Rinse thoroughly, wring dry, and shake out well so as to make it as fluffy as possible. Hang to dry in the fresh air, or in a warm place, with the head up.

To mop a floor

Apparatus:

Mopping pail, mop, mop wringer, soap solution, and hot water.

Procedure:

1. Fill the pail three quarters full of hot water, add one half cup of soap solution, and carry it to the room assigned.
2. Clear the floor of the room as far as possible.
3. Dip the mop in the pail, drain without wringing, wet one section of the floor, and rub it clean. Rinse the mop in the pail, wring it tightly, and dry the wet section thoroughly before proceeding to wet another. It may be necessary to rinse the mop several times.
4. Begin at one corner of the room and work toward the door. Change the water when necessary.
5. Wash and rinse the mop, wring it tightly, and hang it head up to dry in the fresh air if possible.
6. Empty the pail, rinse pail and wringer before putting them away, and leave the tub clean.

To wax a floor

Apparatus:

The can of floor wax, a waxing flannel, a half yard of heavy flannel or a piece of old brussels carpet, and a weighted brush.

Procedure:

1. The floor must be clean and free from dust.
2. If necessary, stand the wax can in a dish of hot water in order to soften the wax.
3. Rub the waxing flannel on the wax and put a very thin, even layer of wax on the floor. It is better to rub along the boards than across. Start at the corner farthest from the door, and do not step on the waxed part.
4. Put away the wax and flannel, and keep off the floor for at least three hours. The polishing can be done after standing an hour, but is more work.
5. Fold the piece of heavy flannel twice, making four layers, put it down on the floor, put the weighted brush on it, and rub each board, with the grain, until it shines. The piece of carpet makes an excellent substitute for the flannel. The polishing can be done on the hands and knees without a weighted brush, but is much harder work.

To polish furniture

Apparatus:

A bottle of furniture polish, a small handful of cotton waste, and one or two flannelette dusters or old soft cloths.

Procedure:

1. Take a piece of the cotton waste or an old soft cloth, put some polish on it, and rub it on the wood. Use as little polish as possible, but rub hard to remove dirt and scratches. Rub with the grain of the wood.
2. Take the rest of the cotton waste and rub as much of the polish as possible off the piece of furniture.
3. Polish finally with the flannelette, rubbing briskly but lightly until the surface is bright and there is no appearance of oiliness. Be especially careful to rub out corners.
4. *Burn all the cotton waste.* Be careful about this, because oily cotton has often caused a fire through its spontaneous combustion.
5. Put away the polish bottle, wiping the outside carefully.
6. Wash the dusters and hang them up to dry.

Recipe for furniture polish:

8 oz. linseed oil — $\frac{1}{2}$ oz. alcohol
$\frac{1}{2}$ pt. vinegar — $\frac{1}{2}$ oz. butter of antimony
$\frac{1}{2}$ oz. muriatic acid

Mix the ingredients thoroughly, and keep in a closely corked bottle. This polish should not be used on pianos.

To clean a piano case

Apparatus:

A bottle of olive oil, a bottle of alcohol, some new or perfectly clean canton flannel, a perfectly clean chamois leather, and a basin of water.

Procedure:

1. Wet a small piece of the flannel and drop on it a few drops of oil.
2. Rub, with the wet flannel, a small section of the case at a time, and immediately rub it thoroughly with a dry piece of the flannel, before proceeding to a fresh section.
3. Polish finally with the chamois or a fresh piece of the flannel. Rub with the grain of the wood, and breathe on it occasionally to help remove any oiliness that may remain. A very little flour rubbed with the grain of the wood will also help to remove oiliness, but its use should not be necessary.
4. Wash the piano keys with a corner of the flannel wet with alcohol. Be careful, however, to avoid touching the wood with the alcohol, as it will ruin the varnish.

To polish woodwork or floors with kerosene

Apparatus:

The kerosene can, the kerosene plate, a kerosene mitt, a handful of cotton waste (or an old soft cloth), and a soft woolen or flannelette cloth.

Procedure:

1. Put a very thin layer of kerosene in the plate and dip the mitt into it.
2. Rub a section of the wood hard with the mitt, being careful to clean out the corners thoroughly. Immediately rub as much kerosene off the section as possible with the cotton waste or old cloth. Then proceed to clean the next section.
3. When all the wood has been cleaned and the first section has stood for an hour, polish it finally with the woolen cloth. It will be all the better to stand three or four hours before the polishing.
4. Put away the kerosene mitt, plate, and can, and burn the waste.
5. Wash the polishing cloth in strong soapsuds, rinse carefully, and hang it to dry.

Note.— In all wood polishing rub with the grain of the wood.

To clean woodwork

Apparatus:

A fiber tub, two flannelette dusters, borax, and warm water.

Procedure:

1. Put a level tablespoonful of borax into the tub and half fill the tub with warm water. The water should be comfortably warm.
2. Wash a section of the woodwork with one duster, and immediately rub dry with the other duster before proceeding to the next section.
3. When two do this work together, better progress is made when one washes and the other dries the wood.
4. A stepladder is necessary for high woodwork.
5. When all the wood is cleaned, wash out the dusters carefully and hang them up to dry.

Note.— A steel wire brush, such as is used by painters, will expedite the cleaning out of corners and angles when the woodwork has been badly neglected.

To dust woodwork

Apparatus:

One or more damp flannelette dusters.

Procedure:

1. Begin at one corner of the room and dust the baseboard of wainscoting. Do the doors and windows as they come.
2. Use the dusters to wipe up the dust and do not shake them about. When one duster becomes dirty, take another. Go over every board of the woodwork, and be careful not to slur over the corners but to take the dust out of them.

3. When dusting stairways it may be necessary to use a long-handled cornice brush in order to reach all parts.
4. Woodwork with many panels is easily dusted with a woolly stove-mitt, which is kept for the purpose.
5. Wash out the dusters with soap and water and hang them up to dry.

LAMPS

Apparatus:

An old newspaper, the kerosene can, a damp flannelette duster, lamp scissors, and a dry towel.

Procedure:

1. Carry the lamps to a sink, or to a table convenient to the sink.
2. Spread the paper and place everything on it.
3. Wash and dry the lamp chimneys as if they were tumblers, set them aside, and put away the towel.
4. Open up the lamp burner, screw up the wick, trim off all the char with the scissors, and screw down the wick a quarter of an inch below the brass. Be careful not to drop the char around. Round wicks must have the char rubbed off with the duster.
5. Soap one corner of the duster and rub carefully every part of the brass burner; if necessary, polish as directed on page 332, "To clean brass and copper."
6. Fill each lamp nearly full of kerosene. See that the burner is properly screwed on, and wipe the body of the lamp carefully.
7. Put on the chimneys and set the lamps in their places.
8. Wash the scissors and duster and hang the duster to dry. Gather all trimmings in the paper and burn both trimmings and paper. They are not safe to leave around.

LAUNDERING

To wash with paraffin

Apparatus:

Paraffin wax, laundry soap, soft water, clothes boiler, saucepan, laundry tub, and wringer.

Procedure:

1. Soak the clothes over night in cold *soft* water.
2. Shred one half cup of paraffin and one half-pound bar of soap, and melt in one pint of hot water.
3. Fill the boiler with soft water and bring to boiling point; add the paraffin mixture.
4. Wring the clothes out of the water in which they are soaking, put them in the boiler, and boil one half hour.

5. Remove the clothes to a tub of soft, warm water, or a washing machine, and rinse the soapsuds well out of them. Only the very dirty parts need to be rubbed. This rinsing water must be kept as warm as possible.
6. Rinse in clear cold water.
7. Rinse in bluing water.

NOTE — For a washing of about five boilerfuls, prepare twice the amount of paraffin and soap, putting one half of it in the first boilerful and adding more to each succeeding boilerful of clothes.

To launder table linen

Apparatus:

Tub, washboard or washing machine, soap, ironing table with blanket and sheet, hot irons, and cloth for cleaning irons.

Procedure:

Washing

1. Remove all stains.
2. Soak over night if possible in softened water.
3. Wash in hot water, using soap and the board or machine.
4. Boil or scald fifteen minutes in soapy water.
5. Rinse in cold water.
6. Rinse in cold bluing water.
7. Dry out of doors if possible.

NOTE.— For old linen add one cup of boiled starch to each gallon of bluing water.

Dampening

1. Dampen well.
2. Roll up tightly and let lie over night if possible.

Ironing

1. General rules:
   a. Pull well into shape.
   b. Have the irons very hot.
   c. Press heavily.
   d. Iron until perfectly dry.
2. Ironing and folding a table napkin:
   a. Place the napkin on the table wrong side up, with the name on the upper right-hand corner.
   b. Fold the lower edge to within $\frac{1}{8}$ inch of the upper edge, and iron.
   c. Fold the lower edge even with the upper edge, and iron.
   d. Fold the left-hand edge to within $\frac{1}{8}$ inch of the right-hand edge, and iron.

e. Fold the left edge even with the right-hand edge, and iron.
f. Turn over and iron the remaining square.

3. Ironing and folding a table cloth in the screen fold of four:
   a Fold the cloth lengthwise, wrong side out.
   b. Fold again lengthwise.
   c. Drop one selvage and bring it back to the folded edge on the opposite side.
   d. Place lengthwise on the ironing table and iron the top quarter.
   e. Open and iron the middle quarters.
   f. Fold the middle quarters together and iron the remaining quarter.

NOTE — If the cloth is very large or the table very narrow, it is better to fold it in two, right side out, iron both sides, and refold in the screen fold.

To wash chamois leather

Apparatus:

Warm water and washing soda, soap, and a clean towel.

Procedure:

1. Dissolve one eighth cup of washing soda in two quarts of lukewarm water.
2. Soak the chamois in the soda water fifteen to sixty minutes, according to dirtiness.
3. Lift the chamois into a basin of warm, strong soapsuds, and squeeze and work them with the hands until clean. Be careful not to rub or wring them. Very soiled places may be put on a smooth surface and brushed with a small brush.
4. Rinse thoroughly in warm, soft water. Press as much water out as possible by pulling through the hand. Roll in the towel and wring tightly. Stretch well in all directions and hang to dry.
5. Stretch and rub the chamois two or three times while they are drying.

METAL WARE

To clean brass and copper

Apparatus:

Rottenstone, sweet oil, scouring flannels, chamois skin, clean dry towel, and a saucer; also, if necessary, a soft brush.

Procedure:

1. Wash the article in hot, soapy water. If badly tarnished, it may be necessary to make a weak solution of oxalic acid and rub this over the article before washing it, The acid, however, is a dangerous thing to use if the skin is broken anywhere on the hands.

2. Mix a little paste of rottenstone and oil in the saucer and scour the brass vigorously with it. Be especially careful to get it into crevices and corners.
3. Wash thoroughly with hot water and soap, rinse, and dry. If the article seems greasy after the washing, the water was not sufficiently soapy and the washing should be done over.
4. Polish with chamois skin.
5. Wash out the cloths and chamois skin and hang them up to dry.

NOTE.— If the article is very badly tarnished it may be rubbed with fine emery paper, or finely pulverized pumice stone may be used as a paste with the acid or with water, rubbing vigorously.

To clean granite ware

Apparatus:

A vessel large enough to hold the utensil being cleaned, and one that will not be affected by strong soda solution; washing soda, bath brick, dishcloth, and dish towel.

Procedure:

1. Place the utensils to be cleaned in the larger vessel.
2. Nearly fill with cold water.
3. Add soda in the proportion of one half cup soda to one quart cold water.
4. Let boil for an hour or until most of the dirt will rinse off readily.
5. Take the utensils out of the soda water and rinse under the tap.
6. If necessary scour the utensils with bath brick or sapolio, in order to remove obstinate spots.
7. Wash like ordinary dishes.

NOTE.—It may be necessary to repeat this operation several times in extreme cases.

To clean ironware

Apparatus:

An old newspaper, a flannelette duster, a lump of beeswax or mutton fat tied in a square of cloth, a piece of old cloth for scouring, some coarse salt, and a basin of soapy water.

Procedure:

To season new ironware

1. Heat the iron utensil hot enough to melt the wax or fat.
2. Spread the newspaper on the table; rub the utensil with the wax.
3. Wash in hot, soapy water.

NOTE.—Repeat several times if necessary.

To clean rusty ironware

1. Spread the newspaper on the table.
2. If very rusty, rub the ironware with kerosene and let stand for an hour, or longer if necessary, before further treatment.
3. Heat the utensil enough to melt the wax or fat.
4. Rub with wax or fat until well covered. Then scour off with salt.
5. Wash the utensil with hot soapsuds and dry.
6. Heat until thoroughly dry.
7. If the weather is damp or the ironware is being put away for some time, rub with wax, vaseline, or saltless fat of any kind, in order to prevent rust.

NOTE.— It may sometimes be necessary to use finely pulverized bath brick in addition to the salt. Flatirons should be cleaned as described for ironware.

To clean nickel

Apparatus:

The bottle of ammonia, a tablespoonful of whiting in a small bowl, a small woolen cloth, and a larger woolen cloth or a flannelette duster.

Procedure:

1. Stir enough household ammonia into the whiting to make a thin paste, as thick as milk.
2. Rub the paste over the nickel, rubbing it well into crevices.
3. When dry, rub the whiting off and polish with the dry woolen cloth.
4. If stains still remain, it will be necessary to scour them off with sapolio or something similar.

NOTE.— When nickel on a stove has been neglected and is very dirty, it is often easier to clean the pieces after they have been unscrewed and taken off; but it is necessary to look after all the bolts and screws carefully and see that all are put back in their proper places.

To clean silver

Apparatus:

A bottle of silver polish, a small piece of old, soft cloth, a clean flannel or flannelette cloth, a plate brush, and a clean chamois skin.

Procedure:

1. Shake the polish bottle thoroughly, wet the old cloth with the polish, and rub all the silver all over with it. Then wash the mouth and cork of the bottle, and cork the bottle tightly. When cleaning a large amount of silver, pour the polish in a small saucer to use.
2. When the whiting is dry on the silver, rub off as much as possible with the flannel cloth.
3. Brush the whiting out of cracks and crevices with the plate brush.

4. Polish with the chamois.
5. If necessary, wash the chamois.

Recipe for silver polish:

1 cup methylated spirit (wood alcohol)
2 tablespoonfuls household ammonia
¼ cup precipitated whiting

Mix the ingredients and keep in a closely corked bottle. Shake thoroughly before using.

NOTE.— The silver polish should be of the consistency of milk when being used.

To clean steel ware

Apparatus:

A knife board if knives are to be cleaned, bath brick or sapolio, cork, dishcloth, dish towel, and clean chamois.

Procedure:

1. Spread a newspaper on the table and place on it the utensils to be cleaned.
2. Pulverize finely some of the bath brick.
3. Moisten the cork with water and dip it in the bath brick or sapolio.
4. Rub the steel utensil vigorously with the moist bath brick.
5. Wash in warm water, being careful not to immerse knife handles in hot water.
6. Wipe thoroughly dry.

NOTE.— If steel utensils are to be kept some time without being used, extra precaution must be taken to have them thoroughly free from moisture. They may be dried in very gentle heat. Dry flour, dry bath brick, or oil on the blades will prevent any rust.

To clean zinc

Apparatus:

The kerosene can, some cotton waste or an old cloth, a bottle of vinegar and alum mixture (see below), and an old pot.

Procedure:

1. Take a piece of cotton waste or an old cloth, pour a little kerosene on the zinc, and spread it all over with the waste or cloth.
2. Start at one corner and rub hard with the waste or cloth until the zinc is clean and bright.
3. Finally, rub off all superfluous kerosene with a piece of fresh waste.
4. If the zinc has been neglected and is very dirty, heat some of the vinegar and alum mixture in the old pot. Apply it hot, rub hard, and wipe off immediately.
5. Burn the waste.

Vinegar and alum mixture:

2 oz. powdered alum
1 qt. strong vinegar

Boil the vinegar, add the alum, and stir until dissolved. Apply hot. Badly stained nickel can be cleaned by boiling in this mixture until the stains begin to disappear, before polishing. Keep in a tightly corked bottle.

THE REFRIGERATOR

Apparatus:

Two dishpans, the trap brush, a small scrub brush, two dishcloths, a clean towel, soap, washing soda, and ammonia.

Procedure:

1. Empty the water pan below and replace it.
2. Fill the sink or a dishpan half full of strong, hot soapsuds. Put warm water into a dishpan to the depth of an inch and add a half tablespoonful ammonia.
3. Remove the ice to the other dishpan, using the dishcloths to prevent its slipping. Gather up any straws or dirt.
4. Remove all food. Put the ice rack and the shelves into the soapsuds.
5. Wash the ice box carefully and quickly with the ammonia water. Be sure to get all the corners clean, and scrub the waste pipe with the trap brush. Rinse it down with the ammonia water and then with a dipperful of fresh, clean water. Dry with the dishcloth wrung out of clean water.
6. If the waste pipe is movable, take it out of the food closet and put it in the soapsuds. Scrub the ice rack and the shelves with the scrub brush, and the pipe with the trap brush. Let off the suds, rinse the pieces in plenty of cold water, and dry with the towel.
7. Replace the ice rack and the ice, and close the ice-box doors.
8. Mix a fresh lot of ammonia water, and wash the walls and floor of the food closet. Be sure the corners are clean. Dry with the towel. Be very sure that movable parts belonging to the waste pipe are taken apart, washed thoroughly, and carefully fitted back into place. Then replace the waste pipe and the shelves.
9. Replace the food, but do not close the doors.
10. Wash out the pipe cap under the refrigerator most carefully with the ammonia water and soap.
11. Empty the water pan and wash it thoroughly, with plenty of soap in the ammonia water, before replacing it.
12. Close the refrigerator doors.
13. Wash out and put away the dishpan, brushes, and cloths.

THE SINK

To flush a sink trap

Apparatus:

An old granite or iron pot, a granite funnel, a stick, and one third cup washing soda for each sink.

Procedure:

1. Put the soda in the pot, add a quart of water for each one third cup of soda. Bring it to a boil, stirring to dissolve the soda but only with a stick that can be thrown away afterwards.
2. Put the funnel in the sink plug-hole and pour down the quart of boiling soda-water. Be careful not to let the soda get on hands or drain boards. Leave the pot, stick, and funnel in the sink.
3. See that no water goes down the sink for half an hour.
4. Plug the sink and fill it with water, hot if possible. Then remove the plug and let the rush of water finish cleaning out the trap.
5. Rinse, dry, and put away the funnel, pot, and other implements and leave everything tidy at the sink.
6. Every sink and trap in the house should have this treatment at least once a week.

To clean out a sink trap

Apparatus:

An empty garbage pail, an old, small sieve, the trap brush, a monkey wrench, an old pot, and one fourth cup washing soda.

Procedure:

1. Put the soda into the pot, add two quarts of water, and boil.
2. Set the pail under the trap and unscrew the cap at the bottom of the S-trap.
3. Remove any obstruction that may be there, and brush out both sides of the trap pipe with the trap brush.
4. Pour the soda solution down the sink, then put on the screw cap.
5. Put the sieve in the sink, empty the contents of the pail through it, then empty the contents of the sieve into the stove.
6. Plug the sink, fill it with water, and wash the sieve, garbage pail, and trap brush. Then let the water away in order to flush the trap. While it is running away, examine the trap to make sure that it is not leaking at the screw.

THE STOVE

To blacklead a kitchen stove

Apparatus:

The black-lead plate, the turpentine bottle, a dauber, a black-lead brush, black lead, soap, an old flannel cloth, a pail of hot water, and a stove apron.

Procedure:

1. Put on the stove apron.
2. Mix the black lead with enough warm water to make it the consistency of cream, then add a few drops of turpentine.
3. Wet the cloth, rub it on the cake of soap, and wash the stove all over with it. Rinse the cloth and renew the soap as often as necessary. The object is to get rid of old blacking and grease, and so make the surface easier to polish. Soda water is an excellent substitute for soap, if the stove is very greasy or has been neglected.
4. Let the stove dry.
5. Commence at the top of the stove. With the dauber apply a thin layer of blacking to one section of the stove, and polish immediately with the black-lead brush; then proceed to blacken and polish the next section. If the blacking is allowed to dry before the brushing, the polish is harder to obtain; therefore, daub only as much as can be polished before it dries out.
6. Fireplace baskets and irons do not require washing very often.
7. Burn the old cloth, wash out the pail, and put everything away tidily.

NOTE.— It is now considered good practice to oil kitchen stoves, thus avoiding the labor and dust of the blackleading process.

To oil a kitchen stove

1. Put a little separator oil on a wad of cotton waste and rub it on all the iron parts of the stove.
2. Rub off with fresh waste, an old cloth, or some crumpled paper.
3. Polish with a dry flannelette or woolen cloth until all oiliness is gone.
4. Burn the waste, old cloth, or paper. Be particular about this because oily waste and oily cloths are a frequent cause of fire through spontaneous combustion.
5. Wash out the polishing cloth.

To clean a gas stove thoroughly

Apparatus:

A stove apron, a couple of old newspapers, a wire sink-brush, a monkey wrench, whisk, dustpan and brush, a sink towel, several pieces of old cloth, soap and washing soda, and the separator-oil bottle.

Procedure:

1. Put on the apron and spread the papers on the table.
2. Turn off the gas at the main supply pipe with the monkey wrench.
3. Fill a large dishpan with strong, hot soapsuds, put into it to soak the dripping pan and rack and any movable nickel pieces of the stove.

4. Fill the sink half full of strong, hot soda water. Put the drop tray in the bottom to soak, and on top of it put the top grates, doors, and all movable black parts of the stove.
5. Brush out both ovens and all parts of the stove frame.
6. Wet one of the old cloths in hot water, rub it on the soap, and wash off the stove. Dry it, if necessary, with an old cloth. Then oil the black parts very lightly with the separator oil and polish it off thoroughly with another old dry cloth.
7. Let the soda water out of the sink, let in fresh warm water, and scrub the doors and other black pieces with the wire brush. Dry them off, take them to the table, oil and polish them, and put them back on the stove.
8. Let the dirty water out of the sink, transfer the nickel pieces, dripping pan, and rack to the sink, pour in the soapy water, scrub the pieces thoroughly, dry them with the sink towel, and return them to place.
9. Scrub, rinse, dry, and return to place the drop tray.
10. Burn the old cloths and wash the sink out carefully. It is especially necessary to be careful about burning oily cloths that are not washed after using, because they have been known to take fire spontaneously and are therefore dangerous when tucked into corners out of sight.

NOTE.— Be sure to have the stove all put together before any oiling is done.

THE WALLS

Apparatus:

A cornice brush.

Procedure:

1. Close all the doors of the room, and cover pictures and other articles.
2. If the room has a cornice, brush the dust out carefully.
3. Brush first the ceiling, then the walls. Brush gently so as to gather the dust on the brush, rather than to scatter it.
4. Shake the brush well, and then put it away.
5. Remove the covers from the pictures and other articles gently, carry the covers outside to shake, and fold them before putting away.

WINDOWS AND WINDOW SHADES

To clean windows

Apparatus:

A high stepladder, fiber tub, damp flannelette duster, scrub cloth, soft linen towel, chamois leather, ammonia, and warm water.

Procedure:

1. Fill the tub half full of warm water and add a tablespoonful of ammonia or a few drops of kerosene.

2. Carry the ladder to the window, roll up the shade, and take it down. Unroll it on the floor or over a table, then roll it up, dusting both sides as it rolls. Stand it aside, marking to which window it belongs if more than one is being cleaned.
3. Dust the window, especially the surrounding woodwork, with the damp flannelette duster.
4. Wash the glass, especially corners, and dry with the linen towel.
5. Polish with the chamois leather.
6. Replace the shade, testing carefully, and make sure the spring works properly.
7. Wash out the tub, towel, cloth, and duster. Hang the cloths to dry and put everything else away.
8. If chamois leather is not available, use crumpled newspaper.
9. The following mixture may be used instead of ammonia and water, but the resulting white dust must be carefully wiped up:

   1 tablespoonful precipitated whiting
   2 tablespoonfuls household ammonia

To dust window shades

Apparatus:

A stepladder and a flannelette duster.

Procedure:

1. Place the ladder firmly, so that it is easy to reach the spring end of the roller.
2. Roll the shade up as far as possible and take it down from the window. If it will not roll all the way up before you take it down, roll it up before coming down from the ladder; otherwise the shade is likely to wrinkle and be damaged.
3. Unroll carefully over a table or out on the floor. Great care must be taken to prevent the shade from wrinkling.
4. Roll up slowly, dusting each side as it is rolled.
5. Replace the shade on the window, and test to see whether it rolls up and down properly. If it does not roll quickly to the middle of the window, take it off again and roll up before replacing. If it will not pull down to the bottom, pull it down as far as possible, take it off again, and unroll it to the length of the window before replacing.
6. Dust the middle ledge of the window before taking the stepladder away.

WOODWORK

See under "Floors, furniture, and woodwork," page 326.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. 1. No. 23 | ITHACA, N. Y. SEPTEMBER 1, 1912 | FARM HOUSE SERIES No. 4

RULES FOR CLEANING

DISCUSSION PAPER

Every good housekeeper sees the necessity of system in her work. She has "short cuts" and methods of her own that are good. May we have the benefit of your experience? For example, a woman told the writer that she always put into the soapy water with which she wiped up the veranda some kerosene to keep away mosquitoes. Every contribution helps toward better housekeeping methods. What will you contribute?

1. Give, in a clear, explicit way, directions for some cleaning process not included in this bulletin.

2. Study carefully the conditions under which you are working, then answer the following question: Is there any way in which you could systematize the work and save both time and strength?

Name ....

Address ....

Date ....

The Cornell Reading-Courses

LESSON FOR THE FARM

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL. 1. No. 2 | ITHACA, N. Y. OCTOBER 15, 1911 | SOIL SERIES No. 1

THE SOIL: ITS USE AND ABUSE

ELMER O. FIPPIN

The agricultural development of any region that has been settled for a generation or more is a very reliable index to the natural soil resources

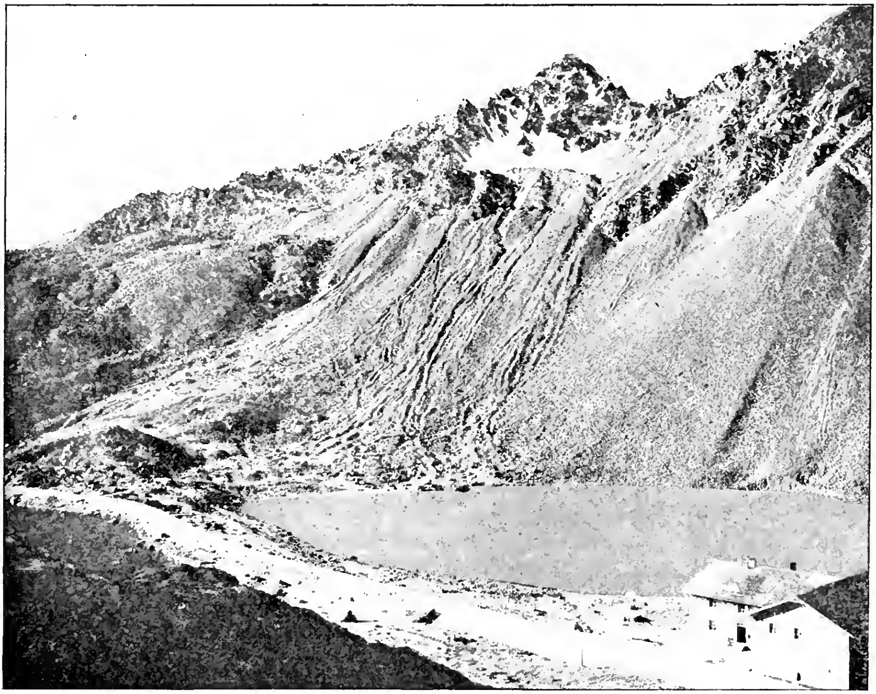


FIG. 1.—*The formation of soil goes on constantly on every part of the earth's surface, but it is usually most active in mountainous regions. Scene in the Swiss Alps*

of that region. The variation in agricultural development of different sections is very largely a reflection of inherent differences in soil conditions.

There are, of course, other conditions that modify these differences, but the soil is one of the greatest natural resources of any people and largely determines its manner of life. It is greater than the mines of all the metals and fuel, the quarries of stone, the forests of timber, and the streams with their latent power and stock of food animals.

The soil, like almost every other natural resource, may be expended and wasted, and its usefulness, if not destroyed, may be brought to an exceedingly ineffective condition by careless and ignorant use.

FIG. 2.—*Accumulations of snow and ice in mountainous regions or regions of high latitude slide down the slope as shown in the above picture of an Alaskan glacier. This has been a very important means of soil formation, having at one time covered all of New York*

On the other hand, so susceptible of re-creation is the soil that under careful and wise handling it is able to maintain its productiveness with scarcely a trace of diminution for decade after decade and century after century. Such has been the history of the soils of many sections of Europe and of the other parts of the world. This long-continued productivity has not always been attained as a result of thorough scientific knowledge, but has rather been the outgrowth of empirical practice by which permanently efficient customs in tillage have been developed.

Nevertheless, probably every one will agree that a more permanently effective system of husbandry may be developed as a result of accurate and thorough knowledge of all the processes and operations involved in producing crops from the soil than is possible by the older "rule of thumb" method. So broad are the relationships of good soil management that no person may properly claim the right to be exempt from a certain fundamental knowledge of the soil and its conservation, however far he may be removed professionally.

THE NATURE OF THE SOIL

The soil material — the superficial area of the earth — is so thin as to be infinitesimal in thickness when compared with the diameter of the earth. We commonly define the soil as the surface area of the earth's crust that

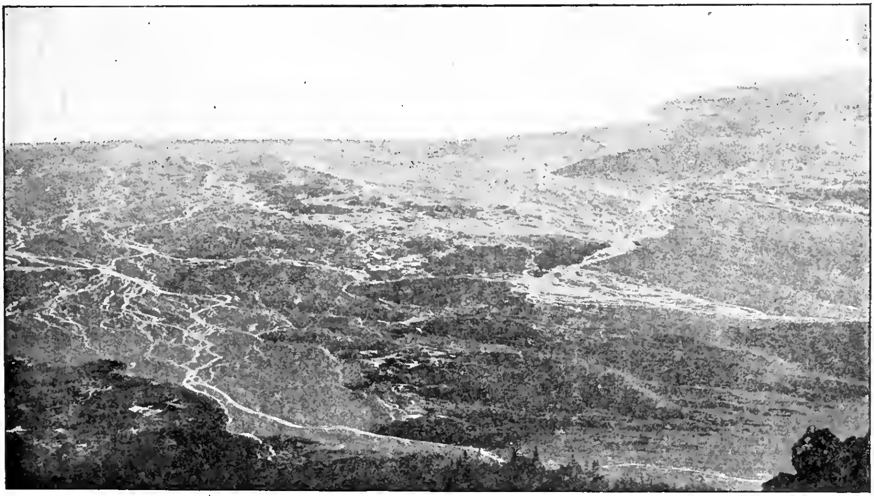


FIG. 3.— *The water from the melting of ice at the front of a glacier carries away and sorts the rock materials and deposits them along its course, later to serve as soil. Much of the land along the lakes and through the valleys in New York has been formed in this way*

is capable of supporting plant growth. The growth that it will support may be ever so simple, as in the case of a few bacteria on some rock cliff, or it may be a tall field of corn on a rich river plain, or a dense forest of trees on a fertile plateau.

We include in the soil all the material to the depth to which plant roots are able to distribute themselves. It therefore includes a wide range of material in depth and character. It may be deep or shallow, coarse or fine, loose or compact, light or dark, wet or dry. It is all soil because it is a medium for the growth of some kind of plant. In general, the soil may be divided into two classes of material: (a) the particles of mineral and fragments of rock, and (b) bits of organic matter of both plant and animal origin that have become more or less decomposed.

The efficiency of any soil is measured by its capacity to supply plants with the several materials and conditions they require for growth. These include food, water, heat, air, and support; and in addition the soil must be free from various diseases and animal enemies that, in spite of a proper supply of all the essential conditions of growth, may still prevent productiveness. In proportion as any particular soil supplies all these essential conditions in well-balanced abundance, the largest growth of plants may be obtained. Again, if these conditions are deficient or improperly balanced by the shortage of one of their number, a lower or more simple type of plant or a smaller growth will result. Difference in soil conditions

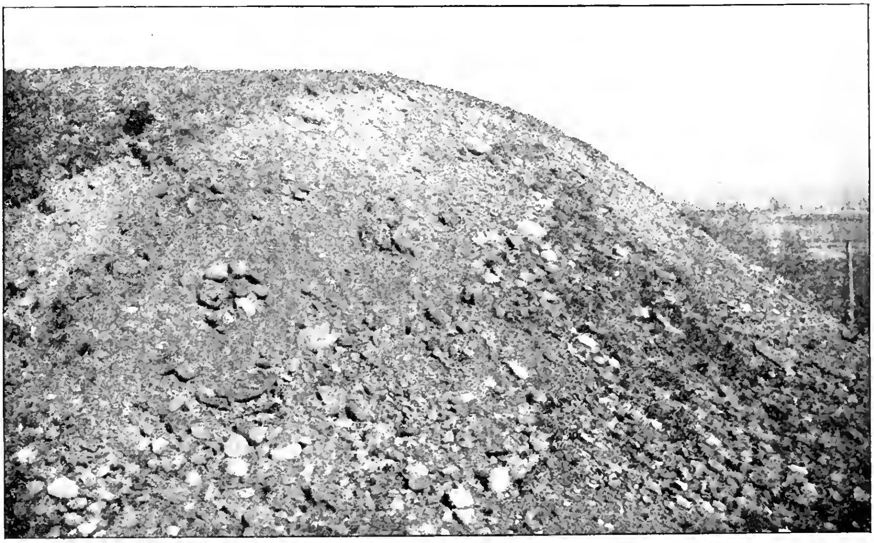


FIG. 4.—*Section of a soil formed by glacial ice, showing its mixed physical composition*

results in different kinds of plant growth. Thus, wheat is grown on deep, fertile loam, and mosses and ferns on thin, rocky slopes; truck crops are grown on dry, warm sand, and sphagnum or sweet flag on mucky marshes. The great variety in plants is due to the great variety of soil conditions that nature affords. Man's province as a tiller of the soil and grower of plants is to change the conditions of the soil so that they shall be more favorable to the crops he desires to grow.

The soil is a complex body and is the result of a complex set of processes, yet we may learn many things about its nature and operation. The fragments of minerals and rocks of which it is chiefly composed have been derived through the operation of many agencies that work together to break down and transport the rocks from which the soils are formed.

Soil is sometimes called pulverized rock, but it is more. Together with the organic matter of which it is composed, it is the seat of activity of millions of bacteria and of minute thread-like plants, called fungi, that contribute to its productiveness.

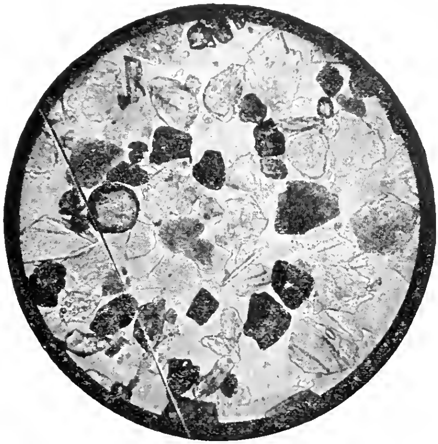


FIG. 5.—*Micro-photograph of fine sand soil showing the irregular shape of the particles and their difference in mineral composition. The mineral plant foods are contained in these particles of mineral*

THE MAKING OF SOIL

Rain, wind, frost, glacial ice, streams, waves, plants and animals, and the solvent power of water, are at work continually on every exposed rock. By these agencies mountains have been reduced to plains, and lakes, and even oceans, filled to the condition of dry land. We may see these processes in operation by the roadside after a shower of rain, or in the garden, as well as in mountain parks. In the Alps Mountains, in Switzerland, the tops are capped by snow and ice which slide down the gorges with a tremendous grinding force; the ice melts and this great volume of water flows away with such violence as to furrow the rock slopes and carry away every bit of loose material. Trees and smaller plants pry their roots into the fissures, and winds send blasts of sand and dust against the ledges. Thus by degrees the mountain of rock becomes a plain of soil.

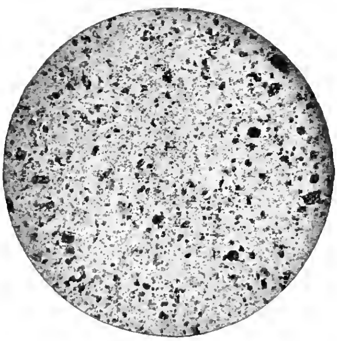


FIG. 6.—*Micro-photograph of silt soil showing the much smaller size of particles. The particles are of the same general shape and variety in mineral composition as the sand. Owing to its greater fineness, the food contained in silt is much more available*

One may see these results wherever he is, and may observe the processes that have given rise to them. They may differ in magnitude but not in kind. Note how frost breaks up clods of clay and even of stone; how the rivulets after a rain gully the hillside and leave a mass of gravel or mud where the water comes to rest. Then note the plants that spring up, and observe their roots—how they thread their way about through the spaces in rock and soil, expanding each a little by their growth and search for water and food.

KINDS OF SOIL

As a result of the many processes at work, we find two general classes of soil. One results from the gradual disintegration and decay of rocks. Such soils have been formed in place; that is, they have not been moved, and we call them *sedentary*. The famous limestone soil of Kentucky is of this class. The other class has been moved more or less, and is called *transported* soil. Water, wind, and ice have been the chief means of transporting the soil material. Our best soils, as a rule, have been formed in the latter way. In New York the greater part of the soil on the uplands

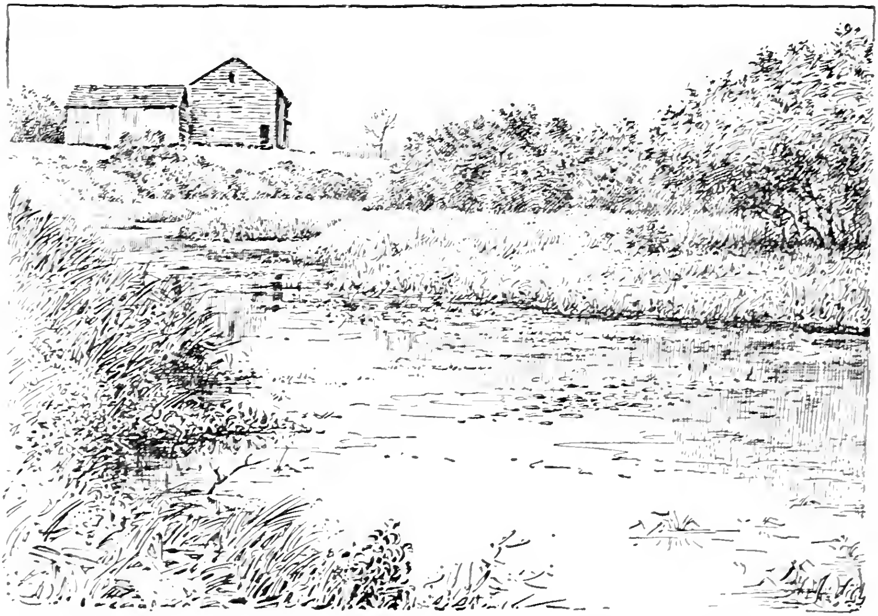


Fig. 7.—*The accumulation of sediment and the remains of swamp plants in wet places form extensive areas of very fertile soil, often of a muck character*

has been formed by ice, which has ground up the rock from many sources and mixed it together in the helter-skelter stony mass generally found. Along the rivers and streams, on the plains of Lakes Erie and Ontario, and on the Long Island coast, the soils owe their character to water which has transported, sorted, and deposited the material in groups, or areas, of considerable uniformity. Thus we find clay in one place, silt in another, and various grades of sand, gravel, and stones in still other places. These different characters give the soils different relations to crop growth. Soils formed by water are, in general, the most extensive and important agriculturally. They are usually fine and uniform in texture and level in topography.

HUMUS

Every good soil contains organic matter. The most famous soils, such as those of the Genesee bottoms, the prairies of the Northwest, or the valley of the Nile River, are well stocked with the decayed remains of plants and animals, which generally impart a dark or black color. The presence of much organic matter greatly increases the productivity of any soil. The experienced farmer usually identifies a dark colored soil as a fertile one for this reason.

Organic matter in this partially decomposed and darkened condition is commonly known as humus, and is the same kind of material as that

FIG. 8.—*Muck soil, which is the decayed remains of swamp plants, is especially well adapted to certain truck crops when drained and properly fertilized*

which leaches from swamp and manure heaps in the form of a brown liquid. This partially decayed plant and animal material is the most valuable single constituent of the soil and the one which every good farmer strives to save and augment. It helps to keep the soil loose and friable, improves its drainage, makes it warmer than it would be otherwise, helps to hold water in a form available for crops, and renders more available the store of food which every soil contains. The maintenance of humus is accomplished by leaving as much of the crop as possible (stubble and roots) on the soil, by turning under green crops occasionally, and by the addition of manures from the stable or the factory. Without the maintenance of humus a permanently productive system of husbandry cannot be maintained.

In a few places, usually wet and swampy ones, plants have grown up, died, and accumulated with little decay until there are deep deposits of brown or black organic material rich in humus. The rawer deposits are termed peat; the more thoroughly decayed ones are termed muck. The latter, when drained, tilled, and, usually, fertilized, are able to produce large yields of some of our most valuable truck crops, such as celery, lettuce, and onions.

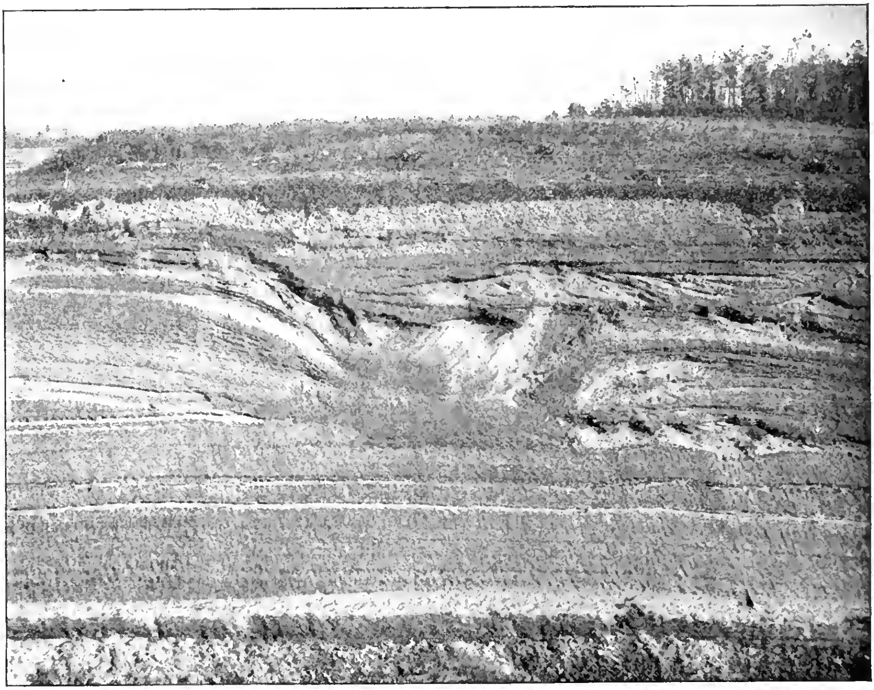


FIG 9.—*Soil formed by water is generally sorted and stratified, as shown in the illustration. The character and arrangement of these strata have large influence on the growth of crops*

SOIL MOISTURE

Soils hold water in their pores as does a sponge, and this water is taken up by plant roots. Water is necessary as food for the plant, as a regulator of its physical condition, and as a carrier from the soil to the plant of other food elements. There must not be too much or too little water in a good farm soil. Some plants require more than others. One class of plants lives in swampy places; another, as the cactus, can live under desert climate conditions. But the great majority of crops prefer a nicely moist condition of the soil, one that holds its form when gently pressed in the hand and that contains only capillary, or film, water between the particles. It is moisture in this latter form that is required by the roots of such crops as beans, corn, and wheat.

When the soil is so wet that water fills the pores and appears on the surface, most farm plants will not thrive. For such conditions, drainage, the drawing off of excess water, is necessary. To drain the soil, ditches are constructed, either open or with short lengths of pipe, usually clay pipe, in the bottom to permit the water to percolate away. Over 10,000 square miles of farm lands in New York require drains to render them most profitable.

When the excess of water has been cared for by either natural or artificial drainage, the remainder of the water in the soil, the capillary water, must be husbanded carefully for the use of the crop. If it becomes deficient, the crop suffers in yield and quality, even though every other condition may be favorable. In order to conserve the soil moisture tillage is required. A farmer keeps the surface, to the depth of an inch or two, loose, level, and dry by proper tillage. He calls this layer a mulch, "a dust blanket," that holds the moisture in the soil below so that it escapes only through plants and thereby accomplishes its work on the way. In this operation of tillage are required knowledge and skill to cultivate each particular soil, at the right time and in the right way to secure the desired results. Soils are as peculiar as folks and sometimes as obstinate.

When good tillage will not maintain a supply of water, it may be added artificially by means of irrigation. In New York, with 35 inches of rainfall, irrigation is not often necessary, and when required it is usually on the very light sandy soils that are used for special crops, such as truck or fruit.

The two types of conditions just described may be observed if we watch any common field plant, or even a window plant, through the summer. Note when it wilts or when it is drowned, and how it behaves in each instance. Then note the corresponding soil conditions.

FOOD SUPPLY IN THE SOIL

The store of available plant food in the soil is a matter of special concern to many persons. Plants require a variety of foods, just as do cattle. They use nitrogen (which costs 20 cents per pound if purchased), phosphorus, potash, lime, magnesia, sulfur, and iron, besides the elements obtained from water and air, which are hydrogen, oxygen, and carbon. The potash and certain other materials are contained in the soil in great quantities, yet the farmer frequently rushes to the fertilizer bag at the first sign of reduction in the crop yields. The average New York soil contains 2,500 pounds of phosphorus, 35,000 pounds of potash, and 20,000 pounds of lime per acre of soil one foot deep. The average weight of an acre foot of soil is 3,500,000 pounds. Of nitrogen, the soil usually contains several hundred, and often several thousand, pounds per acre. All this material is normally in a form not readily available, and requires manipulation in the form of drainage, tillage, etc., to release it for crop use.

The use of fertilizers, or the artificial addition of food to the soil, may be, and often is, necessary for the best results. But many farmers make

FIG. 10.—*An example of good soil tilth. This physical condition is essential to the proper operation of any soil*

the mistake of assuming that this is the first and about the only condition of growth, whereas bad physical condition of the soil, lack of humus, poor drainage, or bad tillage, may be much more in need of consideration. Fertilizers should come only after these other conditions have been attended to. They are the means by which the store of food in the soil is made available to the plant.

It is not often possible to determine by any laboratory analysis the kind of fertilizer to which the soil will respond. The only reliable method of determining this point is by trying different fertilizer materials on plots of the soil in the field.

OBJECTS OF TILLAGE

A crop enjoys good quarters as much as does a cow or a man. Good quarters for the plant means good physical condition of the soil, good tilth. Good physical condition rests upon two things: the texture, or fineness, of the soil, and the structure, or state of aggregation. A sand

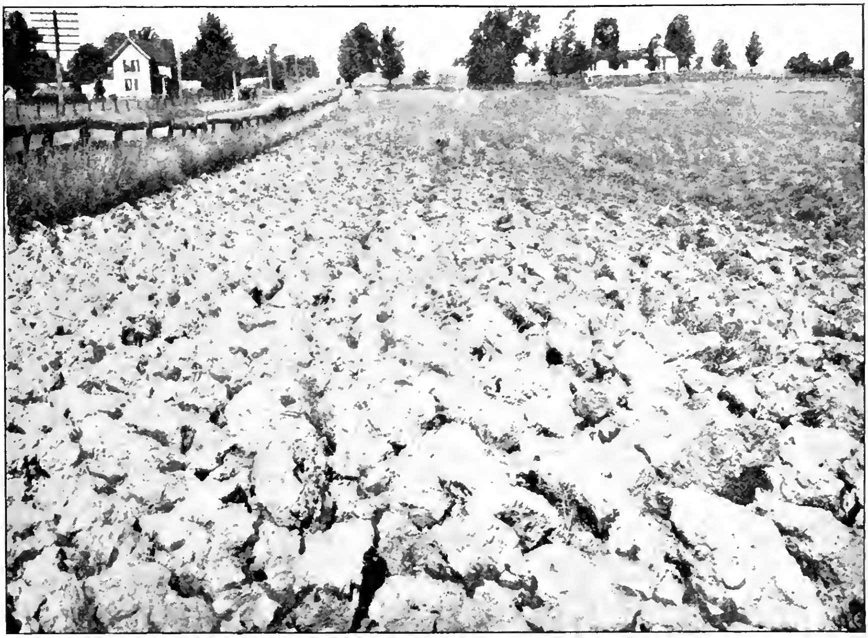


FIG. 11.—*A heavy soil in bad tilth due to unwise handling. Tramping or plowing when too wet is generally the cause of this condition. A poor place for plant growth*

or gravel soil has a coarse, open texture that may be so porous as to be leachy and not hold enough water for crop use. A clay soil is fine textured and may be too compact and hard. The farmer cannot change the texture of the soil. He must make the best of it.

But the farmer can do good work in changing the structure of the soil. One cannot greatly alter the structure of sand and gravel soils. The chief aim in their tillage is to maintain as compact a structure as possible, and to keep a thin surface mulch. Clay soil, on the other hand, is troublesome because of the bad structure it tends to assume. It will puddle, bake, and then break up in great clods. In this condition it is repellent to the average farm crop, and the farmer must alter its structure to get the best results. As a matter of fact, the chief object of all tillage operations is to change the structure of the soil. A nicely granular, friable condition is ideal. Clay soil plowed a little too wet or a little too dry takes on a bad structure, and in order to get the best results with it, to till at the right time and in the right way, careful knowledge and keen observation are required.

The moisture supply, aeration, temperature, and the millions of organisms in the soil, are dependent on its texture and structure, and the farmer controls them all largely through tillage, which renders the structure

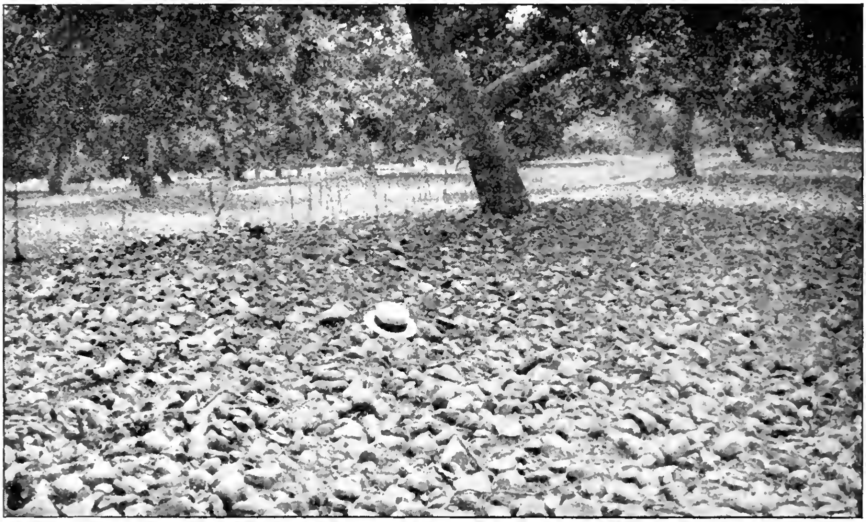


FIG. 12.—*Soil moisture is saved by a mulch, or dry layer of soil on the surface. Stones may serve this purpose*

more or less favorable to each. Tillage is therefore an indirect rather than a direct operation; and therein rests the necessity of knowledge of the relation of the various factors in productivity, one to the other. For example, a clay soil is generally known as a cold soil, although clay itself is not colder than sand or gravel. But clay generally holds more water than sand, and it is this larger amount of water that renders it colder; consequently, any change in the structure of clay which will cause it to hold less water will give it normally a higher temperature.

In order to accomplish desired changes in structure, the farmer may work in cooperation with nature's forces — with frost, rain, and the roots of plants; and without their cooperation his efforts would usually accomplish very little.

PRACTICES AVAILABLE FOR SOIL IMPROVEMENT

We see, then, that by drainage, irrigation, tillage, manures, and fertilizers (including lime), the farmer endeavors to modify the soil. To these he may and should add two other practices essential to the highest financial results. These are crop rotation and crop adaptation.

a. Crop rotation.— Nature rotates her crops, and there must therefore be a fundamental reason for the practice. In the forest, oak follows pine and pine may follow oak. On the farm, corn after corn and wheat after

FIG. 13.—*Potatoes grow best on a fine sandy loam soil. Both the yield and the quality are best on this kind of soil*

wheat soon results in small crops, whereas a succession of crops, properly adjusted, gives a larger total production. It is evident, therefore, that there is created by a one-crop system some soil condition not conducive to the best results. A succession of different crops periodically repeated gives better results: it gives better yields, in the first place; it keeps the soil in better physical and chemical condition; it conserves food, keeps down weeds, reduces disease and insect attacks, and incidentally, although not necessarily, saves labor. A good crop rotation is recognized as an essential part of a good system of crop production.

Many systems of rotation have been devised. They must be adapted to the soil and to the market conditions, or to the type of farming followed.

For example, in the East Central States a standard rotation consists of

Maize (corn)
Wheat
Clover and timothy (one or two years).

The Cornell rotation is

Wheat
Clover and timothy (one year)
Maize (corn)
Oats.

FIG. 14.—*The hill lands of southern New York are especially well adapted to the growth of potatoes*

For the eradication of weeds a good rotation in New York is

Sod
Maize
Potatoes or other tilled crop
Oats or barley, seeded to grass.

b. Crop adaptation.— Not everything in crop production can be accomplished by modification of the soil, however. The soil can be stretched, so to speak, to a certain extent, but that extent is limited. Then attention must be given to the other end of the dilemma: the crop must be taken in hand. We have many crops developed under and suited to particular soil conditions. The wise farmer will adapt his crops to his natural soil conditions. He will not attempt to grow rice on a hill or radishes in a swamp. He will put truck crops on truck soil, celery on muck, grass and wheat on clay, corn on loam, potatoes on sandy loam, peaches and cherries on sandy and gravelly loam, and chestnut timber on rocky land low in lime. He will put good land to plowed crops, grass land to pasture, and rough land to timber. He will adapt his farming to nature's conditions and obtain correspondingly better results. Or he may improve his crops by breeding and selection, to make them better suited to his soil and climate.

In crop adaptation and improvement the opportunities for the profitable and intelligent manipulation of the soil and the plant are limitless. Out of the soil come the chief materials for man's handiwork. The soil welcomes his wisdom and assistance in its task. It repels his unwisdom and carelessness. He has no commission to abuse it. Its frown is poverty, its smile is plenty and peace.

LITERATURE

To the Reader:

If you are interested in this bulletin, which gives the barest outlines of the subject, you should secure other literature that will give you a fuller knowledge. The Reading-Course Lessons are designed merely to introduce the subject; they are elementary and brief. You should supplement them with reading from other sources. We do not wish to recommend any particular books, bulletins, or other publications over others on the same subject; but in connection with the subject considered in this bulletin we believe that you will find the following books and bulletins of special interest:

The Soil. S. W. Fletcher. Doubleday, Page & Co. $2.00.

Principles of Soil Fertility. Alfred Vivian. Orange Judd Company. $1.00.

Principles of Soil Management. T. L. Lyon and E. O. Fippin. The Macmillan Company. $1.75.

Soil Fertility and Permanent Agriculture. C. G. Hopkins. Ginn & Co. $2.25.

Fertilizers. E. B. Voorhees. The Macmillan Company. $1.40.

Practical Farm Drainage. C. G. Elliott. John Wiley & Sons. $1.25.

Farmers' Bulletins:

- No. 44. Commercial Fertilizers: Composition and Use.
- No. 77. Liming of Soil.
- No. 150. Clearing New Land.
- No. 187. Drainage of Farm Land.
- No. 192. Barnyard Manure.
- No. 245. Renovation of Wornout Soils.
- No. 257. Soil Fertility.
- No. 263. Practical Information for Beginners in Irrigation.

No. 266. Management of the Soil to Conserve Moisture.
No. 278. Leguminous Crops for Green Manure.

Farmers' Bulletins are distributed free and may be had on application to the Secretary of Agriculture, Washington, D. C., or to the Senators and Representatives in Congress who have copies for distribution.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. Bailey, *Director*

Course for the Farm, Charles H. Tuck, *Supervisor*

VOL. 1. No. 2 | ITHACA, N. Y. OCTOBER 15, 1911 | SOIL SERIES No. 1

THE SOIL: ITS USE AND ABUSE

DISCUSSION PAPER

A discussion paper is sent out with each Reading-Course Lesson, for two reasons: (1) We should like to have the reader's ideas on the subjects under discussion. On some of the points the reader has probably had experience that will be interesting and valuable to us. No matter what the Lesson says, if you have a different opinion on any of the subjects, do not hesitate to state it on this paper and give your reasons. (2) We should like the reader to use this paper on which to ask us questions. If there are any points that the Lesson has not made clear, or if there are problems in your farming, whether on the subject of the Lesson or any other, on which you think we may be able to help you, write to us on this paper.

The next Reading-Course Lesson will be sent to those who return to us this discussion paper, which will be an acknowledgment of the receipt of this Lesson. This paper will not be returned to the reader, but we shall look it over as carefully as we would a personal letter and write to the reader if there are any points about which correspondence is desirable. The reader may consider this discussion paper, then, as a personal letter to us. It will be treated as such, and under no circumstances will the reader be quoted. As the discussion paper will contain written matter, it will require letter postage.

If you are not interested in this Lesson, there are others on other subjects, and we shall be glad to send any of them to you on request. The titles of the series of available bulletins of the former Farmers' Reading-Course, which has been replaced by this publication, are: 1. The Soil and the Plant. 2. Stock Feeding. 3. Orcharding. 4. (Out of print.) 5. Dairying. 6. Farm Buildings and Yards. 7. Helps for Reading. 8. Miscellaneous. 9. Breeding.

Bulletins in The Cornell Reading-Course for the Farm Home may be obtained by addressing Miss Martha Van Rensselaer, Supervisor.

The following questions will call attention to the soil conditions in your home region. We should be glad to have you direct our attention to any soil conditions that you consider need special investigation, or to any practices that you consider especially successful or especially unwise as applied to your soils.

1. In what way have the soils in your region been formed?

2. What is the general character of the soil and subsoil in your region?

3. Are the soils as productive now as when first cleared? How do you account for any change that may have occurred?

4. Are all of the soils in your region being utilized in the way that will give the best permanent returns? What is the percentage of waste lands? What suggestions can you offer?

5. Name the practices that are followed in your region to maintain the productiveness of the soil.

6. What crop rotation or rotations are followed in your region, and under what conditions?

7. To what extent is attention given to growing on each soil the crop to which it is best adapted, through either selection of seed or systematic plant breeding?

8. Are fertilizers used in your region? What is their composition? On what crops are they used? Are you satisfied that the best fertilizer is being used in each case?

9. Is lime ever used on the land? Do you think its use would be beneficial in any way?

Name.......................................

Date...

County.......................... Post office.....................

Note.— Your name appears on our mailing list as this Lesson is addressed. If incorrect, please notify us.

Address all correspondence to The Cornell Reading-Course for the Farm, Ithaca, N. Y.

The Cornell Reading-Courses

LESSON FOR THE FARM

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL. 1. No. 4 | ITHACA, N. Y. NOVEMBER 15, 1911 | POULTRY SERIES No. 1

INCUBATION.—PART I

F. T. FINCH

The essentials for successful incubation are: (1) eggs of strong hatching qualities; (2) a good hatching device; (3) correct methods of operation; (4) a favorable environment. The absence of one or more of these factors means a hatch of lower percentage and weakened chickens.

To secure the desired quality of eggs we must have strong, active breeding stock, skillfully housed, yarded, and fed; and the eggs must be properly handled and selected before incubation.* How to secure the other three essentials it is the purpose of this lesson to discuss.

NATURAL INCUBATION

In most respects the hen is still superior to the artificial incubator, so far as methods and results are concerned. But there is as much choice in the different breeds of hens for incubation purposes, and in different hens of the same breed, as in the different types of incubators.

If the natural method of hatching chickens is to be employed, it will be well to choose sitters from the general-purpose breeds (Plymouth Rocks, Wyandottes, Rhode Island Reds, Orpingtons, etc.). The meat-type breeds (Cochins, Brahmas, etc.) are usually faithful but clumsy. The egg type, or so-called nonsitting breeds (Leghorns, Hamburgs, etc.), are too small, usually light, and untrustworthy. In selecting the individuals for brooding, it is well to choose the hens that are the least excitable when approached. A nervous hen is likely to break some of the eggs in the nest or to step on the little chicks.

The success of the incubation depends not only on the hen's ability to hatch fertile eggs, but also on the nesting place and the surrounding conditions. The hen that steals her nest and sits undisturbed usually brings off a good brood of chickens. The conditions existing in a hen-

*See "The Importance of Constitutional Vigor in the Breeding of Poultry," Bulletin 45, Cornell Reading-Course for Farmers; also "Building Poultry Houses," Bulletin 274, Cornell University Agricultural Experiment Station.

house, or any building where hens are set, should be made as nearly like the natural conditions as possible. Hens should be set where laying hens cannot be with them, and where they may have free access to a dust bath, fresh water, and grain. If necessary a small coop may be used, provided it is placed in a shady spot and the hen allowed her freedom or the run of a small yard. The nest should be placed where the hen will have easy access to it, preferably on the floor or ground. If placed on the ground, the bottom of the nest box should be knocked out and the earth underneath covered with clean straw or leaves. If the nest is elevated or on a floor, some dirt may be placed in the bottom, arranged to conform to the hen's body, and covered with a layer of straw. (See Fig. 15.)

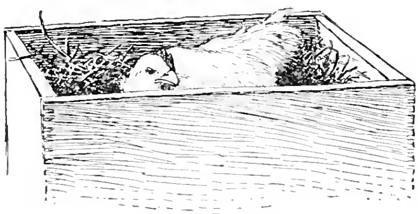


FIG. 15.—*Box nest*

When all is ready the hen and the nest should be thoroughly dusted with lice powder.* The hen should be set on "china eggs" until she becomes accustomed to her new surroundings. If she "settles down to business" at once, the good eggs may be placed under her the following night. It is best to keep her shut in the nest at first to make sure that she does not leave the eggs. In case any eggs are broken in the nest they should be removed at once, and the straw should be replaced by a fresh supply. Should any of the remaining eggs be smeared, they should be washed with warm water.

After the eggs have been incubated seven days they may be tested, and those that contain dead germs or that are infertile may be removed. If several hens are set at the same time, the eggs from two hens may often be placed under one, after the undesirable eggs have been removed. In this way, the other hens may be set again or may be placed in a special coop for broody hens.

Before the chickens are hatched, provision should be made for the hens and their broods. When the chicks are twenty-four to thirty-six hours old they may be removed from the nest and placed in the coops provided for them.

After the hen and chicks have been removed the nests should be disinfected and the litter burned. A liquid disinfectant is best for this purpose and should be used with a spray pump.

* Directions for making Lawry Lice Powder: This powder may be used very successfully for dusting hens or young chicks. It consists of ¼ pint crude carbolic acid, ¾ quart gasoline, and 2½ pounds plaster of paris. The liquids should be mixed thoroughly before adding the plaster of paris. The latter should be well mixed with the liquids and rubbed between the hands, then passed through a mosquito wire screen and allowed to dry. Great care should be used in applying this powder, otherwise both hen and chickens may be injured. A small pinch of the powder is sufficient for each fowl. This should be worked in through the feathers, especially about the vent and under the wings. The powder may be kept indefinitely if placed in a tight package. Do not apply the powder for several days after making. Avoid keeping it in a hot place.

THE PRINCIPLES OF ARTIFICIAL INCUBATION

Incubators may be divided into two classes: those operated by hot air, and those using hot water. The former system is used the more extensively in heating incubators ranging in capacity from 60 to 600 eggs. Incubators holding 1000 eggs or more are heated by a hot water system. There is little reason why either means of heating should have greater success in hatching than the other, provided the same method of supplying the heat to the eggs is used and other factors are equal.

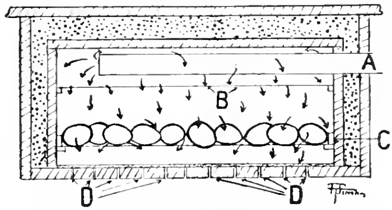


FIG 16.—*Diffusion method. A, Hot air pipe; B, porous diaphragm; C, egg tray; D, space between bottom boards for ventilation*

The most successful methods of supplying heat to the egg chamber are by *diffusion* and *radiation*. There are machines that combine the two principles successfully, and others that use one or the other method with good results.

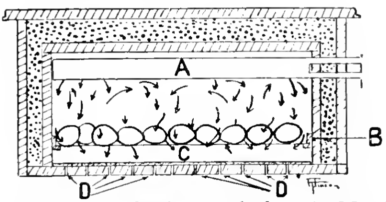


FIG. 17.—*Radiation method. A, Metal radiator; B, C, egg tray; D, ventilators*

Diffusion.— By this method the fresh air enters the heater, is warmed, passes into the upper part of the egg chamber, and is diffused through the pores of a diaphragm of burlap or other material. It then passes down over and around the eggs and out of the incubator through the ventilators or heater.* (See Fig. 16.)

Radiation.— The heat is supplied to the egg chamber by direct radiation from a hot air or hot water tank or pipes. (See Fig. 17.)

The contact method of supplying heat to the eggs is little used. Although this method approaches natural incubation most nearly, it is the least successful. (See Fig. 18.)

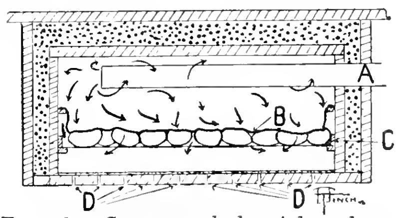


FIG. 18.—*Contact method. A heated surface is brought in contact with the eggs. A, Hot air pipe; B, heated surface; C, egg tray; D, ventilators*

QUALITY AND CAPACITY OF INCUBATORS

Quality should be the first consideration. The main qualification of a good incubator should be, first-class material put together in such a way that the process of incubation may be carried on successfully, con-

* Nearly every incubator company has its own method of letting the used air out of its incubators.

veniently, and inexpensively. The value of a machine should not be based on a record hatch in the hands of an expert; neither should a machine be condemned because an inexperienced operator fails at first to get good results. The best incubators for average operators are those by which the problems of supplying heat, moisture, and ventilation are so simplified and controlled that good hatches may be obtained in various localities, and under varying atmospheric conditions.

If enough chickens are to be hatched each season to make it advisable to incubate by artificial means, a considerable amount of time and extra expense may be saved by installing machines with a large capacity. Incubators holding 250 to 400 eggs are desirable. The expense for oil and labor in operating large machines is surprisingly small in comparison with that in operating enough 60- or 100-egg machines to hold the same number of eggs; and the results usually obtained with the former are enough better to warrant their use. The smaller the incubator, the more easily is the temperature of the egg chamber influenced by the outside temperature. The size of the machine should be governed by the number of chickens to be hatched each season, due consideration being given to the possible desire to increase the number.

DIRECTIONS FOR SETTING UP INCUBATORS

The first step is to remove the crating and place the machine in the room in which it is to be operated. Then the different parts should be checked to make sure that no mistake has been made by the shipper. The detachable parts may be removed from the incubator and the legs fastened in place.

Legs.— The front legs should be securely fastened first and the machine raised to an upright position; then the rear legs may be screwed on in the same way and the incubator placed where it is to be operated.

Leveling.— The machine should be perfectly level to afford an even distribution of heat. To ensure this, a spirit level should be laid on the top, both crosswise and lengthwise. When the incubator is properly leveled, small blocks of wood or pieces of shingle may be placed under the legs, where necessary, to keep it in that position.

Regulator.— The regulating device for most incubators consists chiefly of (1) a wire connecting rod, (2) thumb screw, (3) counterpoise rod, (4) counterpoise weight, (5) regulator bar, (6) thermostat, (7) metal connecting tube, (8) base and pivot casting, and (9) disc. (See Fig. 19.) The apparatus shown represents only one type of regulator, and is used because it happens to be the one at hand. However, the principles followed are very similar in all machines.

The thermostat is a most important part of an incubator. The hatching qualities of a machine depend largely on the sensitiveness and power

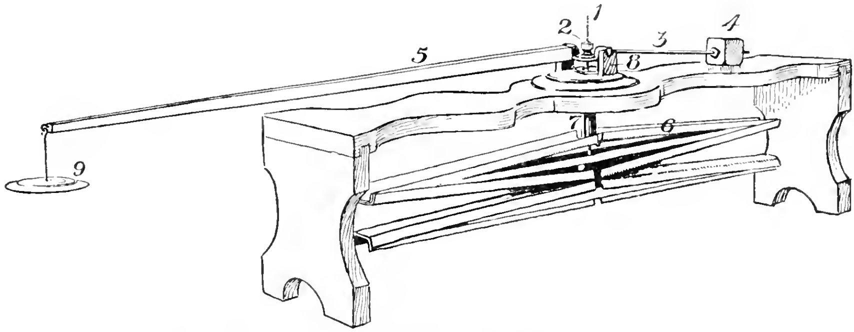


FIG. 19.—*A common type of regulating device with the parts properly connected*

of the thermostat. As the heat expands the thermostat, the latter, if it is properly connected, pulls down on the connecting rod that is fastened to the regulator bar by the thumb screw, raising the disc that is hooked to the end of the regulator bar over the heater and thus allowing the surplus heat to escape. As the heat is lowered the thermostat contracts, allowing the disc to drop down on the heater. The thermostat is usually in place when the incubator comes from the factory, but if found loose or detached little difficulty should be found in screwing it in place.

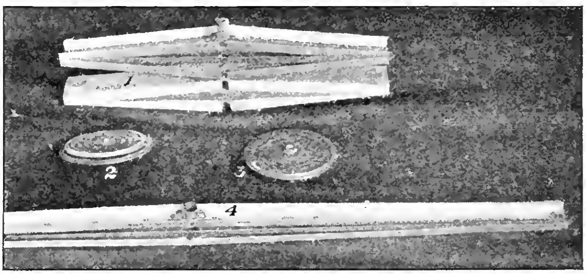


FIG. 20.—*Several styles of thermostats*

There are several styles of thermostats now on the market, as seen in Fig. 20. This illustration shows (1) the six-bar type; (2) the double-disc; (3) the single-disc; (4) the three-bar type. The style most commonly used is composed of three metal bars, usually a bar of steel between two bars of zinc. These bars are riveted together at both ends and expand in the center when heated; therefore the connecting rod is passed through the bars at this point and fastened to the lowest.

FIG. 21.—*Four-bar thermostat*

(See 4, Fig. 20.) The six-bar thermostat is merely two three-bar thermostats riveted together. (See 1, Fig. 20.) Each of these styles is very satisfactory. The wafer or disc thermostats (see 2 and 3, Fig. 20) are usually made of copper and filled with a very sensitive fluid. They are very susceptible of a slight change in temperature.

In addition to the types shown in Fig. 20, there is a four-bar thermostat that is both sensitive and powerful. (See Fig. 21.) It is composed of two bars of steel and two bars of zinc, which are riveted together in such a way that the expansion is greatest at one end. To this end the connecting rod is fastened.

Regulator bar.— The regulator bar should be placed so that the pivot casting rests squarely on the base casting, as indicated in Fig. 19, with the disc, when attached, hanging directly over the exhaust in the top of the heater. The disc should cover the exhaust evenly, entirely closing the exhaust hole when down; otherwise some heat will be lost and the effectiveness of the thermostat's action lessened.

Placing the connecting rod.— The connecting rod is passed down through the connecting tube and into the hole in the top of the thermostat. In some incubators the connecting rod passes through the thermostat and is fastened by screwing a nut to the bottom of the rod; in others, the rod simply screws into the thermostat; either way is satisfactory.

Counterpoise rod and weight.— The counterpoise weight is usually adjusted on the rod before leaving the factory and should not be moved unless it has been pushed back so that it overbalances the bar, preventing an easy action of the bar when lightly pressed down from the wire connecting rod. In the latter case, the weight may be moved until the bar works freely when the thumb screw on the connecting rod is loose above the bar.

The counterpoise weight should never be moved to regulate the heat.

The heater.— The heater comes already attached to the incubator, and no changes should be made unless it has been damaged. The heater should be gas-tight, fireproof, strong, and constructed of a material that will hold all the heat given off by the lamp, thereby making it necessary to run only an ordinary flame, with an economical use of oil. The heater should be cleaned very carefully and thoroughly, especially if the lamp has smoked. A wire with a cloth fastened to one end should be used and the cleaning done by inserting the cloth into the opening and twisting it until all the soot is removed. The isinglass should be cleaned thoroughly after the soot is removed, otherwise it will be difficult to see the flame. An oily cloth should never be used in cleaning incubator heaters. In case the isinglass is broken, it should be replaced in order to prevent fumes from getting into the machine and to protect the flame from draughts. Fig. 22 shows the different parts of the heater.

Felts and diaphragms.— Several types of machines have felts or burlap diaphragms in the bottom. The operator should be sure that these are arranged properly before undertaking to heat the machine. To remove these felts or diaphragms while eggs are being incubated, except as advised by the makers, would greatly lessen the hatching power of the incubator in most cases.

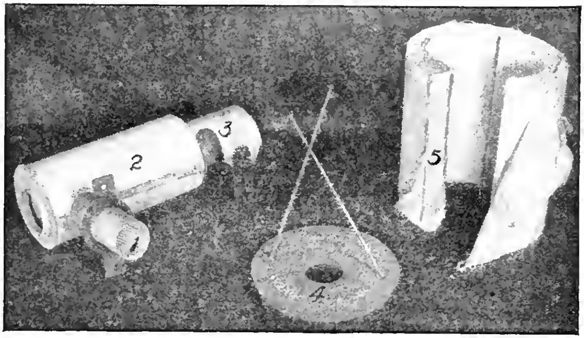


FIG. 22.—*Parts of heater. 1, Screen; 2, fume exit; 3 (below 2), fresh air entrance; 4 (below 3), metal cap; 5, asbestos jacket*

Thermometer.–When the machine is in operation the thermometer should be kept in the place designated by the incubator manufacturers. No other make of thermometer than the one recommended by the incubator company should be used. The most common types are the contact, the standing, and the hanging thermometer (see Fig. 23).

Testing thermometers.— A new thermometer should be tested before using; an old one should be tested each season. To test successfully, a

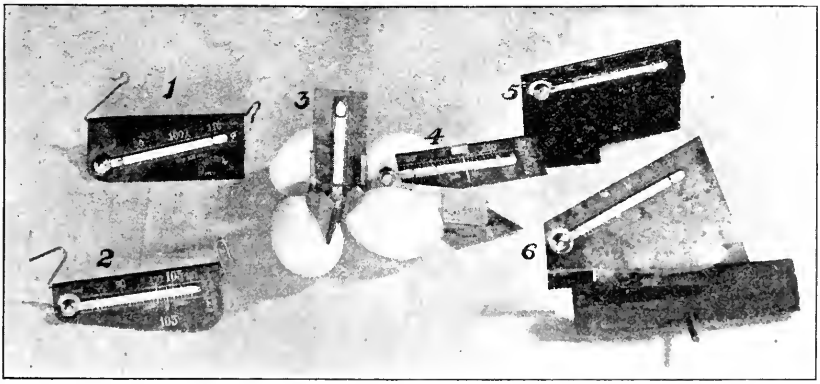


FIG. 23.—*Several styles of thermometers. 1 and 2, Hanging; 3 and 4, contact; 5 and 6, standing*

physician's clinical thermometer should be used, or any standard thermometer that registers correctly between 100° and 110° F. The two bulbs should be dipped together in water registering about 100° F. If the incubator thermometer varies, the amount of variation may be marked on the back of the thermometer, or on a tag tied to it, and the machine run accordingly. If the difference is great, the thermometer should be returned to the company that furnished it.

Should the mercury become separated, it may usually be brought together by swinging the bulb downward quickly, or by running the temperature up several degrees above the point indicated by the separated mercury.

INCUBATOR CELLARS

An ideal incubator cellar is a very valuable factor on a large poultry farm, or in case enough eggs are to be incubated each year to make it necessary to operate several machines. Otherwise, a clean, well-ventilated dwelling-house cellar, or other room, with proper precautions may be used. If a cellar originally designed for other purposes is available it should be thoroughly cleaned. Good ventilation should be provided, and it may be obtained by opening the windows and placing a thin muslin curtain over each opening. There should be at least two windows arranged in this manner even when only one machine is operated. In very cold weather the windows may be partly closed, especially on cold nights.

When a cellar is not available, a room above ground may be used, but the best conditions for successful artificial incubation prevail in a room that is partly under ground. There it is easier to keep an even temperature and to retain moisture.

If possible, incubators should be operated in a building used for no other purpose.

Location.— If a cellar is to be built especially for the incubators, a site should be chosen far enough from the other buildings to avoid great loss from fire in case of accident, but not so far away that it would be inconvenient to reach. Sloping ground presents an ideal condition. The building may then be erected parallel with the slope, having one end of the incubator room in the slope almost entirely below ground, the other end coming out above ground, or nearly so, thereby making it possible to secure good air and drainage. This is shown in Fig. 24.

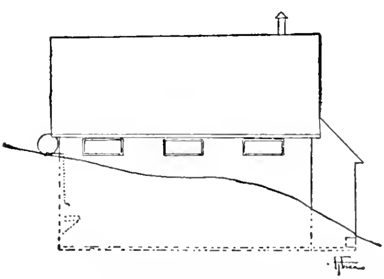


FIG. 24.—*A good location for an incubator cellar*

The building.— A high ceiling is especially beneficial. A room ten feet high and with a distance of seven feet from the floor to the bottom of the windows is very satisfactory. If properly placed, windows are not at all objectionable in an incubator cellar. If hinged at the bottom they may be allowed to drop part-way open and there be securely fastened by a small chain or strong cord. In this way the air passes over them and

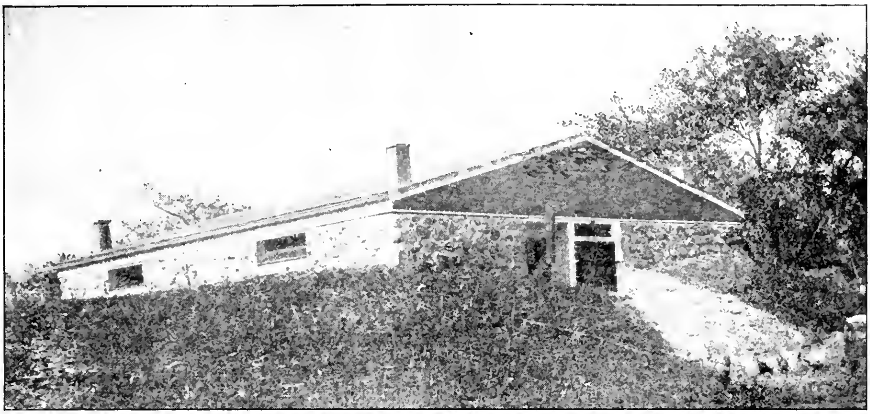


FIG. 25.—*A good incubator cellar*

into the room, an arrangement that does not permit direct draughts to reach the incubators. It is also advisable to place muslin curtains over the windows that are left open permanently, the other windows affording most of the light. The latter may be shaded in case the sun shines through on the incubators or affects the temperature of the room.

Fig. 25 represents the writer's idea of a very good incubator cellar.*

THE OIL SUPPLY

A considerable amount of labor may be saved by piping the oil to the incubator room. This is often done by placing an oil tank under ground a few feet from the cellar wall, the oil being conveyed from the tank to the cellar by means of a small pipe. This pipe is connected with one or more faucets. A very simple and inexpensive arrangement is shown in Figs. 26 and 27. The framework on which the oil barrel rests is made of planks about twelve inches wide. The upper edges of these planks are cut so as to conform to the shape of the barrel. The barrel should be placed in the shade to prevent evaporation of the oil. The north side of the build-

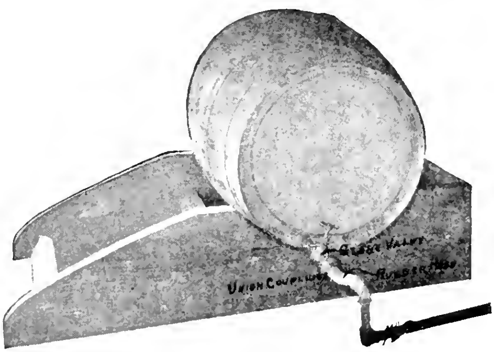


FIG. 26.—*The oil barrel in position*

* This picture was taken from Mr. Joseph Tolman's incubator cellar at Rockland, Mass.

ing is the preferable location. Should this position be inconvenient, the barrel may be placed on the east or west side under an open shed.

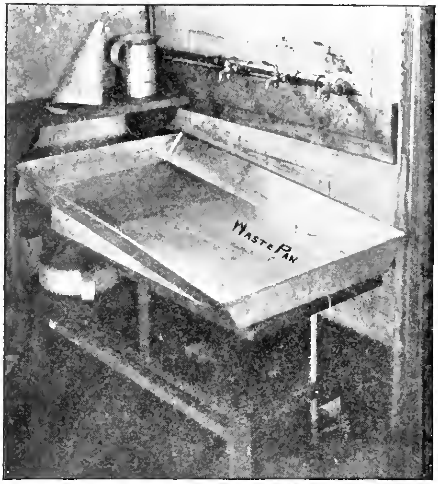


FIG. 27.—*The interior arrangement for drawing the oil*

A short pipe, with a faucet attached, should be screwed into the spigot opening of the barrel. The barrel may then be rolled into place and the faucet connected by a short rubber hose with the pipe leading into the cellar.

The oil faucet in the cellar should be placed in a convenient location, preferably in a corner at some distance from the incubators. A drip pan should be placed underneath the faucet to prevent waste of the oil. A small table on which to place the lamps should be provided near the faucet.

THE CORNELL READING-COURSES

With the October Reading-Course Lesson a new publication, known as The Cornell Reading-Courses, was begun. This is to be an enlargement and revision of the Farmers' Reading-Course and the Farmers' Wives' Reading-Course that have been published by the College for ten years. The purpose of the Courses will be to place before the reader semi-monthly throughout the year a lesson on the Farm and one on the Farm Home, to the end that the reader may receive definite and consecutive information on important farm, household, and general rural problems. The lessons on the Farm Home, numbered from one to twenty-three inclusive by odd numbers, will be issued on the first of each month. The lessons on the Farm, numbered from two to twenty-four inclusive by even numbers, will be issued on the fifteenth of each month.

THE READING-COURSE FOR THE FARM

Definite series of lessons on the Farm, with two or three numbers in each series on such subjects as Soils, Dairying, Horticulture, Poultry, Animal Husbandry, and others, will be started this year, each series to carry a consecutive serial number. The remainder of the lessons in each series will follow as rapidly as practicable. The Reading-Course for the Farm will be a means, therefore, of keeping the reader in constant touch with the latest ideas on agriculture.

The first lesson of The Reading-Course for the Farm is entitled "The Soil," and was issued on October 15, 1911. It is the first of the series on the soil, presenting what the soil is and how it should be managed for the agriculture of the region of New York State. The numbers following in this series on soil will carry the reader to a further discussion of soil problems with special reference to particular crops.

The second lesson for the current year is the present bulletin entitled "Incubation — Part I." It is the first number in the new poultry series. The second number in the poultry series, "Incubation — Part II," will discuss the general details of operating incubators and will be issued on December 15, 1911. The third number, to be issued on January 15, 1912, will be on "Feeding Young Chickens."

The following is a list of the back numbers of the old Farmers' Reading-Course that are still available:

4. Plant-food from the Soil.
5. Plant-food from the Air.
7. Computing Rations.
8. Sample Rations.
9. Soiling, Silage and Roots.
10. Pastures and Meadows.
21. The Care of Milk on the Farm.
22. The Composition of Milk and Cream and Their By-Products.
23. Dairy Stables.
24. Farm Butter-Making.
25. The Dairy Herd.
27. Tasteful Farm Yards.
28. The Plan of the Farm-House.
29. Water Supplies for Farm Residences.
30. Barns and Outbuildings.
34. Seed Corn for Grain and Silage.
36. Agricultural Extension.
37. Drainage.
38. Experiments.
40. Tillage and Fertilizing in Orchards.
41. Improving Plants by Selection or Breeding.
42. Improving Corn by Seed Selection.
43. Methods of Breeding and Improving the Potato Crop.
44. Horse-Breeding in New York State.

Those interested may secure these bulletins by addressing The Cornell Reading-Course for the Farm, Ithaca, N. Y.

The reader is encouraged to ask questions touching farming and rural conditions.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL. 1. No. 4 — ITHACA, N. Y. NOVEMBER 15, 1911 — POULTRY SERIES No. 1

INCUBATION.—PART I

DISCUSSION PAPER

A discussion paper is sent out with each Reading-Course Lesson, for two reasons: (1) We should like to have the reader's ideas on the subjects under discussion. On some of the points the reader has probably had experience that will be interesting and valuable to us. No matter what the Lesson says, if you have a different opinion on any of the subjects, do not hesitate to state it on this paper and give your reasons. (2) We should like the reader to use this paper on which to ask us questions. If there are any points that the Lesson has not made clear, or if there are problems in your farming, whether on the subject of the Lesson or any other, on which you think we may be able to help you, write to us on this paper.

THE NEXT READING-COURSE LESSON WILL BE SENT TO THOSE WHO RETURN TO US THIS DISCUSSION PAPER, WHICH WILL BE AN ACKNOWLEDGMENT OF THE RECEIPT OF THIS LESSON. This paper will not be returned to the reader, but we shall look it over as carefully as we would a personal letter and write to the reader if there are any points about which correspondence is desirable. The reader may consider this discussion paper, then, as a personal letter to us. It will be treated as such, and under no circumstances will the reader be quoted. As the discussion paper will contain written matter, it will require letter postage.

If you are not interested in this Lesson, there are others on other subjects, and we shall be glad to send any of them to you on request. The titles of the series of available bulletins of the Farmers' Reading-Course, which has been replaced by this publication, are: 1. THE SOIL AND THE PLANT. 2. STOCK FEEDING. 3. ORCHARDING. 4. (Out of print.) 5. DAIRYING. 6. FARM BUILDINGS AND YARDS. 7. HELPS FOR READING. 8. MISCELLANEOUS. 9. BREEDING.

Bulletins in The Cornell Reading-Course for the Farm Home may be obtained by addressing Miss Martha Van Rensselaer, Supervisor.

1. Name the four essentials for successful incubation.

2. How should a nest box be arranged for a sitting hen?

3. What care should the sitting hen receive?

4. Distinguish between the diffusion type and the radiation type of incubator.

5. Describe the various steps in setting up an incubator.

6. Why should a new thermometer be tested?

7. Describe the place in which you operate your incubator. How does it compare with the conditions described in this bulletin?

8. Why is a cellar preferable to a room above ground?

9. What should be done regarding sunlight in an incubator room?

10. What is your present method of supplying oil for the incubators? Could this system be improved economically?

Name ....

Address ....

The Cornell Reading-Courses

LESSON FOR THE FARM

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL 1. No. 6 | ITHACA, N. Y. DECEMBER 15, 1911 | POULTRY SERIES No. 2

INCUBATION.—PART II

F. T. FINCH

The operation of the incubator is but one of several factors determining the success of a hatch; yet it is possible, through carelessness or neglect in such operation or through ignorance of the principles of incubation, to destroy completely the hatching power of strong and fertile eggs. On the other hand, careful and intelligent operation may secure excellent results from strong eggs and really satisfactory results from weaker eggs. By slightly changing his methods the experienced operator is able to counteract, to some extent, the effect of certain mistakes in operation. Success in artificial incubation comes only through a thorough understanding of the factors discussed in this lesson.

THE LAMP

Care of the lamp.— The results of incubation will depend largely on the care given to the lamp, for which one person should be responsible. No one else should raise or lower the flame, or interfere with the lamp in any way except to prevent an accident. The lamp should be filled, the wick trimmed, and the burner cleaned once daily.

Filling the lamp.— A regular hour should be assigned for filling the lamp, preferably in the morning and *never at night*, and all other work should be arranged to conform to this time; otherwise the lamp may be neglected and serious results may follow. The best time in the morning for this work is immediately after the eggs have been cared for. If the lamp is handled before the eggs are turned, the hands may become oily and thus soil the eggs. Incubator lamps should be filled to within one half inch of the top, and never completely full. Only the best grade of oil should be used. Before replacing the lamp, the oil should be carefully wiped off with a cloth kept for the purpose.

Trimming the wick.— A square, clean-cut flame is preferable. The proper method of trimming the wick is to throw back the burner top, turn the wick down slightly, and cut away the burned part. If scissors are used, they should be placed flat on the wick tube and the wick cut straight across, the burned part being severed at a stroke. Practically the same result may be obtained by drawing a burned match across the wick tube.

Cleaning the burner.— Before cleaning the wick tube, the wick should be turned down in order that it may not be disturbed and the flame thus be made irregular. All the black material should be removed by sand-paper, a knife, or some other sharp instrument, and the tube should be wiped with a cloth. Care should be taken not to bend the wick tube, as such bending will prevent the wick from working freely. The other parts of the burner should be well cleaned. The screen around the wick tube should be cleaned once a week, and the burner should be boiled at least once a season in hot water containing washing powder.

Regulating the flame.— A new wick or one that is newly trimmed should be watched at first to prevent the flame from running up and smoking. The flame should be maintained sufficiently high to keep the temperature at the proper degree and the disc raised slightly during the day. In case the room temperature drops at night, the surplus heat will be used to prevent a drop in temperature in the egg chamber. If the flame flickers, the operator should look for a broken isinglass in the heater and should see that the burner is in place and is working properly.

Regulating the heat.— The heat is regulated by turning the adjustment nut above the regulator bar on the connecting rod. By screwing up on the adjustment nut until the disc over the heater drops flat on the heater exhaust, all the heat will pass into the machine and the temperature will be increased. By screwing down on the adjustment nut and thus raising the disc, the heat will be allowed to escape. When the proper temperature has been reached, the thumbscrew should be turned until the disc is about one eighth of an inch above the heater. When once correctly regulated, the temperature will vary only slightly if proper care is given to the lamp flame. Outside temperature changes should be met by altering the lamp flame and not the regulator; as the chickens develop, however, more heat will be given off from the eggs, and the resulting increase in temperature will necessitate changing the regulator. *The eggs should never be placed in the incubator until the temperature is properly regulated.*

TEMPERATURE, MOISTURE, AND VENTILATION

Temperature.— After the eggs have been placed in the machine, the temperature will drop and remain low for some time; it will then gradually rise, taking perhaps twelve to fourteen hours to reach the desired degree. The operator should not attempt to run the heat up too rapidly, but should allow this gradual increase. When the correct degree is reached, the incubator should be run with only slight variations. Although it is best to maintain an even temperature, it is not always possible to do so, and an occasional variation of one half degree, or slightly more, will not result seriously if the average temperature is correct. A high temperature should be avoided, especially at the beginning of incubation. The temperature should be read through the glass door, which should be opened as little as possible.

Temperature, first week.— The position of the thermometer should always be considered in determining the proper temperature to maintain. If the thermometer hangs above the trays, as it does in some incubators, thereby registering the temperature of the air and not that of the eggs, the actual temperature of the eggs is one to one and one-half degrees lower the first week than the registered temperature. Therefore, in order to give the eggs the proper amount of heat the first week, when hanging thermometers are used, it is necessary to keep the temperature at 102.5° or 103° F.; with contact thermometers, the temperature should be 102°. Contact thermometers should always be placed between two fertile eggs.

Temperature, second week.— The temperature within the incubator is less influenced by that outside after the first week, owing to the increasing amount of animal heat given off by the growing embryos. With hanging thermometers the mercury should be held at 103° F., while with contact thermometers the heat should be increased to 103° F.

Temperature, third week.— The temperature should be maintained as near 103° as possible up to about the eighteenth day, when it may be allowed to rise to 104°.*

Moisture and ventilation.— Oxygen is essential for the normal development of the embryo chick, the amount required increasing with the growth of the embryo. The eggs give off carbon dioxid, which is formed in the developing chick by the combining of carbon and oxygen, and this increases in amount as the embryo grows. The eggs need, therefore, only a comparatively small amount of air the first few days, as only a small amount of carbon dioxid is given off at the beginning of incubation. It is asserted by some authorities that the natural amount of carbon dioxid given off by the eggs is beneficial, on the ground that it aids in dissolving the carbonate of lime in the shells. Some experimenters go so far as to assert that it is really necessary for the successful development of the embryos. The writer is not yet ready to indorse this statement.

Excessive ventilation, permitting a rapid circulation of air in the egg chamber, would result in rapid evaporation of the moisture. Hence, for normal development it is necessary to provide moderate, well-controlled

*Directions for controlling the temperature after the eighteenth day are given under the heading "Hatching time."

ventilation throughout incubation, or at first to check ventilation and then to increase it as this becomes necessary. With either method it is essential that moisture be present to prevent undue evaporation. When the ventilation is checked it is not considered so necessary to supply moisture, because evaporation takes place much more slowly when the change of air in the egg chamber is lessened than when it is increased. The amount of evaporation of the egg contents may be controlled very successfully by maintaining a proper degree of humidity in air that is taken into the machine. The humidity under a sitting hen usually registers about 60°. If a non-moisture machine is operated in a room in which the air is dry owing to climatic conditions, or in which several incubators are being operated, it may be necessary to supply moisture.

Supplying moisture.— Unless the manufacturers so direct, moisture should never be supplied in an incubator.* If non-moisture machines are operated in a dry place, the floor of the room may be kept wet unless it is of wood, in which event pans containing water may be placed under the machines. The amount of moisture exhaled from a surface in a given space of time is governed by the extent of the surface and not by the depth of the receptacle. This principle should be remembered when supplying moisture in a room or in an incubator. With machines in which arrangements have been made for supplying moisture, certain days should be set for looking after the supply in order to avoid a possible chance of the moisture receptacle becoming dry. Moisture on the glass at pipping time usually indicates a good hatch, being due to the large amount evaporated from the chicks.

Controlling ventilation.— In some cases ventilation is controlled by slides over the ventilator openings, which are usually in the bottom of the incubator. With such machines it is a good practice to restrict ventilation the first week by keeping the slides closed, opening them gradually from the seventh day until they are wide open. The temperature of the room must be considered in regulating the ventilators, and the warmer the weather the wider they may be opened. Generally it is advisable to close the slides the nineteenth day. They may be opened again as soon as the hatch is completed, to admit plenty of fresh air. Some machines have additional ventilators to be opened only after the chicks are through hatching; these must not be mistaken for the ventilators to be used during incubation. Constant ventilation is provided in some types of incubators that are not fitted with slides. Such machines should never be tampered with. The necessity of following the manufacturers' directions in regard to ventilation cannot be too strongly impressed on the mind of the novice.

* The same amount of moisture placed above the eggs that is often placed underneath them would cause complete saturation and damage the hatch in most machines; hence, the manufacturers' directions should always be followed.

HANDLING THE EGGS

The eggs should not be placed in the incubator until it has been run for several days and properly regulated, and all directions have been followed in regard to setting up, special attention having been given to the manufacturers' directions concerning ventilators, felts, trays, etc. Eggs of a uniform size, shape, and color should be chosen so far as possible, and those with very porous or otherwise defective shells should be eliminated. (See Fig. 28.) A few more hours are usually required in hatching eggs from the heavy type of fowls than are needed for Leghorn eggs, so that it is not advisable to set the two kinds of eggs together in an incubator.

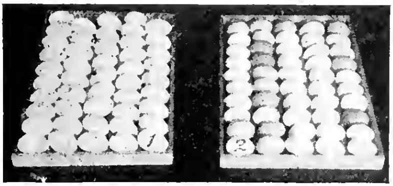


FIG. 28.—*Eggs for incubation: 1, Selected; 2, non-selected*

Turning the eggs.— From the time the eggs become thoroughly heated until the chicks issue from the shells, more or less evaporation of the egg contents takes place. Consequently, there is a tendency for the parts next to the shell to become dried to the shell unless the egg is well turned at frequent intervals. It is said that the sitting hen turns her eggs several times during the day and night; but conditions existing in artificial incubation do not admit of so many turnings. However, it has been found essential to turn the eggs twice daily, beginning twenty-four to thirty-six hours after they are put in the incubator and continuing up to the nineteenth day, on and after which the machine should be kept closed. The additional fact that incubators, as a rule, do not supply the same amount of heat to each egg makes it doubly necessary, not only that the eggs be well turned twice each day, but that their positions on the trays be changed as regularly as they are turned. Regularity in turning has much to do with the success of the hatch. The best time to turn the eggs is the first thing in the morning and the last thing at night. This arrangement not only enables the operator to have a specified time for doing the work, but it keeps the turnings as far apart as is conveniently possible and equalizes the space of time between turnings — two important factors.

FIG. 29.—*Turning eggs*

Since the principal reasons for turning eggs are (1) to prevent drying to the shell and (2) to equalize the heat, it is necessary that the eggs be given a thorough shuffling. (See Fig. 29.) This may be done satisfactorily by rolling them around on the tray with the flat of the hands. They must not be shoved roughly against one another nor rolled harshly. The tray may be turned end for end at each turning of the eggs; and if two trays are used they may be interchanged at one turning and turned end for end the next time.

Cooling.— The successful cooling of eggs during incubation counterbalances, to some extent, the still imperfect methods of ventilation. To cool eggs properly, one must consider the length of time they have been incubated, the weather conditions, and the room temperature. It is not known just how much cooling is necessary for the best results, nor can a time-table be made that will work successfully with all types of incubators and under the varying atmospheric conditions. But the fact that eggs incubated by hens undergo more or less cooling and hatch well, makes it appear essential that those artificially incubated be treated correspondingly. Results prove this theory to be true.

It has been shown that excessive ventilation causes a too rapid evaporation of the egg contents. Eggs cooled too much are affected similarly. Therefore, for the first seven days it is best not to leave them out of the machine longer than is necessary for proper turning. The length of time to cool may be determined by touching several eggs to the eye or the lips. If sufficiently cooled, the eggs will feel cool at first touch. They should never be left out long enough to become cold. Some authorities assert that it is possible to govern the amount of cooling, to a certain extent, by comparing the size of the air cells with those undergoing the natural process of incubation, notwithstanding the fact that the air cells of different eggs in the same machine will vary in size. If the general tendency of the incubator eggs is to have larger air cells than those under hens, less cooling is necessary, and *vice versa*. This method, however, is fast becoming unpopular. By observing the air cells of eggs being incubated in various machines at this Station, each operated by a different person, it has been found that eggs in moisture machines usually have smaller air cells than those in non-moisture machines. This fact does not appear to have any material influence on their hatching power, as there was no great difference in the percentage of chickens hatched. The above instance is verified by extended observations and experience with many incubators operated at one time under practically ideal conditions. Little dependence should be placed on the relation of the size of the air cells to cooling. It is highly probable, however, that cooling, ventilation, and moisture have some influence on the size of air cells.

When cooling is begun it will take only a very few minutes, perhaps four or five, to cool the eggs sufficiently, the length of time depending on the temperature of the room. The cooling should be gradually extended over a longer period as the embryo grows. In warm weather thirty to sixty minutes may be needed to air the eggs properly during the latter stages of incubation. On very sultry days extra cooling is beneficial; less is desirable on cool days. In cold weather only a comparatively short time will be required to cool the eggs sufficiently. Cooling may be done after either the morning or the night turning, or at both times. If the eggs are cooled twice daily, only half as long a period each time should be required.

Eggs may be cooled on a table, or perhaps on the incubator. Some authorities advise cooling in the machine by dropping the door. If the latter method is used, it is not generally advisable to cool the eggs so long a time as in the former cases. While the doors remain open the heat is constantly escaping, and the incubator becomes cooled as well as the eggs. A longer time is then required to bring the egg chamber back to the proper temperature than when the eggs are cooled outside and the incubator kept closed. If the machine contains a moisture pan the door should not be left open in cold weather. Cooling should be discontinued on the nineteenth day.

A great many accidents may be avoided if the operator forms the habit of looking at the incubators before leaving the room, making sure that the doors are closed and that everything is in place.

TESTING

Probably the most important of the several reasons for testing eggs during incubation is to learn the percentage of fertility and the strength of the germs. When these conditions are known to be unsatisfactory, it may be possible to make such changes in the mating or in the environment as will add to the fertility and strengthen the germs, thereby increasing the percentage of eggs that will hatch and also improving the quality of the chickens. When three or four incubators are started at the same time, the eggs left in one machine may be divided among the others, thus saving oil and lessening the labor. Removing the dead germs helps to prevent bad odors that are sure to accumulate when eggs are being incubated. Odors from duck eggs are more noticeable than from hen eggs. If in an incubator, it is the more necessary that the bad eggs be removed.

Carefully tested infertile incubator eggs, if put on the market promptly, may be sold for a certain percentage of their original value. Incubator eggs offered for sale should, of course, always be so labeled. In large cities they are used in bakeries and for family cooking. There is no reason why such eggs should not be used. They are, without doubt, as good as or better than many of the so-called fresh eggs on the market. If white eggs are being incubated and those that are infertile are to be sold for cooking purposes, they may be tested the fourth or fifth day. Brown eggs are less easily tested and it is usually advisable not to test them before the sixth or seventh day.

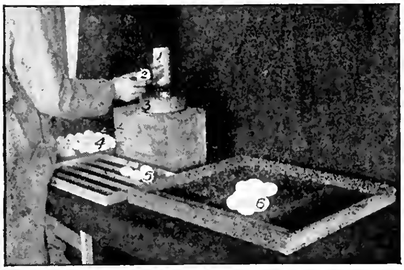


FIG. 30.—*Testing eggs: 1, Common tester; 2, egg properly held; 3, incubator lamp; 4, untested eggs; 5, infertile eggs; 6, good eggs*

For the best results, the eggs should be tested first on the seventh day of incubation and again on the fourteenth day. A common method of testing is illustrated in Fig. 30. If the germs are strong and the eggs have been properly incubated, only a few dead germs should be found on the second test. It is better to do the testing at night unless the room can be darkened. A convenient movable room for day or night testing is easily constructed at a low cost, as follows: The framework may be made of 2 x 2 inch lumber, the sides and back covered with thin lumber down to about 1½ inches from the floor and painted black on the inside; or heavy black cloth or paper may be used in place of the latter. Black cloth is preferable to lumber for covering the top, as the former will allow the heat to escape. The size of the room is governed by the space it is to occupy and by the size of the egg trays. A dark-colored window shade or black cloth should be hung in front. A hole a little smaller than an ordinary egg should be cut in the back, sufficiently high, and at the proper distance from the sides of the room, to be convenient in testing eggs held in the right hand. The work is less tiresome if this opening is directly opposite the right arm and as low as possible without causing the operator to stoop. A shelf for the egg trays should be placed inside, across the back, and another underneath to hold the baskets or trays for the tested eggs. On the outside of the back a third shelf must be provided, to hold the lamp that is used in testing. Any ordinary lamp that can be fitted with an egg tester will answer the purpose, provided it gives a good flame; or a "rochester burner" may be used without the tester by placing asbestos between the testing room and the chimney. In case a tester is used, the front should be placed against the hole in the testing room. By placing casters on the four legs the testing room may be moved from one incubator to another, thus avoiding the extra labor of carrying the eggs to and from the tester. This arrangement will prove a decided advantage in connection with a large egg capacity, and testing may be done very well during the daytime. The construction of this testing room is shown in Figs. 31, 32, and 33.*

* Mr. Robert Herman, of Lakewood, N. J., originated a room very similar to the one here shown.

If the operator prefers to do the testing at night, a common tester and a house lamp are sufficient for the purpose. On bright, sunny days

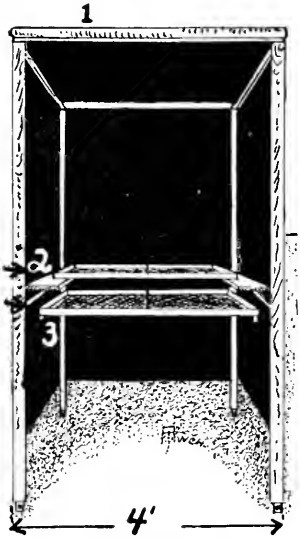


FIG. 32.—*Interior view of testing room: 1, Curtain rolled; 2, shelf and tray for untested eggs; 3, shelf and tray for infertile and dead germ eggs*

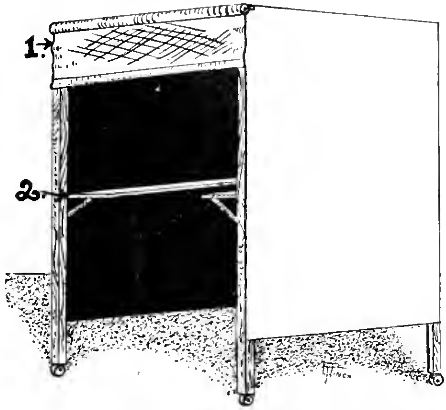


FIG. 31.—*Movable testing room: 1, Curtain; 2, shelf*

testing may be done accurately without a testing room by using a frame that fits tightly against a window facing the sun. This frame should be covered with heavy black cloth or paper, in which is cut a round or oval opening about the size of an egg. This arrangement is illustrated in Fig. 34.

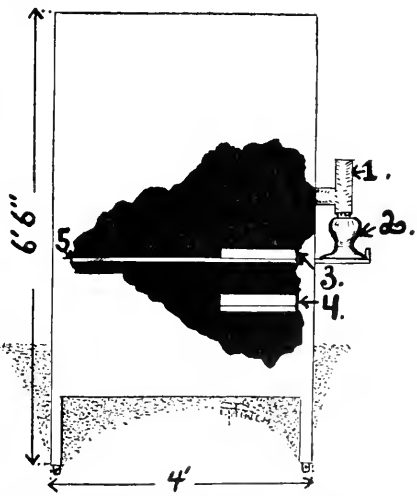


FIG. 33.—*Side view of testing room cut away, showing: 1, Tester; 2, lamp; 3, egg tray; 4, tray for infertile and dead germ eggs*

During winter weather it is advisable to cover the eggs while testing. This is not necessary in a warm room unless the eggs are out of the incubator for some time. In case the first test is made on the seventh day of incubation, the live germ, if strong, will show distinctly the blood vessels branching in various directions. The germ should be centrally located in this network of blood vessels and is usually found near the air cell, provided the egg is held with the large end up. A live embryo is easily moved by turning the egg about. Occasionally the germ will be hardly visible, but its presence is readily detected by a darker appearance of the egg contents than is shown by an infertile egg. If for any reason the person doing the testing is in doubt as to whether a germ is alive or dead, it is well to mark the egg and test it later; this practice will help to make the operator more expert and will add interest to the work.

An infertile egg looks like a fresh egg, the only apparent difference being in the size of the air cell. In Fig. 35 may be seen several types of eggs and conditions of development as they appear after seven days of incubation. Dead germs are found in various forms and sizes on the

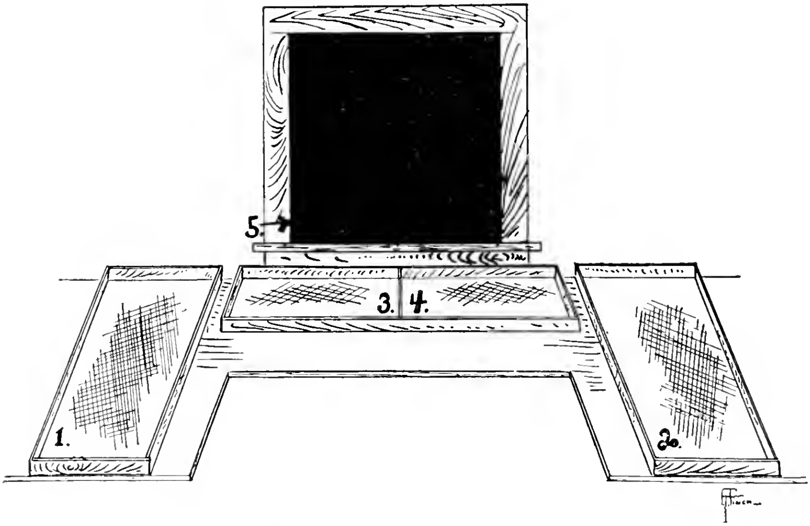


FIG. 34.—*A convenient arrangement for sunlight testing: 1, Tray for untested eggs; 2, tray for good eggs; 3 and 4, trays for infertile and dead germ eggs; 5, curtain in place*

seventh day, the most common of which are shown in Fig. 36 (2, 3, 4, 5, and 6). All of these should be discarded. Blood rings, also shown in Fig. 36, are caused by the bursting of the blood vessels, due to overheating or to an otherwise weakened condition.

The second test is more difficult to make than is the first. Many of the weaker germs will not differ materially in appearance from those that are dead, and some that have died within a few days of the test cannot be distinguished from the living embryos. However, if an egg contains a strong germ it will be dark and apparently fairly well developed; the space below the membrane forming the air cell will be filled, making the division dark and firm, and occasionally life will be denoted by motion within the egg. The less developed the embryo appears to be, the fewer are the chances of its hatching. Should the egg contents immediately below the air cell appear uneven and indistinct and the remainder of this division

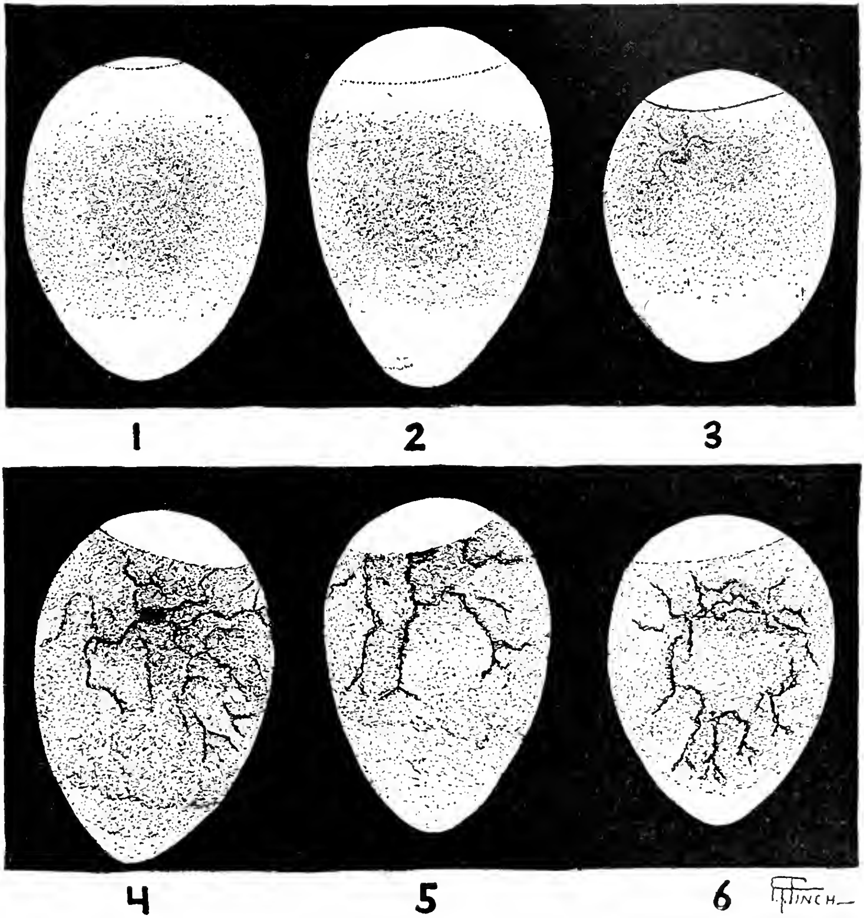


FIG. 35.—*Eggs as they appear when held before tester after seven days of incubation, compared with fresh egg: 1, Fresh egg; 2, infertile egg; 3, weak germ; 4, strong germ as most commonly found; 5, strong germ very near air cell; 6, germ not visible*

show no development of the embryo as in the other eggs, it may be concluded that the germ is dead.

In Fig. 37 are shown drawings of some eggs containing living germs on the fourteenth day of incubation, and of other eggs in which the embryo is dead. By comparing the air cells as shown in Figs. 35 and 36 with those shown in Fig. 37, it will be seen that the air cell increases in size during the first two weeks. This increase continues until about the nineteenth day, the size of the cell varying with the individual eggs in the same incubator or under the same hen. The air cells in eggs under the hen are

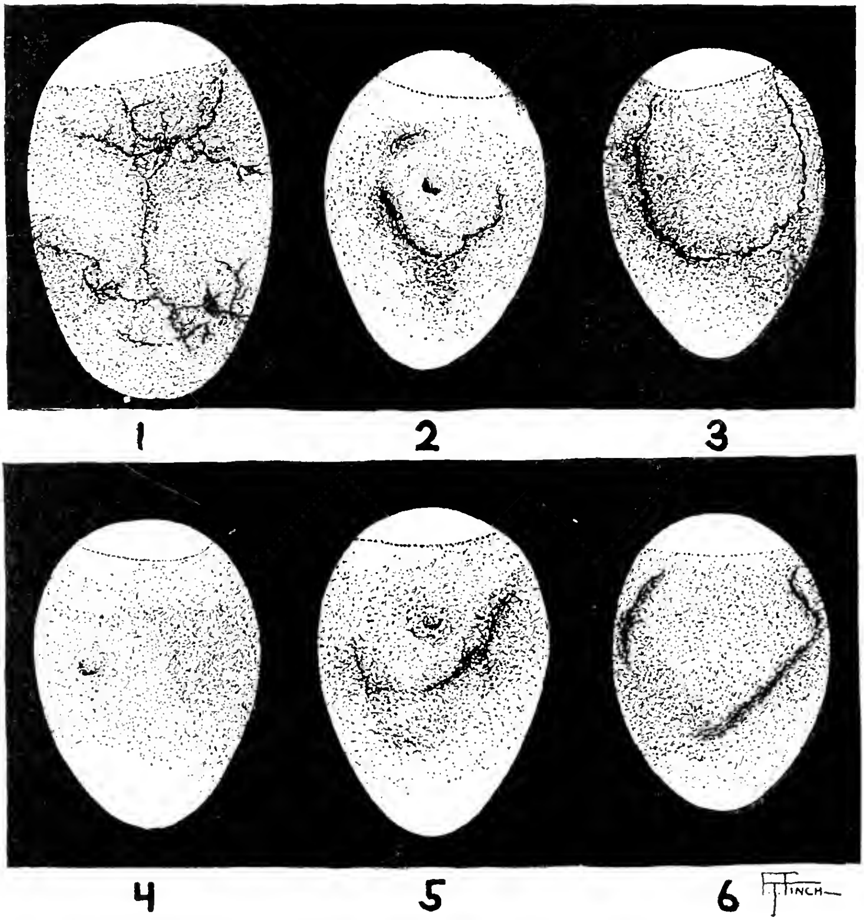


FIG. 36.—*Dead germs seventh day of incubation (2, 3, 4, 5, and 6), to be compared with a live germ as seen in 1 and in Fig. 35 (4 and 5): 1, Live germs in a double-yolked egg; 2, blood ring and germ stuck to shell; 3, blood ring; 4, floating germ; 5, floating germ and blood ring; 6, blood ring*

usually the smallest. Eggs incubated in a moisture machine generally have smaller air cells than those in non-moisture incubators. The air cell is ordinarily found at the large end of the egg, but occasionally one is found a little at one side or near the small end. Various positions of the air cell, and also the comparative sizes of the air cell at different periods of incubation, are shown in Figs. 38 and 39.

HATCHING TIME

This is a critical period, and special attention is necessary. In most cases the incubator door should not be opened after the nineteenth day,

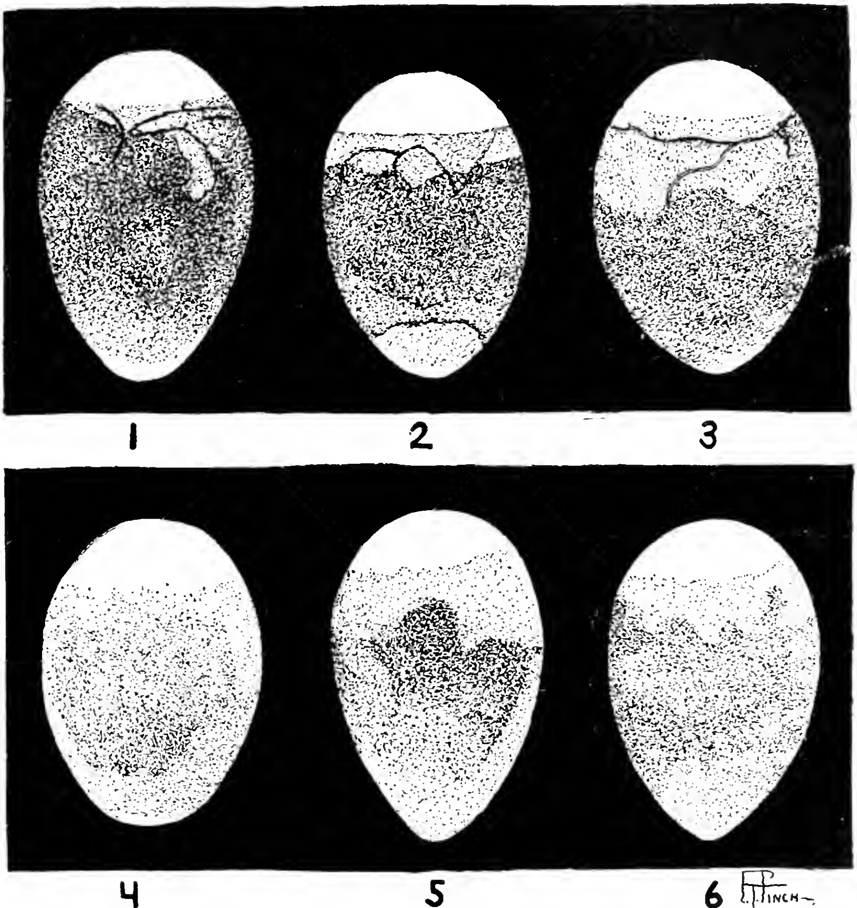


FIG. 37.—*Eggs at fourteenth day of incubation: 1, Strong live embryo; 2, live embryo; 3, weak live embryo; 4, 5, 6, dead embryos*

and all work requiring handling the eggs or opening the door should be completed on the eighteenth day. The trays should be so arranged that the chicks will drop into the nursery as they come toward the light. If the thermometer in use stands on the tray it should be securely fastened, otherwise the chicks will upset it; this would necessitate opening the machine in order to right the thermometer, or running the risk of a wide variation in temperature.

A temperature higher than 105° and one lower than 103° should be avoided at this time. Both of these undesired extremes will occur at some time during the hatching period unless careful provision is made against them. It would be much better to remove the lamp for a time than to permit the great increase in temperature that usually occurs when the hatch is at its best. Generally, this increase may be overcome by turning down the lamp flame. Very often toward the end of the hatching period it is necessary to raise the flame in order to keep the required temperature. These two changes in temperature in so short a time will be readily understood when it is remembered that the eggs supply a great amount of animal heat during the last week of incubation, and that this animal heat naturally increases as the chickens commence to work their way out of the shells. After the chickens are all hatched and have dropped into the nursery, the heat decreases. There is also more or less condensation of moisture from the newly-hatched chick at this time, and this has a tendency to lower the temperature.

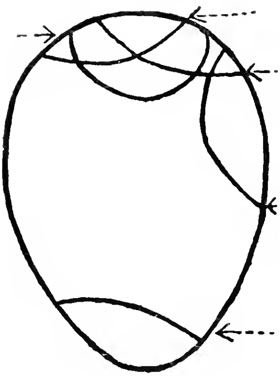


FIG. 38.—*Various positions of air cells*

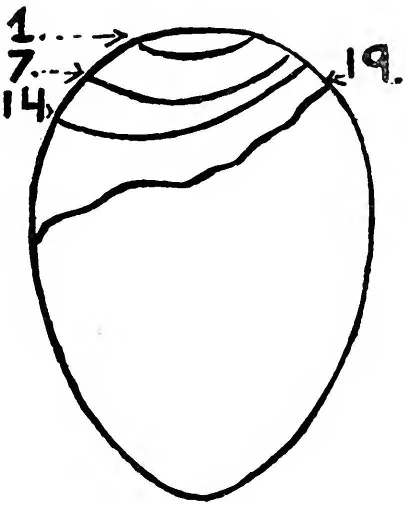


FIG. 39.—*Size of the air cell at different periods of incubation: 1 day, 7 days, 14 days, and 19 days of incubation*

The position of the ventilators at hatching time depends on the make of the incubator. It is not considered advisable to permit a very great change of air until the chickens are all out. After the hatch is completed the egg trays should be removed, together with any eggshells that may have dropped into the nursery, and the ventilators should be opened full width. If the room is warm the incubator door may be fastened open one half inch at the top.

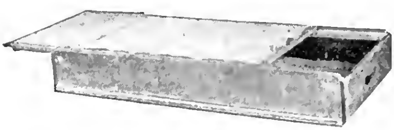


FIG. 40.—*A serviceable box for moving chicks from the incubator to the brooder*

The chickens should be left in the nursery until the day after the hatch. They should be thirty-six to forty-eight hours old when removed to the brooder. A box for transferring chickens to the brooder is shown in Fig. 40. If a market basket is used, it should be lined with burlap and a burlap blanket placed over the chicks.

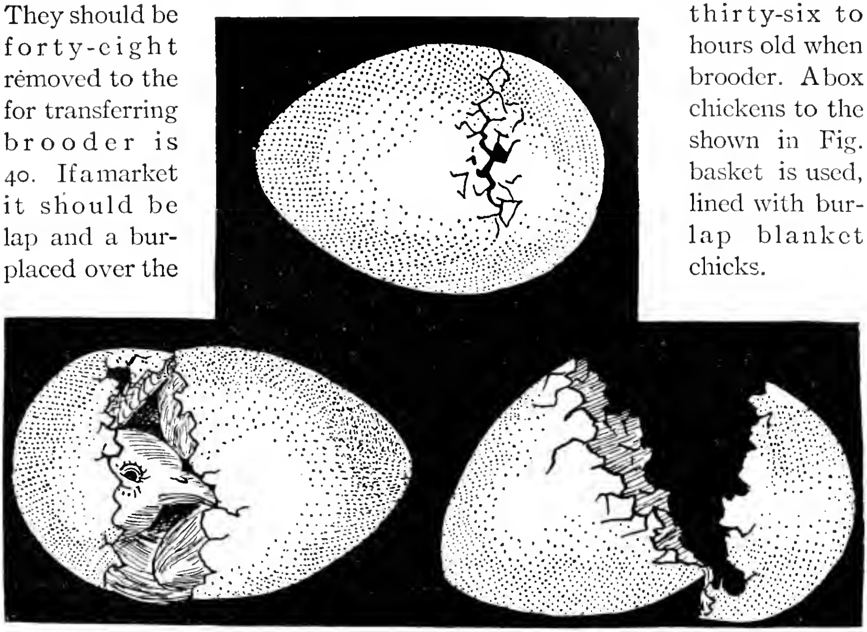


FIG. 41.—*Stages in the escape of the chick from the shell* (*Drawing by Finch*)

DISINFECTING

Absolute cleanliness is essential in incubators. The germs of the various communicable diseases most common among young chicks are sometimes carried on the eggshell. In order to guard against future infection, the incubator should be thoroughly cleaned and disinfected after each hatch. If eggs are used from flocks not absolutely free from disease, they should first be dipped in 95 per cent grain alcohol. The eggs should be dipped quickly and dried immediately.

To prepare for disinfection, all the portable parts of the incubator should be removed, as shown in Fig. 42, and should be washed with warm water containing a little soap powder. A putty knife or a stiff brush is excellent to use in removing the pieces of shell and down that stick to the egg and nursery trays. As often as the burlap in the bottom of the nursery becomes soiled, it should be replaced with clean burlap sacking.

After the parts have been thoroughly cleaned, they should be disinfected and placed in the sun to dry. A disinfectant should also be applied to the inside of the incubator. A spray pump or a hard brush is a convenient instrument for distributing this. The disinfectants used in the incubator cellar at Cornell University are creoline, zenoleum, and crude carbolic acid.* Either creoline or zenoleum may be recommended to do the work without having an injurious effect on the hatch, provided the directions are followed. Crude carbolic acid is a good disinfectant, but it has a very strong, disagreeable odor. There is also danger of leaving oily spots in the incubator unless the solution is kept well stirred. The odor from the two first-named liquids is mild and inoffensive. It is also

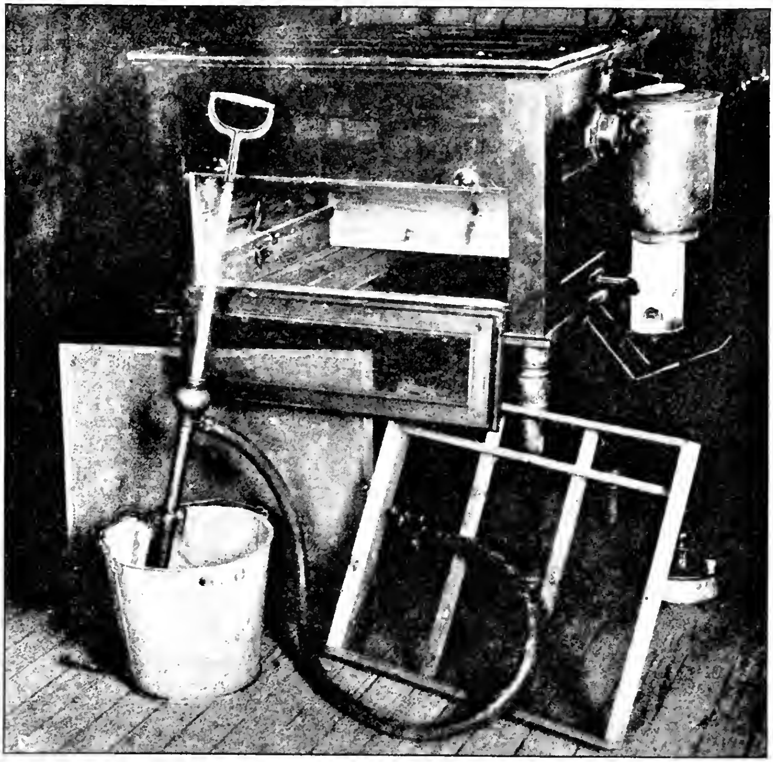


FIG. 42.—*The parts of an incubator and the spraying outfit, ready for disinfecting*

easier to dry the machine after their use. Of these two, creoline is the more expensive. In using any one of the three agents, the proper proportion is one part of the disinfectant to nineteen parts of water, the mixture being stirred thoroughly.

The incubator should be carefully dried and aired before it is used again. It is well to close the door of the machine for a day, keeping the lamp lighted, after which the door may be left open over night or until the incubator is well aired.

* Creoline, zenoleum, or crude carbolic acid may be purchased at most drug stores.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. Bailey, *Director*

Course for the Farm, Charles H. Tuck, *Supervisor*

VOL 1. No. 6 | ITHACA, N. Y. DECEMBER 15, 1911 | POULTRY SERIES No. 2

INCUBATION.—PART II

DISCUSSION PAPER

A discussion paper is sent out with each Reading-Course Lesson, for two reasons: (1) We should like to have the reader's ideas on the subjects under discussion. On some of the points the reader has probably had experience that will be interesting and valuable to us. No matter what the Lesson says, if you have a different opinion on any of the subjects, do not hesitate to state it on this paper and give your reasons. (2) We should like the reader to use this paper on which to ask us questions. If there are any points which the Lesson has not made clear, or if there are problems in your farming, whether on the subject of the Lesson or any other, on which you think we may be able to help you, write to us on this paper.

The next Reading-Course Lesson will be sent to those who return to us this discussion paper, which will be an acknowledgment of the receipt of this Lesson. This paper will not be returned to the reader, but we shall look it over as carefully as we would a personal letter and write to the reader if there are any points about which correspondence is desirable. The reader may consider this discussion paper, then, as a personal letter to us. It will be treated as such, and under no circumstances will the reader be quoted. As the discussion paper will contain written matter, it will require letter postage.

If you are not interested in this Lesson, there are others on other subjects, and we shall be glad to send any of them to you on request. The titles of the series of available bulletins of the former Farmers' Reading-Course, which has been replaced by this publication, are: 1. The Soil and the Plant. 2. Stock Feeding. 3. Orcharding. 4. (Out of print.) 5. Dairying. 6. Farm Buildings and Yards. 7. Helps for Reading. 8. Miscellaneous. 9. Breeding.

Reading-Course Lessons for the Farm Home may be obtained by addressing Miss Martha Van Rensselaer, Supervisor.

1. At what temperature would you incubate eggs during each week of incubation?

2. What are the conditions of temperature and of moisture in the room in which your incubator is operated? What results have you obtained?

3. Would you place eggs from different breeds of fowls in the same incubator? Have you noticed any difference in the time required to hatch brown eggs and white eggs when placed in the same incubator?

4. What has been your experience in operating ventilators (*a*) in your incubator? (*b*) In your cellar?

5. Describe fully how you would turn the eggs. What is the best time for doing this? Why?

6. How would you determine the amount of cooling that is necessary? How should this vary during the incubating period?

7. How often would you test eggs during incubation? Have you compared testing eggs by sunlight with testing them by lamplight? Which method do you prefer?

8. Describe how eggs in the following conditions should look when tested: (*a*) fertile; (*b*) infertile; (*c*) dead germs; (*d*) blood rings. What conditions are likely to be found on the seventh day, and what on the fourteenth?

9. Have you tried dipping eggs that are to be used for hatching? Do you think it worth while?

10. Describe fully the manner of disinfecting an incubator.

Name ....

Address ....

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL. 1. No. 8 — ITHACA, N. Y. JANUARY 15, 1912 — RURAL ENGINEERING SERIES No. 1

KNOTS, HITCHES, AND SPLICES

HOWARD W. RILEY

EVERY farmer uses rope in some way many times in a year, and therefore practical knowledge of correct methods of tying, hitching, and mending ropes has for him a real money value. Besides being a convenience, such knowledge may be the means of saving time on occasions when time is of very great importance; or it may prevent a serious accident due to the failure of a hitch that is incorrectly made or is of a kind not adapted to the work in hand. Thus, for instance, if the hay rope breaks during haying time just as a storm is coming up, ignorance of a good way of splicing it may cause delay, resulting in much loss in damage to the crop; or a horse tied about the neck with a knot that will slip may strangle himself if he begins pulling; or, again, in hoisting a timber an insecure hitch may let the timber fall, possibly at the cost of human life.

With these considerations in mind, this lesson has been prepared to show as clearly as possible each step in the quickest and easiest methods of making such knots, hitches, and splices as will be found most generally useful.

The list of applications of knots and hitches (p. 46) is given with the view of suggesting the kinds of knots and hitches best suited to particular lines of work. It is realized that this list is far from complete, and readers will confer a favor by mentioning other important cases to which some knots are especially adapted. Information as to wholly new knots or easier ways of making those here shown will also be appreciated.

HOW THIS LESSON MAY BE USED

General arrangement of the lesson.— The reader will note that the lesson as a whole is divided into sections, each section covering one particular part of the subject. Thus, one section contains the different methods for finishing the end of a rope to make a knob or to prevent the strands from untwisting; another takes up the ways of making loops in a rope; still another deals with the various kinds of splices. Great care has been taken to describe only such things as are of distinct practical use. It is realized, however, that busy farmers will not have sufficient time to study the entire subject. They will want to know, first, what parts of this lesson are most important for them to read, and second, what kinds of knots should be used for any particular piece of work. The answers to these questions are given in the following paragraphs:

Knots every farmer should know:

Coiling and uncoiling, Fig. 45, p. 51
Whipping, Figs. 51–55, p. 53
Wall knot, Figs. 56–60, p. 54
Timber hitch, Fig. 72, p. 57
Two half hitches, Figs. 73–74, p. 57
Clove hitch:
  Sailor's method, Figs. 79–81, p. 58
  Circus method, Figs. 84–86, p. 59
Miller's knot, Figs. 90–92, p. 60
Blackwall hitch, Figs. 99–100, p. 62
Square knot, Figs. 112–113, p. 65
Weaver's knot, Figs. 117–121, p. 65
Slip knot, Figs. 122–125, p. 66
Hitching tie, Figs. 126–130, p. 67
Bowline knot:
  Overhand method, Figs. 135–138, p. 69
  Underhand method, Figs. 139–141, p. 70
Long splice, Figs. 167–177, p. 76

Applications of knots and hitches:

Tying a horse or a cow:
  Hitching tie, Figs. 126–130, p. 67
  Halter tie, Figs. 131–134, p. 68
  Bowline knot:
    Underhand method, Figs. 139–141, p. 70
    Texas method, Figs. 142–146, p. 70
  Emergency rope halter, Figs. 194–195, p. 84
At haying time:
  Whipping, Figs. 51–55, p. 53
  Figure-eight knot, Figs. 67–68, p. 56

Blackwall hitch, Figs. 99–100, p. 62
Sheepshank, Figs. 103–107, p. 63
Rope tackle, Figs. 108–110, p. 64
Bowline knot:
Overhand method, Figs. 135–138, p. 69
Underhand method, Figs. 139–141, p. 70
Long splice, Figs. 167–177, p. 76
Renewing a broken strand, Figs. 178–179, p. 80
Handling bundles of corn or grain, or sacks of feed:
Emergency trip sling, Figs. 148–149, p. 71
Making loops in corn ties:
Halter tie, Figs. 131–134, p. 68
At threshing time:
Miller's knot, Figs. 90–92, p. 60
Painting a house:
Scaffold hitch, Figs. 87–89, p. 59
Bowline knot:
Overhand method, Figs. 135–138, p. 69
Underhand method, Figs. 139–141, p. 70
Building or moving a barn:
Timber hitch, Fig. 72, p. 57
Two half hitches, Figs. 73–74, p. 57
Timber hitch and half hitch combined, Fig. 76, p. 57
Clove hitch, Figs. 77–86, p. 57
Scaffold hitch, Figs. 87–89, p. 59
Taut line hitch, Figs. 93–94, p. 61
Blackwall hitch, Figs. 99–100, p. 62
Catspaw, Figs. 101–102, p. 62
Sheepshank, Figs. 103–107, p. 63
Square knot, Figs. 112–113, p. 65
Bowline knot:
Overhand method, Figs. 135–138, p. 69
Underhand method, Figs. 139–141, p. 70
Bowline on a bight, Figs. 148–150, p. 71
Spanish bowline, Figs. 151–153, p. 73
Harness hitch, Figs. 154–156, p. 73
Farmer's loop, Figs. 157–161, p. 74
Installing deep well pump:
Clove hitch, sailor's method, Figs. 79–81, p. 58
Miller's knot, Figs. 90–92, p. 60
Bundling lath:
Jam hitch, Figs. 95–97, p. 61

Tying packages:
- Two half hitches, Figs. 73–74, p. 57
- Jam hitch, Figs. 95–97, p. 61
- Crossing hitch, Fig. 98, p. 62
- Surgeon's knot, Fig. 116, p. 65
- Slip knot, Figs. 122–125, p. 66

Tying yarn:
- Weaver's knot, Figs. 117–121, p. 65

GENERAL INFORMATION REGARDING ROPE

Kinds of rope.— Rope is made of hemp, of cotton, or of wire. The last-named, being used very little by the farmer, will not be considered here. Cotton rope is of value mainly by reason of its softness, and should be used in making rope halters for young animals having tender skins. Because of its strength and durability hemp rope is universally used. Of late years the supply of true hemp has been insufficient to fill the demand, and a substitute has been found in the outer fibers of the leaves of a species of the banana plant grown in the Philippine Islands. The prepared fiber is exported from the city of Manila under the name of "manila hemp," the rope made from it being called manila rope.

"In manufacturing rope the fibers are first spun into a 'yarn,' this yarn being twisted in a direction called 'right hand.' A number of yarns are then put together and twisted in the opposite direction, or 'left hand,' into a 'strand.' Three of these strands for a three-strand or four for a four-strand rope are then twisted together, the twist being again in the 'right hand' direction. When the strand is twisted it untwists each of the yarns, and when the three or four strands are twisted together into rope it untwists the strands but again twists up the yarns. It is this opposite twist that keeps the rope in its proper form. When a weight is hung on the end of a rope the tendency is for the rope to untwist and become longer. In untwisting the rope it will twist the threads up and the weight will revolve until the strain of the untwisting strands just equals the strain of the yarns being twisted tighter. In making a rope it is impossible to make these strains exactly balance each other. It is this fact that makes it necessary to take out the 'turns' in a new rope, that is, untwist it when it is at work. The amount of twist that should be put in the yarns has been ascertained approximately by experience."*

In Figs. 43 and 44 are shown the end views of three-strand and four-strand ropes of the same size, a circle having been drawn about each in order that their solidness may be compared. In the three-strand rope the strands are larger than those in the four-strand rope, and yet the circle

* From a pamphlet issued by the C. W. Hunt Company, of New York.

in Fig. 43 is not so well filled as is the circle in Fig. 44. From this may be inferred what is really the fact: that four-strand rope differs from three-strand rope in that the former is stronger and more pliable, has a more even surface, weighs more per foot, and, being constructed on a core, the strands are kept away from the very center and therefore chafe one another less as the rope is bent around a pulley. The four-strand rope costs more per pound and there are fewer feet to the pound; nevertheless, it is a good investment if properly cared for. If absolutely necessary, a size slightly smaller than would be required in three-strand rope may be used, because of the greater strength and durability of the four-strand rope.

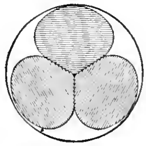


FIG. 43.—*Three-strand rope*

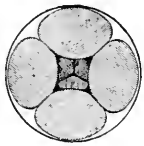


FIG. 44.—*Four-strand rope*

Rope data.— In the following table the figures given refer to average-grade manila rope, new and without knots. As explained later, knots weaken a rope. The "safe load" given in column V is the greatest load that a single rope should be made to carry, and it is about one seventh of the "breaking load," or one seventh of the pull in pounds required to break a rope of any given size.

TABLE 1. USEFUL FACTS ABOUT THREE-STRAND MANILA ROPE.

I	II	III	IV		V	VI	VII
Diameter (Inches)	Circumference (Inches)	Weight of 100 feet of rope (Pounds)	Length of each pound of rope Ft.	Ins.	Safe load (Pounds)	Breaking load (Pounds)*	Diameter of pulley (Inches)
3/16	9/16	2	50	0	35	230	1 1/2
1/4	3/4	3	33	4	55	400	2
5/16	1	4	25	0	90	630	2 1/2
3/8	1 1/8	5	20	0	130	900	3
7/16	1 1/4	6	16	8	175	1,240	3 1/2
1/2	1 1/2	7 2/3	13	0	230	1,620	4
5/8	2	13 1/3	7	6	410	2,880	5
3/4	2 1/4	16 1/3	6	1	520	3,640	6
7/8	2 3/4	23 2/3	4	3	775	5,440	7
1	3	28 1/3	3	6	925	6,480	8
1 1/8	3 1/2	38	2	7	1,260	8,820	9
1 1/4	3 3/4	45	2	2	1,445	10,120	10
1 3/8	4 1/4	58	1	8	1,855	13,000	11
1 1/2	4 1/2	65	1	6	2,085	14,600	12
1 3/4	5 1/4	97	1	0	3,070	21,500	14
2	6	113	0	10	3,600	25,200	16
2 1/2	7 1/2	184	0	$6\frac{1}{2}$	5,630	39,400	20
3	9	262	0	$4\frac{1}{2}$	8,100	56,700	24

* From the rules by C. W. Hunt and Spencer Miller

Size of pulleys.— When used for hoisting, as on a hay carrier or in a tackle, rope is continually bending and straightening as it goes around the pulleys. This bending causes the strands to chafe one another at the center of the rope. The smaller the pulley, the worse is the chafing; therefore, in order to avoid serious wear on a hoisting rope from this cause, it should be run over a pulley of a diameter not less than eight times the diameter of the rope, as shown in column VII of Table 1. Thus, a hay car carrying a $\frac{3}{4}$-inch rope should have rope wheels 6 inches in diameter, and for a 1-inch rope 8-inch wheels should be used; the wheels in the pulley blocks should be equally large or larger. In order to give economical service, rope used for transmitting power should be run over pulleys not smaller in diameter than forty times the diameter of the rope.

As mentioned above, the chafing in a four-strand rope is less than that in a three-strand rope, and for this reason if small pulleys are absolutely necessary or are already on hand a four-strand rope should be used.

Weakening effect of knots.— Knots weaken a rope because the rope is bent in order to form a knot and the outside fibers take most of the strain at the bend, with the result that they are overloaded and break; this throws the strain on the fibers below, which later break, and soon the entire rope is gone. The knot that weakens the rope least is the one requiring the least abrupt bending. Thus, in making a timber hitch (Fig. 72) the rope that carries the load is bent very gradually in passing around the timber, and is weakened but 35 per cent; while in making a weaver's knot (Fig. 120) the bend in the loaded rope is abrupt and the rope is weakened 50 per cent. The following table shows the percentage of strength left in a straight rope of any size, after any one of the knots mentioned has been tied in the rope. The strength of the rope when tied in knots not given may be estimated by comparison.

TABLE 2. APPROXIMATE EFFICIENCY OF KNOTS, HITCHES, AND SPLICES*

	Straight rope	Eye-splice over an iron eye	Short splice	Timber hitch, anchor bend	Clove hitch, running bowline	Square knot, weaver's knot	Over-hand knot
Efficiency of the knot.	100	90	80	65	60	50	45

Care of rope.—(1) Storing. Rope is sold by the pound, so it is usually stored by merchants in their cellars. This is bad for the rope. Rope

* From experiments by Professor E. F. Miller, Massachusetts Institute of Technology.

should be kept dry, and if wet it should be laid in the sun until all dampness is gone before it is coiled.

(2) Coiling and uncoiling. Because of the way in which rope is twisted in its manufacture, it must always be coiled and uncoiled in certain definite ways to avoid trouble from kinks. The usual method is to coil the rope around "with the sun," or with the hands of the clock, as shown by the arrow in Fig. 45. In this case, in uncoiling turn the coil over and draw the end A up from the inverted coil; or the end last laid down may be drawn off the top of the coil if desired. If end A is drawn up through the center of the coil as shown in the cut, the rope will twist and kink.

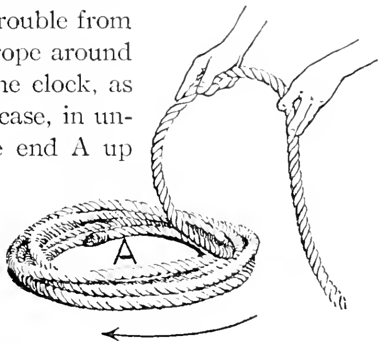


FIG. 45.—*Coiling a rope*

When uncoiling a new bale of rope from the factory, however, it is necessary to reverse these directions. The end A will always be found inside of the bale near one end of it. Place the bale with this end down and draw the rope end A up through the center of the bale. In this case this procedure will prevent kinking, as bales are laid up in the factory in a direction "against the sun" instead of with it.

The same remarks apply to binder twine; if the end is not drawn out as directed on the tag on each ball, the twine will soon kink, catch, and break.

(3) The proper method of undoing snarls. In order to disentangle a snarl, begin by loosening it, drawing out one end as far as possible as shown at A in Fig. 46, and then opening the center of the snarl so as to form a hole of considerable size around the rope A. The whole bundle of tangled rope is then seized and forced through the hole thus made, putting the outside part of the bundle through first as shown by the arrows in Fig. 46, a process much like kneading bread. This will add a little straight rope to the end A, and if patiently continued the process will surely unravel the worst possible tangle.

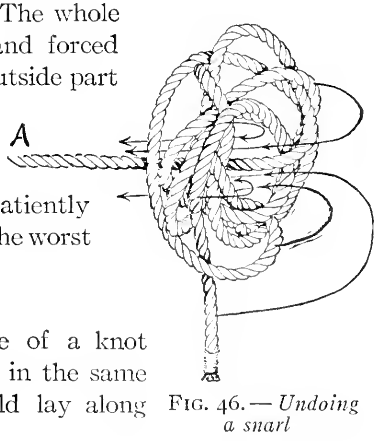


FIG. 46.—*Undoing a snarl*

THEORY OF KNOTS

Principles of a knot.—"The principle of a knot is that no two parts which would move in the same direction if the rope were to slip, should lay along side of and touching each other." *

Another principle that should be added to the above is that a knot or a hitch must be so devised that the tight part of the rope must bear on

* From "The Mechanical Engineer's Pocket-Book" by William Kent, 1908, p. 345.

the free end in such a manner as to pinch and to hold it, in a knot, against another tight part of the rope, or in a hitch, against the object to which the rope is attached. This principle is well illustrated in the stevedore's knot (Figs. 69 and 70) and in the half hitch (Fig. 71).

Elements of a knot.— The bends that a rope undergoes in the formation of a knot or of a hitch are of three kinds: the bight, the loop or turn, and the round turn. The bight (Fig. 47) is formed by simply bending the

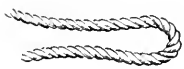


FIG. 47.—*Bight*

FIG. 48.—*Loop or turn*

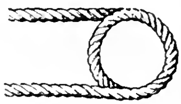


FIG. 49.—*Round turn*

rope, keeping the sides parallel; the loop or turn (Fig. 48) is made by crossing the sides of a bight; the round turn (Fig. 49) consists in the further bending of one side of a loop.

Knots and hitches are made by combining these elements in different ways conforming to the principles of a knot given above. For example, the half hitch (Fig. 71) is a loop around a rope, with the free end locked under the rope; the clove hitch (Fig. 81) consists of two loops over a post; the sheepshank (Fig. 106) comprises two bights with a loop around each; the anchor bend (Fig. 75) is a round turn and two loops; the bowline knot (Fig. 138) is a loop with a bight through it and around the main rope; and the weaver's knot (Fig 120) is the same as the bowline knot, except that the ends take a somewhat different direction.

METHODS OF FINISHING THE END OF A ROPE

Relaying an untwisted rope.— The process of building up a rope from strands is called laying a rope, and so twisting together strands that have become untwisted is called relaying.

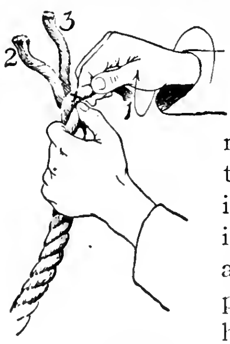


FIG. 50.—*Relaying*

The latter process is illustrated in Fig. 50. The rope being held in the left hand, strand No. 1 is twisted up tightly by turning the right hand as indicated by the arrow around the wrist. This strand is then pulled down snugly into its place in the rope and is held there by pressing the left thumb on the point X. The rope should not be turned in the left hand. The next step is to grasp strand No. 2, twist it up tightly, lay it in snugly above No. 1, holding it with the left thumb by pressing on a point on No. 2 just above the point X and on the same side of the rope. The left thumb should not work around the rope, but should move straight up the same side. Strand No. 3 is treated as was No. 2, and then No. 1 is in place to be laid in above No. 3. This process is repeated until the end of the rope is reached and it should result in the return of the rope to its original condition provided the strands themselves are not too badly untwisted; in the latter event it is cheaper to cut off the rope than to try to relay it.

Whipping.— Binding the end of a rope with twine to prevent it from untwisting is called whipping. Ropes that are to be passed through pulley blocks or, like halter ropes, through small holes, should be finished in this way. A method of doing this so that both ends of the twine are fastened by tucking under the whipping is as follows:

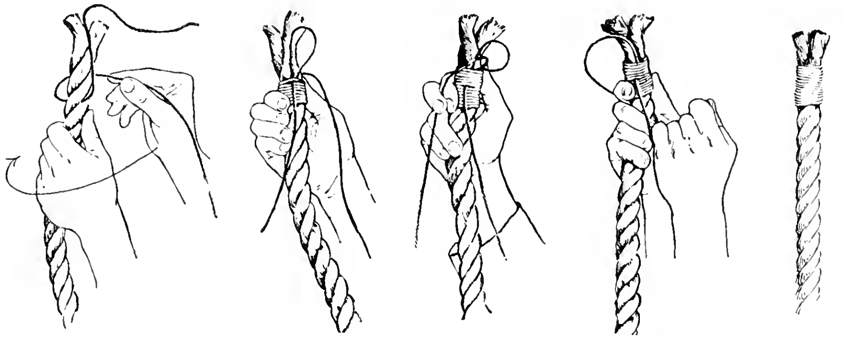


FIG. 51 FIG. 52 FIG. 53 FIG. 54 FIG. 55

Whipping the end of a rope

Unlay one strand of the rope back to the point where the whipping is to begin. Under this strand lay the twine, leaving the end eight or ten inches long as shown in Fig. 51, and then relay the strand into the rope, keeping it twisted up tightly and pulled hard down into its place as directed for relaying. If an especially secure whipping is to be made, the twine may be tied about the strand under which it is tucked; usually, however, this is not necessary. Whip the long end of the twine around both the rope and the short end of the twine, being careful to pull it up tightly and to leave no vacant spaces between turns. When about half the desired distance is covered, bend back the short end of the twine so as to form a bight extending out beyond the end of the rope, and begin whipping over both sides of the bight as shown in Fig. 52. Continue whipping as far as desired, and then pass the long end of the twine through the bight and pull it up firmly, as in Fig. 53. By pulling on the free end of the bight, draw the long end of the twine downward underneath the whipping as far as it will go (see Fig. 54). Finish the whipping by cutting off both loose ends of the twine as closely as possible. The completed result is shown in Fig. 55.

Wall knot.— When a small knob on the end of a rope is desirable, or when such a knob is not objectionable and a quick and secure method of fastening the strands is needed, the wall knot may be used.

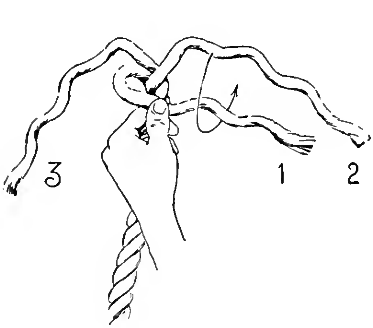


FIG. 56

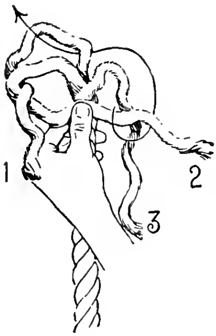


FIG. 57

Wall knot begun

This is made according to the following directions: Unlay the rope for five or ten inches or more, depending on the size. Holding the rope in the left hand with the loose strands up, take any strand, as No. 1, lay it down and across the rope with the end toward the right, and hold it in place with the left thumb as shown in Fig. 56. Take the next strand to the right, No. 2, and pass it around the end of No. 1 as shown by the arrow in Fig. 56. Before releasing No. 2 take the left thumb off No. 1 and use it to hold No. 2 as in Fig. 57. Strand No. 3 is now to be passed around the end of No. 2 and up through the loop of No. 1, as indicated by the arrow in Fig. 57 and as shown in Fig. 58. The knot should next be tightened by pulling all of the strands, one after the other, until it appears as in Fig. 59. The last steps are to pull the strands closely together in the center, roll the knot toward the end of the rope to hold them, and cut the strands sufficiently long to insure their not pulling back.

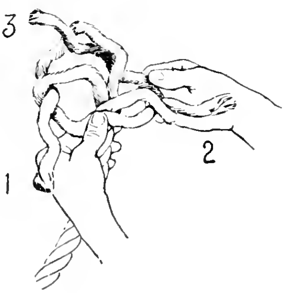


FIG. 58

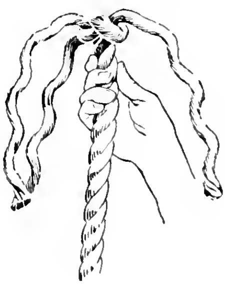


FIG. 59

FIG. 60

Wall knot completed

Crowning is a very neat, secure, and permanent method of fastening the strands of a rope when a slight enlargement of the end is not an objection. This is done in the following manner:

Unlay the rope for five to ten inches or more, according to the size.

Hold the rope in the left hand with the loose strands up. Select as No. 1 the strand on the left. Lay this strand across the end of the rope and between the other two strands, leaving an open bight projecting to the left as shown in Fig. 61. Bring the rear strand, No. 2, forward and down over No. 1, as indicated by the arrow in Fig. 61, into the position shown in Fig. 62. Strand No. 3 now goes over No. 2 and down through the bight left in No. 1, as indicated by the arrow in Fig. 62, into the position shown in Fig. 63.

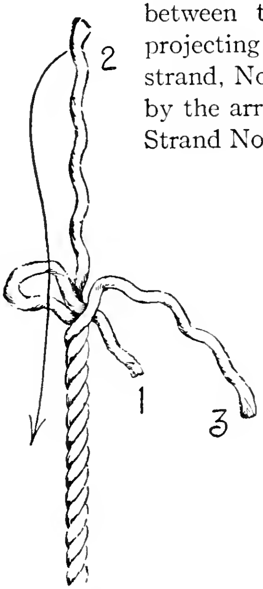


FIG. 61

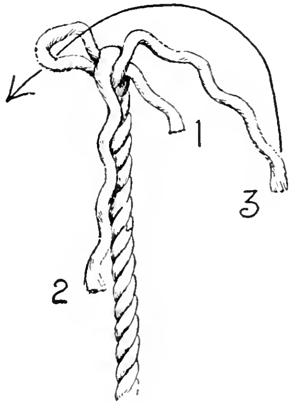


FIG. 62

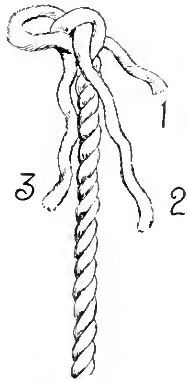


FIG. 63

Crowning begun

Pull the crown down tightly.

Now proceed to splice back the loose ends. Each one is to pass over the nearest strand of the main rope and under the one beyond in a direction diagonally to the right, which is approximately at right angles to the strands of the rope. For this work procure a smooth, round, hardwood stick, pointed at one end and rounded at the other, called a marline spike.

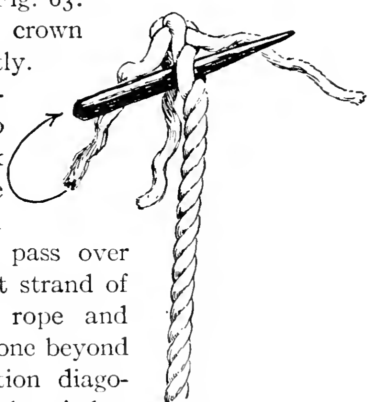


FIG. 64

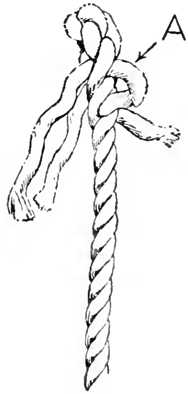


FIG. 65


FIG. 66

Crowning completed

With this instrument raise a strand of the rope close to where the loose ends project, and in the hole thus made insert the end of the proper loose strand as indicated by the arrow in Fig. 64. Draw it down firmly. This process is called tucking the strand. Raise the strand of the rope next beyond and tuck the next loose strand under it. Then tuck the third strand. Draw all down securely.

FIG. 67 FIG. 68
Figure-eight knot

The loose strands should be given two or three more tucks, each strand receiving only one tuck at a time. As the strands are drawn down into place they tend to twist and kink. This tight twisting causes the tucked strand to stand out from the main rope and makes the splicing bulky. In order to prevent this, just before the strand is pulled into place untwist it at point A, Fig. 65, and hold down about an inch of the loosened strand with the left thumb. Now draw down all of the strand not held by the thumb. A kink will form which must be drawn through, leaving the loosened strand that was held by the thumb to spread out in a thin band against the main rope. By cutting out some of the material of each strand after each tuck, the splice may be neatly tapered into the main rope, as shown in Fig. 66. Do not cut the ends of the strands too close to the rope, as they are likely to draw back with use and become untucked. With a smooth round stick pound the splice down solid, and roll it on the floor under the foot.

Figure-eight knot.— This is used for making a knob on the end of a rope or for keeping the strands from untwisting. It may be untied easily.

Form a bight near the end of the rope, give the short end one complete turn about the long rope, and pass it up into the bight (Fig. 67). Pull up tightly, so that the end is square across the rope. By putting in a short stick, or shackle, as shown in Fig. 68, the knot may be very easily untied.

Stevedore's knot.— This knot is used for making an extra large knob on the end of a rope. It is tied the same as a figure-eight knot, except that two turns are taken around the rope instead of one, and it may be made either without or with a shackle as in Fig. 69 and in Fig. 70.

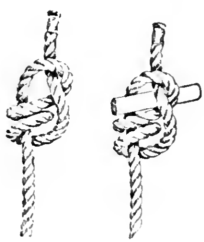


FIG. 69 FIG. 70
Stevedore's knot

HITCHES

Half hitch.— This forms a temporary and not very secure fastening. In Fig. 71 the half hitch is shown taken around the main rope, and it is seen to consist merely of a loop around the rope, with the free end pinched between the rope and the object to which it is attached.

Timber hitch.— A secure temporary fastening very easily undone, which is used to a considerable extent by carpenters for raising timbers, may be made as follows:

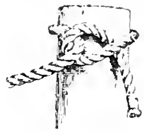


FIG. 71.—*Half hitch*

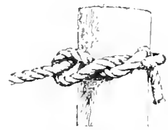


FIG. 72.—*Timber hitch*

Pass the rope around the timber, take a half hitch around the rope, and then pass the free end once more between the rope and the timber, as shown in Fig. 72.

Two half hitches.— A good fastening is made by taking two half hitches around the rope as shown in Fig. 74. This is secure provided it is well pulled down and set before being subjected to a load. If tied according to Fig. 74, the hitches are easily loosened, but if made as shown in Fig. 73 they will jam tightly.

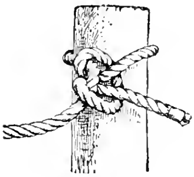


FIG. 73.—*Incorrect*

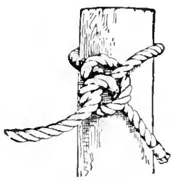


FIG. 74.—*Correct*

Two half hitches

Anchor bend.— This hitch, also called fisherman's bend, is used for fastening a rope securely to a metal ring, such as that on an anchor, with a double rope in contact with the metal to prevent excessive wear.

Take a round turn around the ring and then two half hitches around the rope, passing the end for the first half hitch through the loop of the round turn as shown in Fig. 75. In this form the hitch is very secure, but it may be made more so by whipping the end to the main rope as shown in the cut on the first page of this lesson.

FIG. 75. — *Anchor bend*

Timber hitch and half hitch combined.— As shown in Fig. 76, this forms a secure fastening useful in handling long articles that must be kept in line with the pull of the rope. Note that the half hitch is around the object this time, and not around the rope.

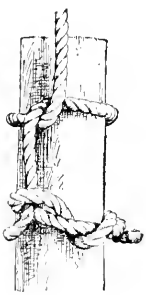


FIG. 76. — *A timber hitch and a half hitch combined*

Clove hitch.— This consists of two half hitches arranged for fastening a rope around an object. It may be made in the middle of a long rope without access to the ends, and will stand a pull from either direction without slipping when once properly set. It is easily undone and is a very useful hitch. The clove hitch is made in various ways, as follows:

(1) Beginner's method. By twisting the rope to the right with the right hand, form two loops in a figure eight with the ends of the rope side by side at the center and extending in opposite directions, as shown in Fig. 77. By still further twisting the right hand in the same direction, as indicated by the arrow in Fig. 77, the hitch is thrown into the completed form as shown in Fig. 78. Put the loops over the object and pull taut.

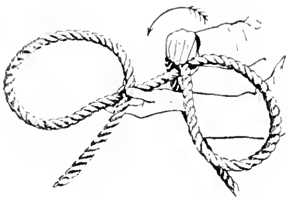


FIG. 77

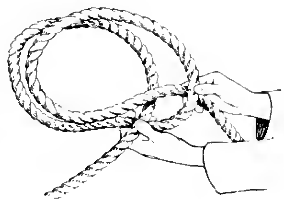


FIG. 78

Clove hitch. Beginner's method

(2) By the sailor's method the hitch is made while there is a pull on the rope, as in mooring a boat. Sustain the strain on the rope with the left hand, as shown in Fig. 79, and by twisting the rope to the right with the right hand, as indicated by the arrow, first form a loop in the rope and then roll the loop over the top of the post. Move the left hand up beyond the loop, hold the rope there, and with the right hand form a second loop and roll it in place as shown in Fig. 80. Note that in the finished hitch, Fig. 81, the diagonal rope binds both ends against the post.

(3) Hand and toe method. This is used by sailors for heavy rope. Draw the rope along the floor from left to right across the toe of the right foot, and then swing it around back again from right to left, forming a loop. With the foot turn the whole loop upside down and over to the left. Then form a second loop by swinging the rope around in the same direction as before. The loops will then be arranged as in Fig. 77, except

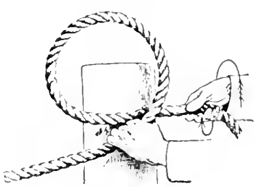


FIG. 79

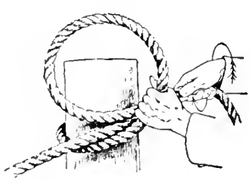


FIG. 80

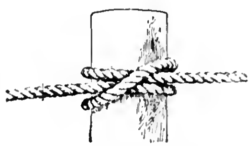


FIG. 81

Clove hitch. Sailor's method

that the left-hand rope will in this case come down from above instead of up from below as in the picture, and the right-hand one will go from below upward. Pick up the loops, folding them together as in Fig. 78.

(4) Cowboy's method. The advantages of this way of making the hitch are that in the first stage (Fig. 82) the rope is very conveniently carried in the field while walking, and that the last stage (Fig. 83) is instantly made from the first. Pick up the rope with the left hand, and with the right form a loop to be held by the left as shown in Fig. 82. Grasp the rope farther out with the right hand. Without releasing the rope bring the hands upward and together as indicated by the arrows, so that the knuckles of the left hand press the backs of the fingers of the right, as shown in Fig. 83. Grasp all the ropes with either hand, and the hitch is ready for use.

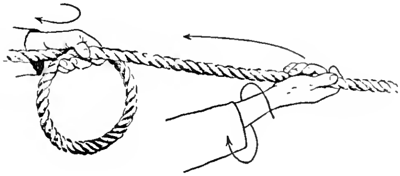


FIG. 82

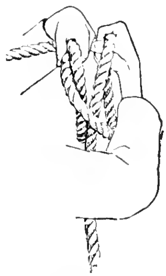


FIG. 83

Clove hitch. Cowboy's method

(5) Circus method. This is the quickest way of making the clove hitch, and should be learned by every one. It is especially useful in pitching large tents, when many ropes must be picked up from the ground and fastened to short stakes. Cross the arms in front of the body, the left outside the right, and pick up the rope as shown in Fig. 84. Without twisting the wrists uncross the arms, as indicated by the arrows in Fig. 84, and take the position shown in Fig. 85. Now rotate both hands to the right as indicated by the arrows around the wrists, and put the knuckles of the left hand into the palm of the right, as shown in Fig. 86. Slip the loop from the left hand into the right, and the hitch is ready. (*Note.*—For most persons these drawings will be more easily followed if they are inverted.)

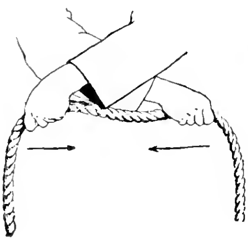


FIG. 84

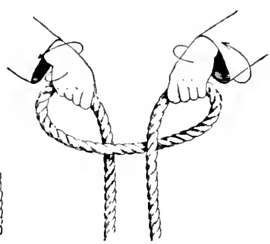


FIG. 85

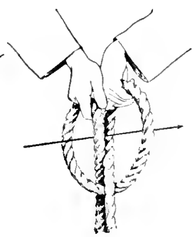


FIG. 86

Clove hitch. Circus method

Scaffold hitch.—Many occasions arise involving the need of a single board scaffold, hung by a single rope at each end. If a scaffold of this kind is to be safe, the ropes must be attached to the board in such a way that the board will not turn. The scaffold hitch fills this need. It is made in the following manner:

By the cowboy's method or the circus method form a clove hitch of

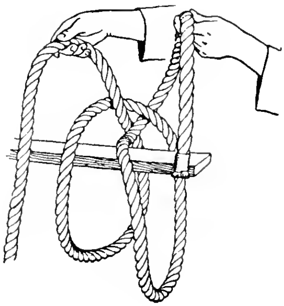


FIG. 87]

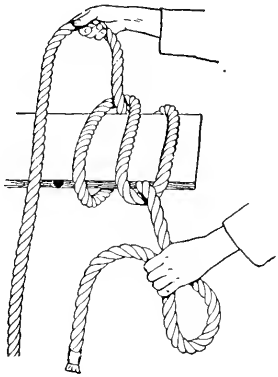


FIG. 88

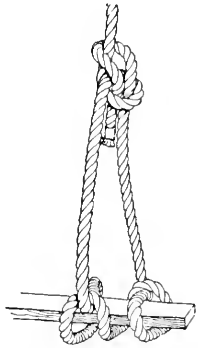


FIG. 89

Scaffold hitch

ample size so that when placed over the end of the scaffold plank it will hang loosely below it, as in Fig. 87. Draw to the left the rope in the left hand in Fig. 87, and to the right the rope in the right hand in the same figure, thus gaining the position shown in Fig. 88. Turn the plank over, draw the ropes up above it, join the short end to the long rope by an overhand bowline (Fig. 138), pull the bowline tight, at the same time adjusting the length of the two ropes so that they hold the plank level, and the hitch is finished as shown in Fig. 89. Attach a second rope to the other end of the plank in the same way and the scaffold is ready.

Miller's knot.—This knot is especially adapted to tying up grain and flour sacks; it is also useful in place of a clove hitch in fastening a rope to an object whose ends cannot be reached, such as a post in a barn. Take a round turn about the neck of the sack or the fixed object, crossing the ropes in doing so, as shown in Fig. 90.

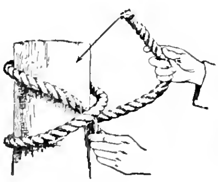


FIG. 90

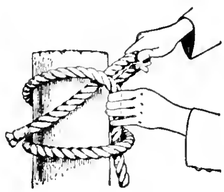


FIG. 91

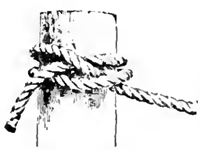


FIG. 92

Miller's knot

Raise the main rope just above the crossing, pass the free end under, as in Fig. 91, and draw up tightly (Fig. 92). This hitch may be loosened by grasping either end of the rope and pulling it around to the right or left, as the case may be.

In tying sacks it is convenient to hold the mouth of the sack shut with the left hand, and to wrap the twine around the sack and the little finger of the left hand in such a way that the finger is in the place of the upper rope's end in Fig. 91. The twine is brought on around the sack, caught by the finger, and drawn back under the first wrap of twine in a direction diagonally upward from left to right.

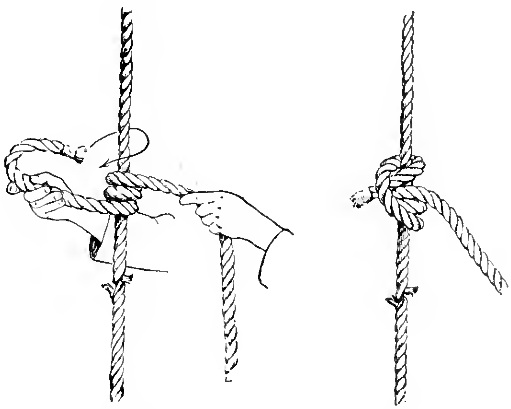


FIG. 93 FIG. 94

Taut line hitch or rolling hitch

Taut line hitch.— There are many occasions when it is necessary to attach a rope to another rope that is supporting a load and that therefore cannot be bent. For instance, if a strand breaks, a new rope must be attached to the rope above the break; or if in hauling with block and tackle on a rope to raise a load the tackle is pulled together without getting the load high enough, a new rope must be attached to the taut one near the load in order to support it temporarily and to allow the tackle to be extended and reattached to the pull rope farther up. For use on such occasions as these the taut line hitch is necessary.

Wrap the new rope two full turns around the taut one, progressing in a direction away from the load as in Fig. 93. Pass the end up over the wrapping, draw it firmly, and take one or two half hitches about the taut rope between the wrapping and the load, as indicated by the arrow in Fig. 93 and as shown in Fig. 94. The hitch will not hold unless the wrapping and the half hitch are pulled up securely in the first place and are tightened as the strain is put on the new rope.

Jam hitch.— In tying up light packages, such as bundles of lath, small boxes, rolls of paper, and the like, a hitch that will slide along a cord in one direction, but will jam and hold against moving the other way, will be found exceedingly convenient. The jam hitch will answer these requirements, provided the cord used is large enough and of not too hard a body nor too smooth a surface.

Pass the cord around the package, bringing the short end beyond the long cord and from right to left, as shown in Fig. 95. Bend the short end to the right to form a bight around the long cord, and then take a turn around the other side of the bight, as indicated by the arrow in

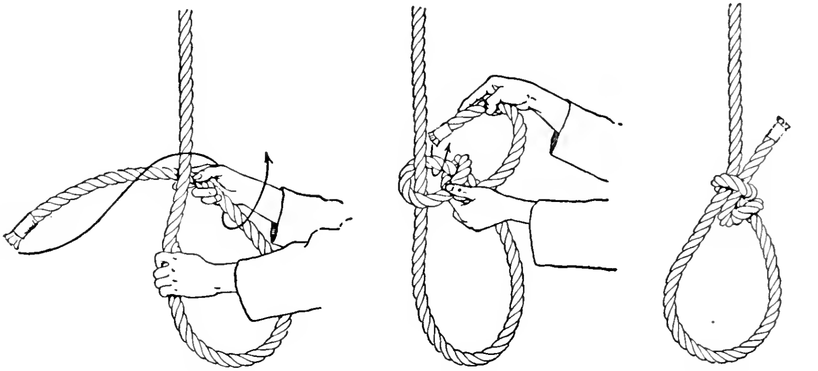


FIG. 95 FIG. 96 FIG. 97

Jam hitch

Fig. 95 and as shown in Fig. 96. Pass the end upward inside the bight and next to the long cord, as indicated by the arrow in Fig. 96 and as shown in Fig. 97. Pull the hitch up tightly so as to pinch the long cord. It can now be slipped down to tighten the loop about the package, and if the cord is of the right kind and size it will jam and hold.

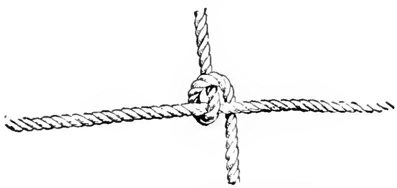


FIG. 98.—*Crossing hitch*

Crossing hitch.—The purpose of this hitch is to prevent slipping at the crossing point of ropes or of twine. It is especially useful in tying up packages, and is so simple as to require no explanation.

Blackwall hitch.—There are frequent occasions when it is necessary to attach a rope to a hook. A quick and secure temporary fastening is the blackwall hitch, which is simply a half hitch about the shank of the hook.

FIG. 99 FIG. 100

Blackwall hitch

Form a bight in the rope and pass it under and back of the hook, as illustrated in Fig. 99. Cross the sides of the bight to form a loop about the shank of the hook, passing the free end between the hook and the main rope as in Fig. 100.

Catspaw.—This method of fastening a rope to a hook provides a double rope where wear comes, and permits a load to be carried on either end of the rope.

Form a bight in the rope, grasp the sides of the bight, as shown in Fig. 101, thus forming two loops, twist each loop a full turn in the direction indicated by the arrows, and hang the loops on the hook (Fig. 102).

Sheepshank.— This hitch, used for shortening a rope, is made quickly and without access to the ends. It may be tied in a rope and the rope may then be cut at the end of one of the two bights or along the central part in Fig. 106, after which a strain may safely be put on the rope just as if it were not cut. It is said that this fact is utilized by steeple climbers, who, before lowering themselves by ropes from towers where they have been at work, make a sheepshank near the upper end of the rope, cut it as described above, lower themselves to the ground, and then loosen the sheepshank by shaking it, when the cut rope falls to the ground leaving only a short end up on the tower.

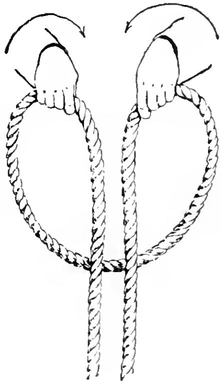


FIG. 101

FIG. 102

Catspaw

Form a bight and lay it against the rope, leaving below it a second bight or loop as long as is needful for reducing the rope to the required length (see Fig. 103). Holding the first bight with the right hand, with the left hand throw a half hitch around it as indicated by the arrow in Fig. 103 and as shown in Fig. 104. With the left hand grasp the sides of the second bight and with the right hand throw a half hitch of the rope over this bight by turning

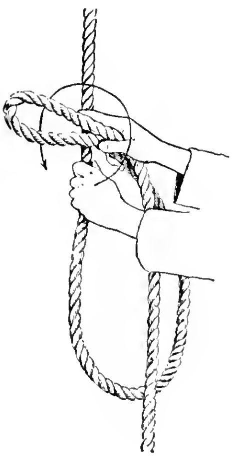


FIG. 103

FIG. 104

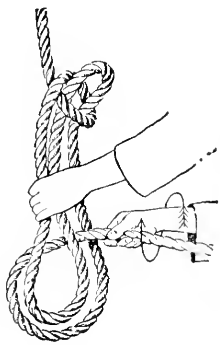


FIG. 105

Sheepshank begun

the right wrist, as indicated by the arrow in Fig. 105 and as shown in the finished sheepshank in Fig. 106. If it is desired to shorten the rope permanently, the ends may be passed through the first and the second bights, as shown in Fig. 107.

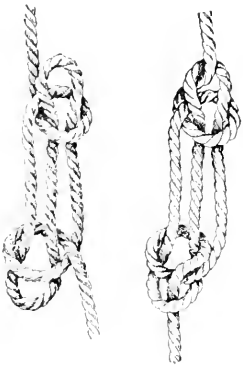


FIG. 106 FIG. 107
Sheepshank completed

Rope tackle.— There are times when a temporary substitute for a tackle block would be found most useful, as, for example, in drawing down a rope over a load of hay to hold it without a pole. The rope tackle shown in Fig. 110 forms such a temporary substitute. Make a bight in the rope and throw a half hitch over it, as described for the sheepshank and as shown in Figs. 108 and 109. Through the hanging loop thus formed pass the lower end of the rope, as indicated by the arrow in Fig. 109. This gives the finished tackle as shown in Fig. 110. If, now, in the example cited above, the rope A (Fig. 110) comes from over the load of hay and the bight C is caught over the end of the reach or some other convenient part of the wagon, by pulling on rope D we can cause the rope to pull on loop B, which will act as a tackle block and will greatly increase the pull on A. Both sides of the loop C must pull on the tackle above, otherwise the half hitch will pull out.

The rope slides and chafes badly at B and somewhat at C, so this tackle should not be made up frequently in the same place in the rope. It is intended for emergency use only.

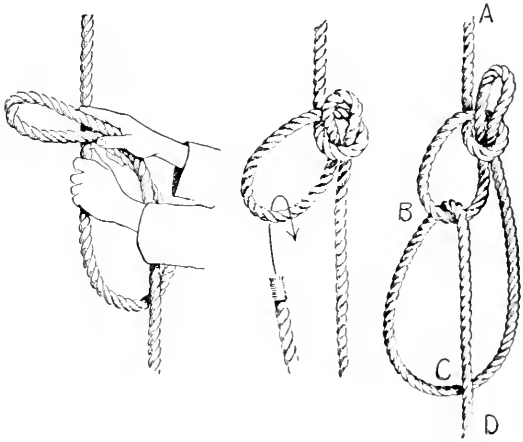


FIG. 108 FIG. 109 FIG. 110
Rope tackle

KNOTS FOR JOINING ENDS

Grain binder knot.— This is the simplest way of joining two ropes, and the one used on the automatic binding attachments of all grain-harvesting machines. It is made by simply laying the ends side by side and tying an overhand knot in them (Fig. 111). The disadvantage of this method is that the knot is difficult to untie when once pulled tightly.

FIG. 111.—*Grain binder knot*

Square knot.— This, the most frequently used of all knots, is secure when set and may be untied without difficulty. In making it, care should be taken not to make a granny knot (see description below).

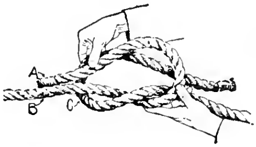


FIG. 112

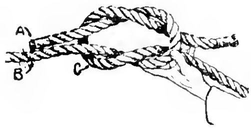


FIG. 113

Square knot

Cross the ropes, placing the right under the left, wrap the end of the left rope around the right, and bend each rope back on itself (see Fig. 112). Note that ropes A and B are on the same side of C. Wrap A around the other rope end, producing the knot as shown in Fig. 113, A and B being still on the same side of C.

Granny knot.— This is frequently tied by mistake for a square knot. It tends to slip under strain and is very hard to untie when set. The point at which a granny knot may be detected is in the position shown in Fig. 114. Ropes A and B are not on the same side of C, as they should be in making a square knot, and when the knot is completed they are still wrong, as shown in Fig. 115.

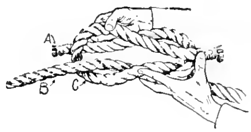


FIG. 114

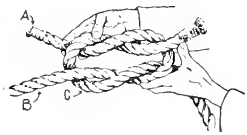


FIG. 115

Granny knot

Surgeon's knot.— A modified form of the square knot is here described. In the beginning the left end is wrapped twice around the other rope, instead of once as for the square knot. If now the rope is pulled up tightly, the extra twists tend to keep the knot from slipping while the second part of the tie is made. In using this knot with smooth cord, as in tying bundles, after the first wraps have been taken and the cord drawn up firmly it is necessary to kink the double twists into a bunch so as to jam them, by swinging the hands around in such a manner that the wrists cross, while still pulling. The knot will then hold securely while the second part of the tie is made and drawn up tightly.

FIG. 116.
Surgeon's knot

Weaver's knot.— This is a secure fastening, capable of being made with great rapidity and easily untied. It is universally used by weavers for tying threads and yarns.

Cross the ends, the right under the left, as in Fig. 117. With the right hand pass the right rope from left to right to form a loop around its own end passing twice above the left rope, as indicated by the arrow in Fig. 117 and as shown in Fig. 118. Release the right rope, and with the right hand bend back the end of the left rope into the loop just formed, as indicated by the arrow in Fig. 118 and as shown in Fig. 119. Pull the end well through, grasp the ropes as shown in Fig. 120, and draw the knot tightly as indicated by the arrows.

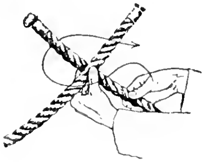


FIG. 117

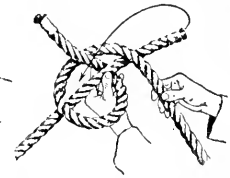


FIG. 118

FIG. 119

Weaver's knot begun

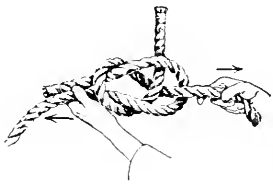


FIG. 120

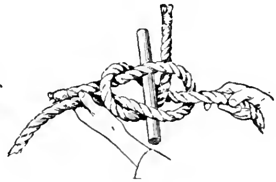


FIG. 121

Weaver's knot completed

If it is desired to untie the knot quickly, insert a wooden stick as a shackle as shown in Fig. 121.

KNOTS FOR FORMING LOOPS

Slip knot.— This knot, the simplest slip loop possible, may be made starting either with the position shown in Fig. 122 or with that in Fig. 124, whichever is easier for the person tying the loop.

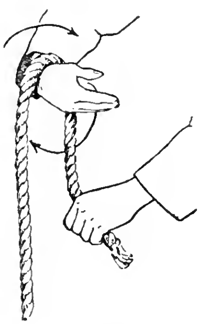


FIG. 122

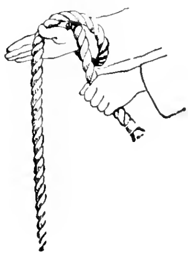


FIG. 123

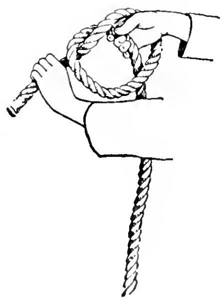


FIG. 124

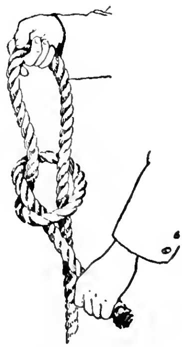


FIG. 125

Slip knot

When beginning with Fig. 122, grasp the end of the rope in the left hand and, bringing the right hand upward, pick up a bight of the rope on the wrist as shown. Bend the right wrist so that the palm of the hand is upward and the little finger touches the short end of the rope. Then rotate the wrist as shown by the upper arrow. This will cross the sides of the bight and form a loop around the wrist, and at the same time will bring the main rope in between the thumb and the first finger as shown in Fig. 123 and as indicated by the lower arrow in Fig. 122. Grasp the main rope and draw a bight up through the loop, as shown in Figs. 124 and 125.

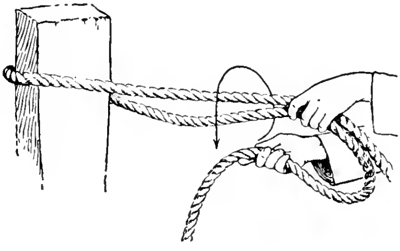


FIG. 126

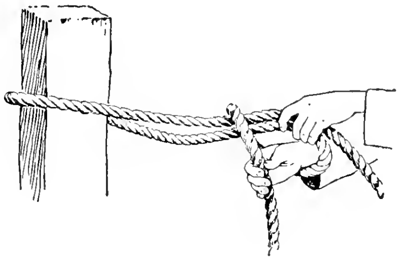


FIG. 127

Hitching tie begun

In starting with the position shown in Fig. 124, the end is held in the left hand and the loop formed by twirling the rope to the right between the thumb and the fingers of the right hand.

Either method is easy, provided the end is held in the left hand at the beginning.

Hitching tie.— This knot is used for hitching a tie rope to a post. It is made as follows:

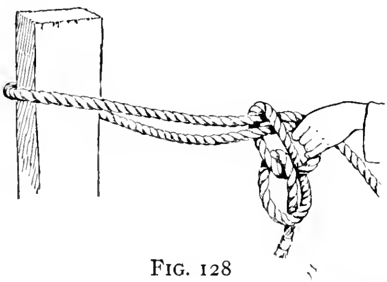


FIG. 128

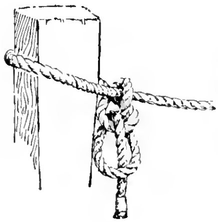


FIG. 129

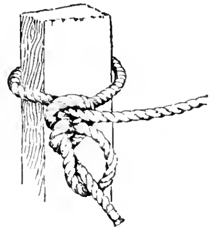


FIG. 130

Hitching tie finished

Pass the rope around the post from left to right, thus forming a bight. Grasp both sides of the bight in the left hand, and with the right hand throw the short end across the ropes in front of the left hand as indicated by the arrow in Fig. 126, thus forming a second bight below the left hand. Pass the right hand through this second bight, as in Fig. 127, and pull the rope back through it to form a third bight, down through which the end of the rope is passed as shown in Fig. 128. Pull the knot up tightly.

There is a right way and a wrong way to leave this tie when hitching to a plain post without a groove, ring, or crossbar to keep the rope from slipping down. If the knot is twisted around to the right of the post, as in Fig. 129, a pull on the tie rope will draw the rope tightly about the post and will thus prevent it from slipping down; if, on the other hand, the knot is at the left, as in Fig. 130, a pull will not tighten it and it will slip down.

Halter tie.— This is a knot preferred by some persons to the hitching tie just described, for use in hitching or in tying the halter rope in the stall. If properly set, it is secure and may be used in some cases in place of the underhand bowline knot. The halter tie should never be used around a horse's neck, because if the tie is not set up correctly it forms a slip knot and its use might result in strangulation of the animal.

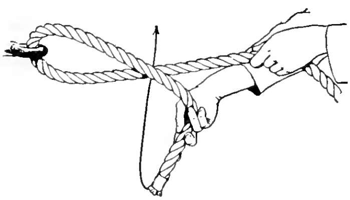


FIG. 131

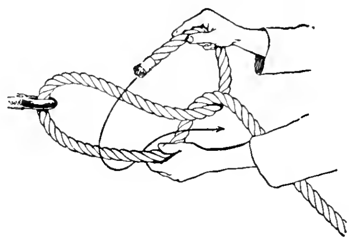


FIG. 132

Halter tie begun

Pass the end of the rope upward through the ring, then downward on the left of the long rope, grasping it with the right hand and holding the long rope with the left hand as shown in Fig. 131. Draw the end to the right and upward, as indicated by the arrow in Fig. 131, thus supporting the long rope as shown in Fig. 132. Now pass the end of the rope over, under, and again over the long rope, as indicated by the arrow in Fig. 132 and as shown in Fig. 133. Draw the end through, as in Fig. 134, and set the knot *by pulling first on the short end.* This is important. If the long rope is pulled first and the kinks in it are straightened out, the tie forms a slip knot, being simply two half hitches around the rope, as in Fig. 74.

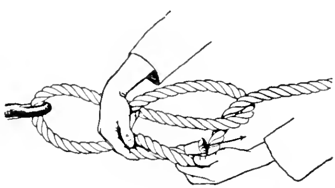


FIG. 133

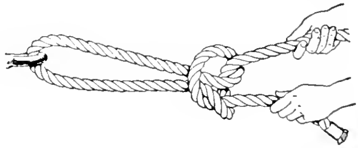


FIG. 134

Halter tie finished

Bowline knot.— This is the best knot known for forming a loop that will not slip under strain and that may be easily untied. The following methods are used in making the bowline knot:

(1) Overhand method. To be used when standing opposite the end

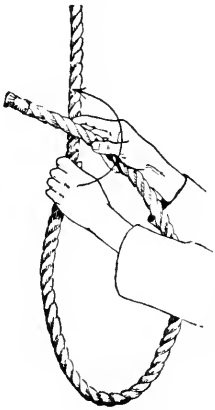


FIG. 135

FIG. 136

FIG. 137

FIG. 138

Bowline knot. Overhand method

of a slack rope and making a loop that is not fastened to any object. With the right hand lay the end of the rope over the long rope, and with the left hand grasp the long rope below the crossing, as in Fig. 135. Hold

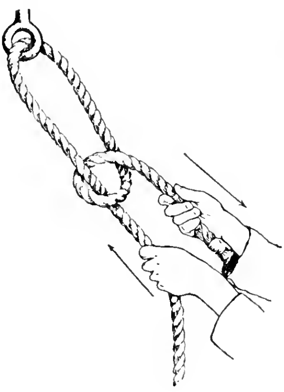


FIG. 139

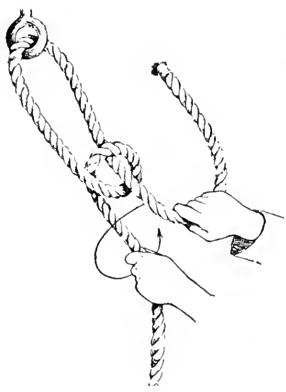


FIG. 140

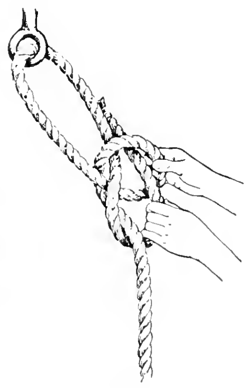


FIG. 141

Bowline knot. Underhand method

the right hand stationary, and with the left hand bring the long rope up and over to form a loop about the end, as indicated by the arrow in Fig. 135 and as shown in Fig. 136. With the right hand draw the end up through the loop and pass it around behind the long rope from right to left, as indicated by the arrow in Fig. 136 and as shown in Fig. 137. Pass the end forward and down into the loop again from above, as indicated by the arrow in Fig. 137 and as shown in Fig. 138. Note that this knot consists of a loop with a bight up through it, the bight going around behind the long rope.

(2) Underhand method. To be used when standing alongside of the rope and making a loop around some object or through an eye. Pass the rope through the eye or around the object from left to right, holding the long rope in the left hand. Take a half hitch around the long rope, starting it by passing the end across over the long rope (see Fig. 139). Now transfer the loop from the short rope to the long rope. This is done by giving slack with the left hand and pulling up with the right, as indicated by the arrows in Fig. 139. With the loop transferred to the long rope and the end passing through it, as in Fig. 140, it is necessary only to bring the end from left to right under the long rope, as indicated by the arrow in Fig. 140, and back into the loop from below, as shown in Fig. 141. The knot is now ready to be tightened up, when it will be finished.

(3) Texas method. Like the underhand method, the Texas method is to be used in making a bowline knot when standing alongside of the rope; it is particularly useful in fastening a tie rope about a horse's neck, since the size of the loop is easily adjusted, as explained below. Throw the rope over the horse's neck or pass it through the bolt eye, as the case may be. Lay both hands, side by side with the palms down, on the long rope as shown in Fig. 142. Rotate the right hand as if the forearm were a long pivot, as indicated by the arrow in Fig. 142, and thus form a loop as in Fig. 143. With the left hand push a bight of the long rope from left to right through this loop, as indicated by the arrow in Fig. 143 and as shown at B, Fig. 144. Reach under the horse's

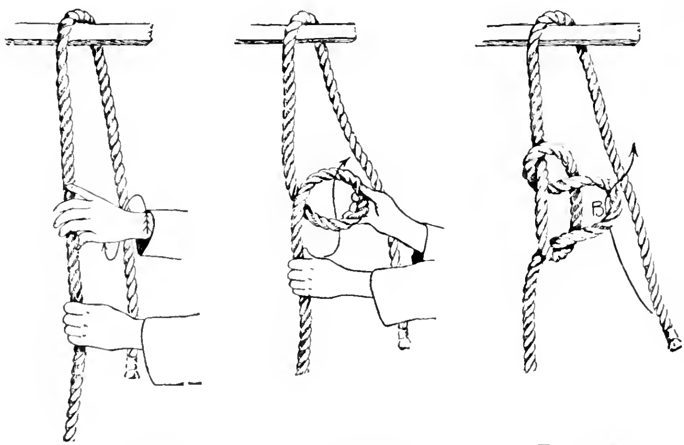


FIG. 142 FIG. 143 FIG. 144

Bowline knot. Texas method begun

neck, grasp the short end of the rope, and pass it upward through bight B as indicated by the arrow in Fig. 144. Draw the end up until the loop about the horse's neck is of the size desired, bend the rope end back on itself to form bight A (Fig. 145), and grasp both sides of the bight with the right hand as shown. Downward pulling on the long rope will straighten bight B and will force loop C up over bight A, as indicated by the arrows in Fig. 145 and as shown in Fig. 146. Continue pulling until the knot is set firmly.

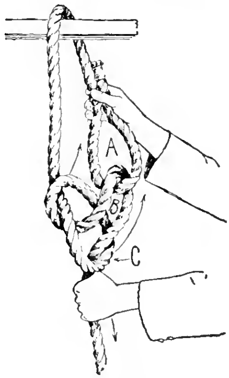


FIG. 145
Bowline knot.

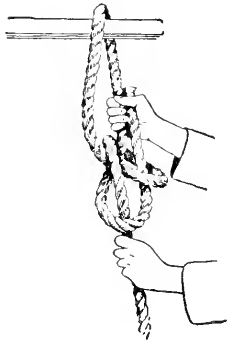


FIG. 146
Texas method completed

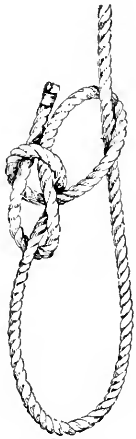


FIG. 147.–*Running bowline*

Running bowline.—This is simply a slip knot wherein the loop through which the rope slips is formed by using the bowline knot, as already described.

Bowline on a bight.— To make a loop with a bowline knot in the middle of a long rope, or to get a loop of double rope at the end of a rope, a bowline knot is tied by the overhand method, using a bight of the rope instead of a single rope.

The steps indicated in Fig. 148 are the same as those described for Fig. 135. After arriving at the position shown in Fig. 149, however, the knot is made differently. Instead of bight A being passed around behind the long ropes, it is pulled up through the small loop and then brought downward, as indicated by the arrow in Fig. 149, and the whole of the large loop B is passed through the bight A. The bight is then brought back to its starting point and loop B is pulled out again, which brings bight A down into place and produces the finished knot as shown in Fig. 150.

Emergency trip sling.— It is sometimes desirable to use a sling that can be tripped, and the load dropped, without slacking up on the hoisting rope as is done with a regular trip sling for hay. If such a sling is not at hand, a substitute may be made as follows:

Procure a piece of rope of sufficient length, splice or tie the ends together to make it endless, draw the loop out long, and lay on it the material to be raised. Pull the sling up around the load and lay one end of the sling on the double ropes of the other end, as is done in Fig. 148. Throw a half hitch over the first end, as shown in Fig. 149, getting the hitch as

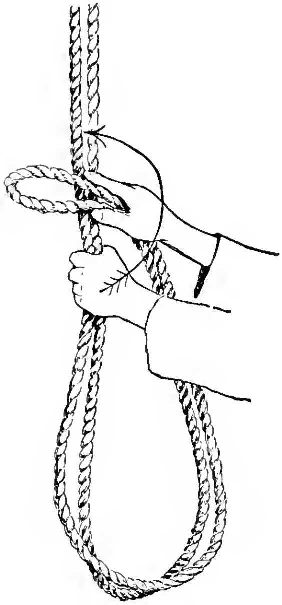


FIG. 148

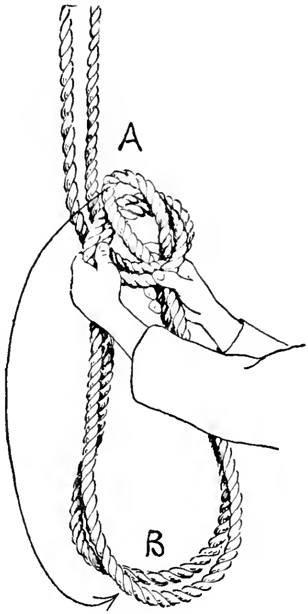


FIG. 149

FIG. 150

Bowline on a bight

near the load as possible and at the same time leaving the end A only long enough to hold. In this case the two ropes extending upward in

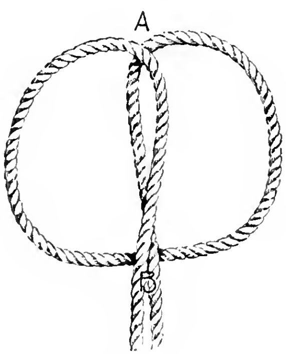


FIG. 151

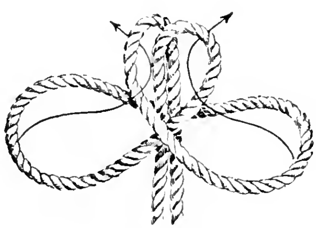


FIG. 152

FIG. 153

Spanish bowline

Fig. 149 would be joined, forming a bight. Into this bight fasten the hoisting rope and begin hoisting gradually, watching the hitch to see that it becomes properly set. If a trip rope is fastened at the point held by the left hand in Fig. 149, the hitch may be tripped by a sharp pull toward the right.

It must be remembered that this is only an emergency hitch and, while quite secure when properly set, it will give way if not so set. Therefore it is necessary to keep from beneath the load.

Spanish bowline.— This knot may be made in the middle of a long rope or in a bight at the end, and gives two single loops that may be thrown over two separate posts or both thrown over one. Either loop will hold without slipping and is easily untied.

Form a bight in the rope and bring the end of the bight up underneath the sides at point B, Fig. 151, thus forming two loops. Cross the sides of the bight at A in the same figure. Grasp this crossing and fold

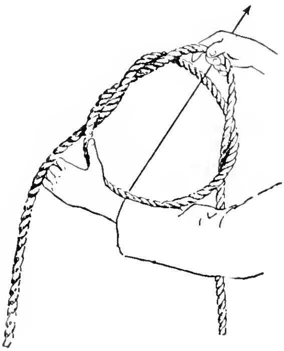


FIG. 154

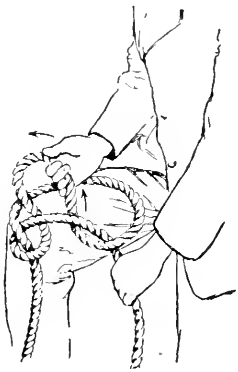


FIG. 155

Harness hitch

FIG. 156

it down on point B, thus forming two new smaller loops as shown in Fig. 152. Pass the end of each large loop back through the nearest small loop, as indicated by the arrows in Fig. 152, pull these loops out hard, and the knot is finished (Fig. 153).

Harness hitch.— This is used by sailors for making loops in a towline. It does not weaken the rope very seriously and is easily untied.

Start a slip knot by making a loop and drawing a bight up through it, as shown in Fig. 124, but pull the bight through only so far as is shown in Fig. 154. Now take the lower part of the loop, shown touching the left wrist in Fig. 154, and pass it between the bight and the side of the loop as indicated by the arrow in Fig. 154 and as shown in Fig. 155. To pull the knot up tightly and have it keep its form, it is necessary to lay it on the right knee or on some other surface and draw the new bight through by pulling up the side of it toward the body, as indicated by the arrows in Fig. 155. Pull the knot up tightly, attaining the finished form (Fig. 156).

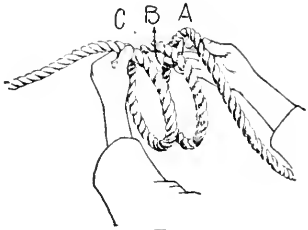


FIG. 157

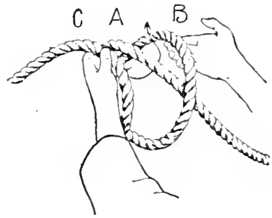


FIG. 158

Farmer's loop begun

*Farmer's loop.**—A secure loop, quickly tied without access to the ends of the rope and capable of being untied after having been drawn tightly, is made in the following manner:

Form two round turns and hold them as shown in Fig. 157, thus bringing side by side three ropes, A, B, and C. Pass A under B and up between B and C, as indicated by the arrow in Fig. 157 and as shown in Fig. 158. Pass C under A, as indicated by the arrow in Fig. 158 and as shown in Fig. 159. Pass B under C, as indicated by the arrow in Fig. 159 and as shown in Fig. 160, pull B out to form the loop, and tighten the knot to the condition shown in Fig. 161.

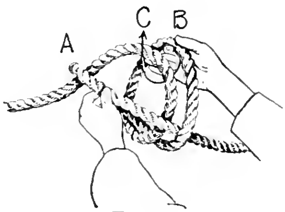


FIG. 159

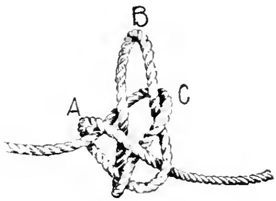


FIG. 160

Farmer's loop, last stage

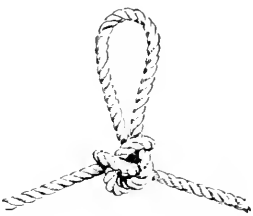


FIG. 161.— *Farmer's loop completed*

SPLICES

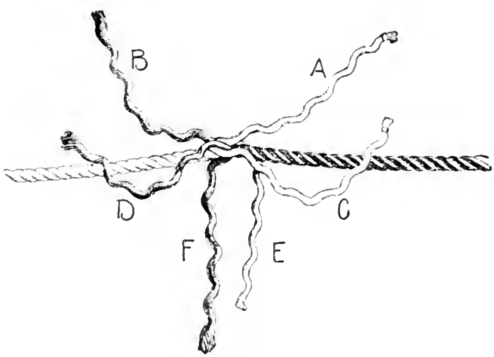


FIG. 162.—*Short splice, first stage*

Short splice.— To join the ends of two ropes by interlacing or weaving their strands together, the short splice is sometimes used. As all the strands of one rope are woven into the other rope at one place, the rope at that place is six strands thick and the splice is of necessity considerably larger than the original rope. The short splice will not run through pulley blocks.

* The writer has never seen this knot described in any reference book. It was shown to him by a farmer at the Genesee County Fair at Batavia in 1910.

Untwist the strands at one end of each rope for a length of six to fifteen inches or more, depending on the size of the rope. Butt these ends tightly together as in Fig. 162, laying each strand of each end between two strands from the other end, as strand A is between strands B and D, C between D and F, and so on. This process we may call locking the strands. With a simple over-

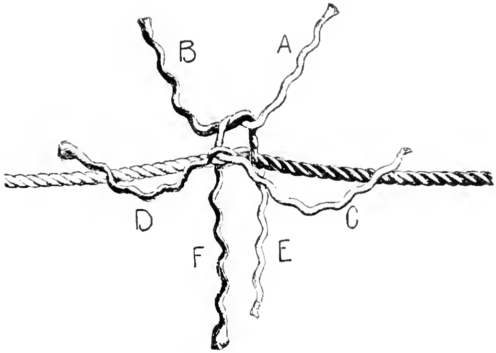


FIG. 163.—*Short splice, second stage*

hand knot, tie each strand of one rope to the corresponding strand of the other rope, as A and B in Fig. 163. Note particularly the way in which this knot is tied. The black strand just beyond the white one is the corresponding one for that white strand; as, A corresponds to B, while D does not. The knots being all pulled down, the splice appears as in Fig. 164. Give each strand of the left rope one tuck toward the right,

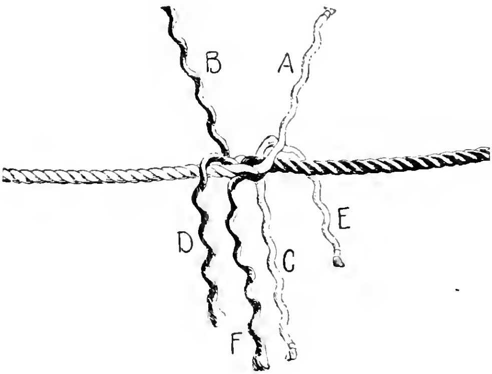


FIG. 164.—*Short splice, third stage*

as described for splicing back the ends in crowning (Fig. 64). The splice will now appear as shown in Fig. 165. Tuck each of the other three strands once to the left.

The splice will hold if carried no farther, and therefore if only a rough job is desired the strands may now be cut about one

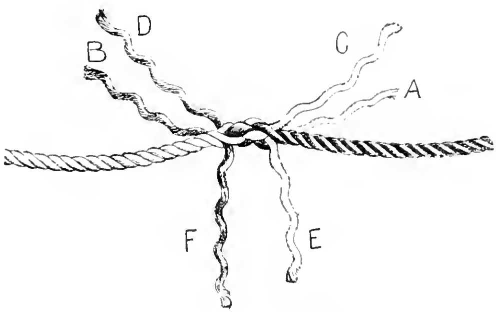


FIG. 165.—*Short splice, fourth stage*

quarter or even one half inch from the rope. If a nicely finished job is desired, however, finish the splice as directed for Figs. 65 and 66, giving the result shown in Fig. 166.

FIG. 166.—*Short splice, completed*

Long splice.— This may be made with either three-strand or four-strand rope, as follows:

(1) Three-strand rope. In order to secure a splice not so bulky as that described above, and one that will run through pulley blocks, the strands are untwisted for a longer distance and the splice is so made that each pair of strands is joined in a separate place in the rope instead of all at one place. The greatest number of strands at any place in the spliced rope is thus four instead of six.

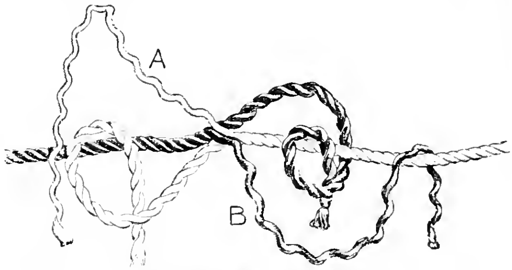


FIG. 167.—*Long splice, three-strand rope. First stage*

FIG. 168.—*Long splice, three-strand rope. Second stage*

Unlay only one strand of each rope for a distance depending on the size of the rope: 18 inches for $\frac{3}{8}$-inch rope, 24 inches for $\frac{1}{2}$-inch rope, 30 inches for $\frac{3}{4}$-inch rope, 36 inches for 1-inch rope, and so on. Lock and draw the ends of the ropes tightly together, as shown in Fig. 167, having the single strands A and B side by side. Taking care not to let the ends of the ropes separate, unlay strand A from its rope one turn and follow it with strand B. Keep B twisted up tightly and pulled down firmly into its place, as explained for relaying (Fig. 50). Continue this procedure until only six to nine inches of strand B is left out (Fig. 168), depending on the size of the rope.

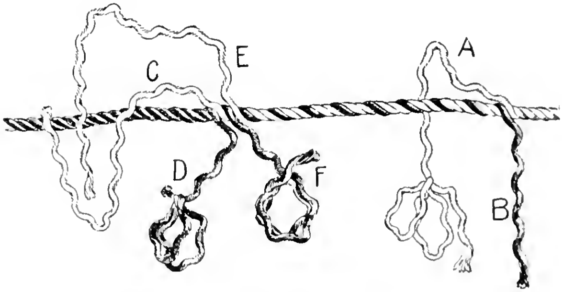


FIG. 169.—*Long splice, three-strand rope. Third stage*

Now, untwist the two pairs of strands left at the center and lock them, as shown in Fig. 169, C between D and F, and F between C and E. Unlay toward the left strand D and follow it with C, as was done toward the right with strands A and B. Do not mistake and unlay F instead of D, and follow it with C; this will cause trouble if done. Continue until strand

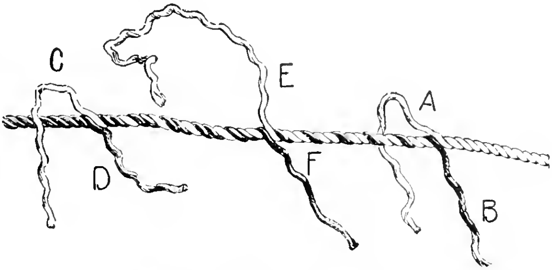


FIG. 170.—*Long splice, three-strand rope. Fourth stage*

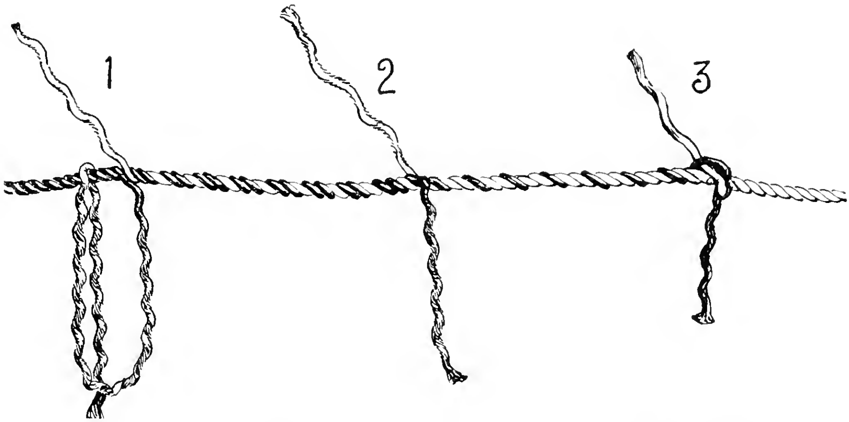


FIG. 171.—*Long splice, three-strand rope. Fifth stage, tying the strands*

C is only six to nine inches long. The breaks in the strands are now separated, as shown in Fig. 170.

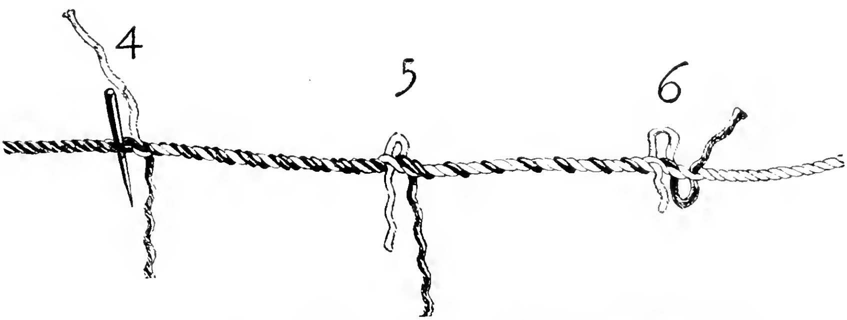


FIG. 172.—*Long splice, three-strand rope. Sixth stage, tucking the ends*

Each pair of strands is now to be tied together and the end of each strand tucked. The different stages of the process are shown in order in the accompanying illustrations.

To begin with, some of the ends are too long, as at 1, Fig. 171. Cut

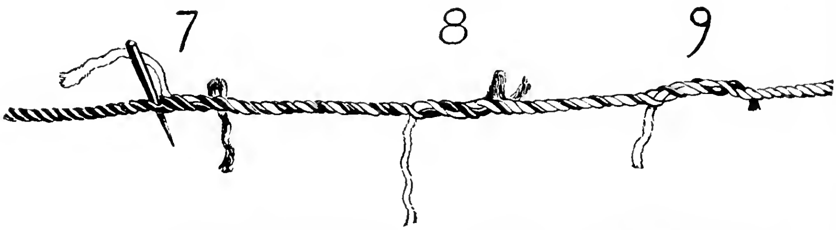


FIG. 173.—*Long splice, three-strand rope. Seventh stage, completing the tucking*

all strands to the length of the shortest, that is to say, six to nine inches. Arrange each pair so that the strand from the left is in front of the strand from the right; or, in other words, arrange the strands so that they cannot

FIG. 174.—*Long splice, three-strand rope. Completed*

untwist from the rope without first uncrossing (see 2, Fig. 171). Tie an overhand knot, as at 3, Fig. 171, and pull it down tightly into the rope.

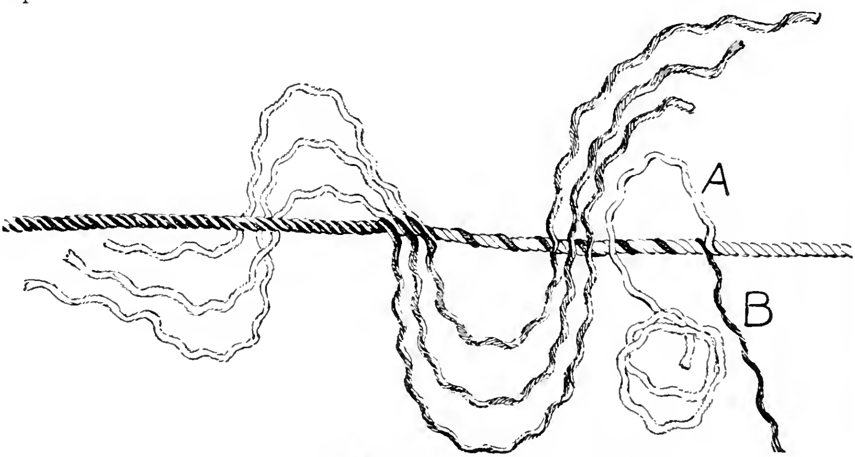


FIG. 175.—*Long splice, four-strand rope. Third stage*

Each strand is now tucked, as shown at 4, 5, and 6, Fig. 172, in the same way as for crowning (Figs. 64, 65, and 66). At 6 (Fig. 172), untwist each strand before pulling down, as was explained for A in Fig. 65. Tuck each strand twice more (see 7 and 8, Fig. 173), tapering the ends if desired, and cut the end one quarter inch long (as at 9, Fig. 173, and at 10, Fig. 174). With a round stick pound down each part of the splice and roll it on the floor under the foot.

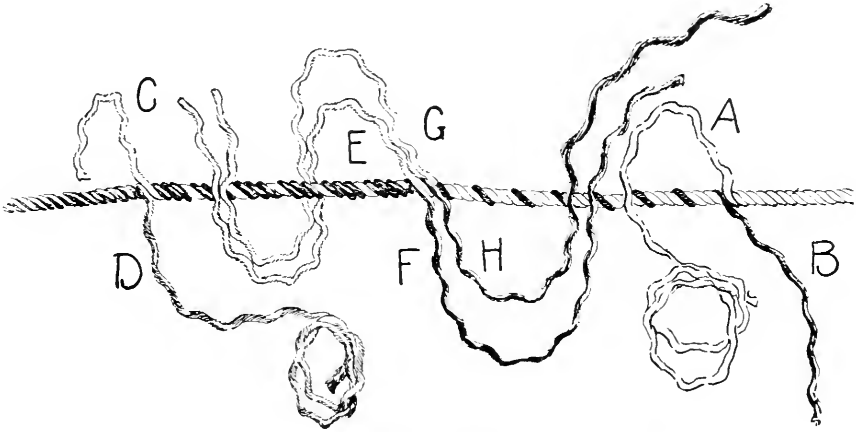


FIG. 176.—*Long splice, four-strand rope. Fourth stage*

(2) Four-strand rope. The first steps in making this splice are identical with those shown in Figs. 167 and 168. The first strand, however, must be unlaid nine inches or a foot farther than for a splice in a three-strand rope.

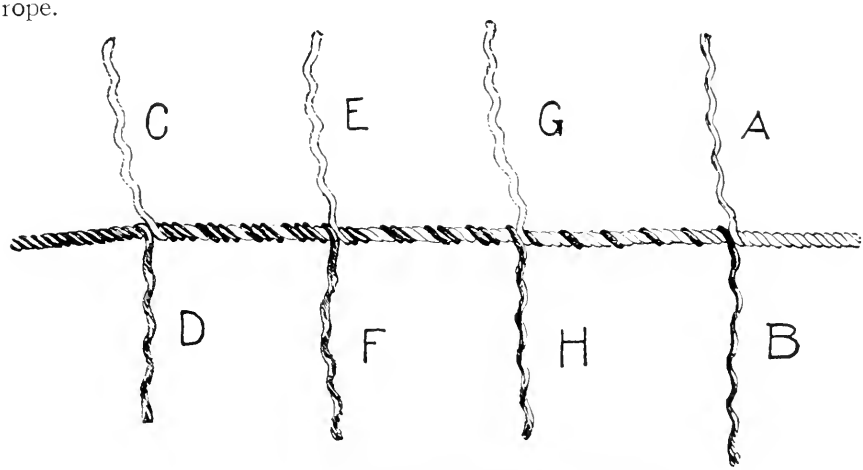


FIG. 177.—*Long splice, four-strand rope. Fifth stage*

Untwist the strands left at the center and lock them, as in Fig. 175. Unlay toward the left strand D and follow it with C, leaving E, F, G and H at the center (see Fig. 176). Follow the instructions for this part of the work as given for the three-strand splice. Then unlay strand F toward the left and follow it with E for one third the distance from the center to where strands C and D are left. Run G and H an equal distance toward the right. Cut all the long ends to the length of the shortest strand as in Fig. 177. The splice is completed as explained for Figs. 171 to 174.

Renewing a broken strand.— Should a single strand break, as in Fig. 178, it may easily be renewed.

Unlay each end of the strand nine to eighteen inches, depending on the size of the rope. Procure a new strand of sufficient length and lay it in as directed for Fig. 168. Tie the strands and tuck the ends, as directed for Figs. 171 to 174.

FIG. 178

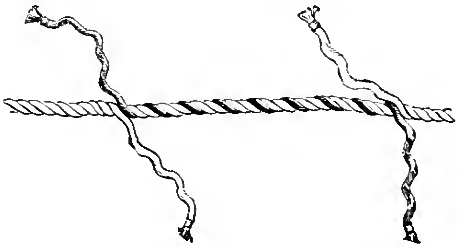


FIG. 179
Renewing a broken strand

Side splice or eye splice.— This is often called by the latter name because it is used for forming an eye or a loop in the end of a rope by splicing the end into the side.

Untwist the strands of the rope end six to fifteen inches or more, depending on the size of the rope. Select as No. 1 the strand that is on the top

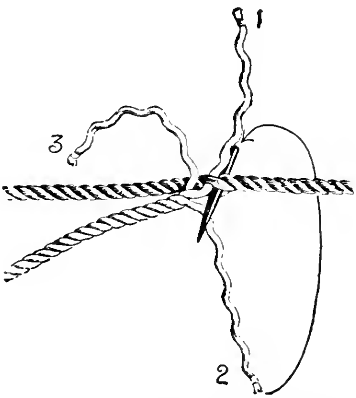


FIG. 180.—*Side splice, first stage*

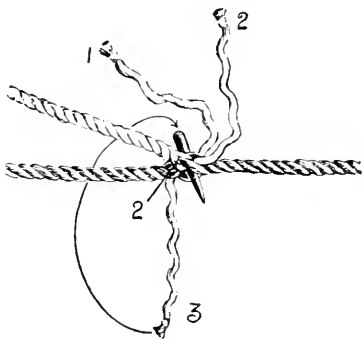


FIG. 181.—*Side splice, second stage*

of the rope and in the middle between the other two strands. Raise a strand on the top of the solid rope and pass No. 1 under it diagonally to the right, as in Fig. 180. Pull it up securely. Turn the two ropes over to the position shown in Fig. 181. Raise the next strand on this side of the one first raised and tuck No. 2 under it away from the body as in Fig. 181. When the marline spike is inserted for this tuck, it comes out where strand No. 1 went in, as shown in Fig. 180. Turn the ropes back to their original position (Fig. 182).

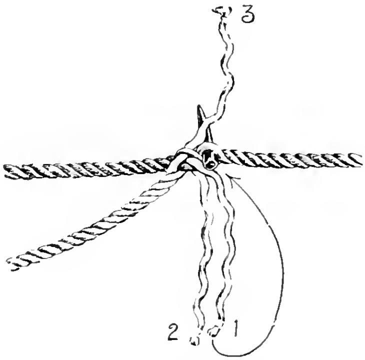


FIG. 182.—*Side splice, third stage*

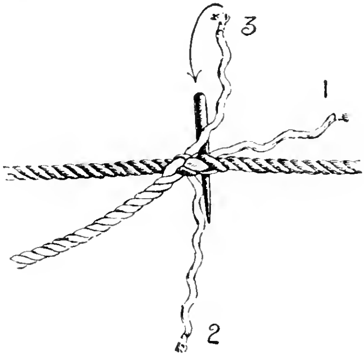


FIG. 183.—*Side splice, fourth stage*

Strand No. 3 is now to be tucked. This strand is inserted at the place where No. 1 comes through, as shown in Fig. 182; it comes out where No. 2 starts in, as indicated in Fig. 181 where the spike is shown inserted for tucking No. 3. Pull the splice up firmly and then proceed to splice the ends into the solid rope, as shown in Figs. 183 to 185, in precisely the same manner as was explained for Figs. 64, 65, and 66. Pound the splice and roll it under the foot.

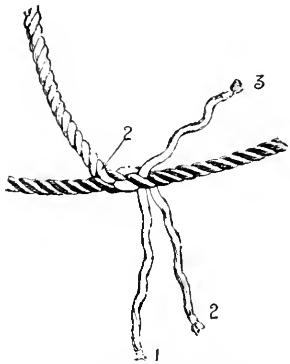


FIG. 184.—*Side splice, fifth stage*

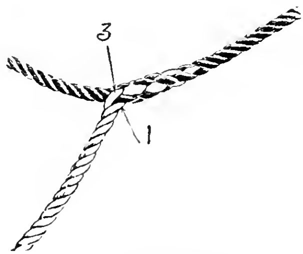


FIG. 185.—*Side splice completed*

ROPE HALTERS AND BRIDLE

Rope halter.— This is used very largely for cattle and for young stock, and frequently for horses. A knowledge of the manner of making this halter may be valuable in an emergency.

Procure rope of the proper size and length as directed in the table on page 83. Measure from one end to A (Fig. 186) the distance given in the table, and with a lead pencil mark the point. From A measure back toward the end the required distance to B and mark the rope. Bend the rope at A to form a bight, and lay it on the knees with the bend toward the right and the short rope away from the body (see Fig. 186). Raise the top strand of the rope at B and pass the long end through under it away from the body, using the whole rope, as indicated by the arrow in Fig. 186, and pull the rope through until A is at the end of the loop as shown in

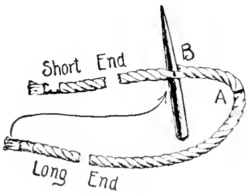


FIG. 186

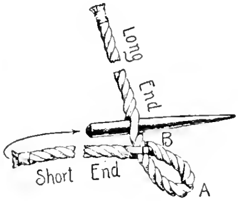


FIG. 187

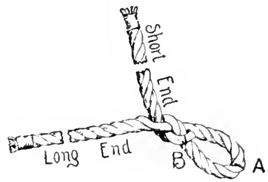


FIG. 188

Rope halter. Forming the eye

Fig. 187. Raise a strand on the top of the long end and pass the short end through under it from left to right, as indicated by the arrow in Fig. 187, and pull up tightly as shown in Fig. 188. From B measure along the short end the distance given in the table to C, and from B measure along the long end to D (Fig. 189).

If the halter is to be of the guard loop type, as shown in Figs. 190 and 191, proceed as follows: Form the halter over the knee, with the eye to the left, the short end over the knee for the head piece, the long end in front for the nose piece. At the mark C on the short end raise the outside strand and pass the long end through from front to back up to the mark D, as in Fig. 189. Just back of this crossing raise the outside strand of the long end and pass the short end through from below, as indicated by the arrow in Fig. 189, and pull up tightly as in Fig. 188.

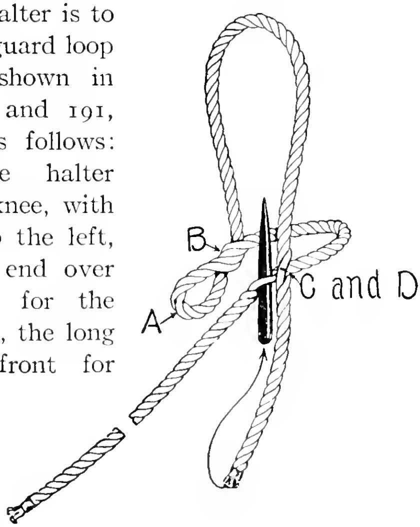


FIG. 189

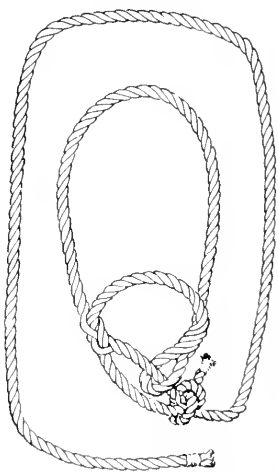


FIG. 190

Rope halter. Loose guard loop type

Pass the long end through the eye and knot the short end, as in Fig. 190, if the halter is to be of the loose guard loop type. If a standard guard loop halter is desired, whip the short end to the long one, as in Fig. 191.

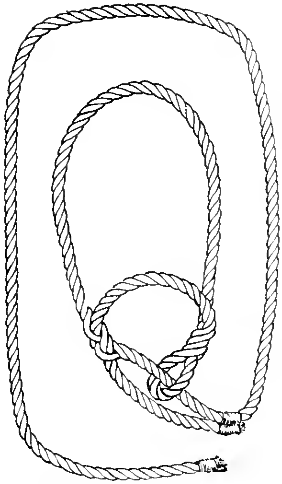
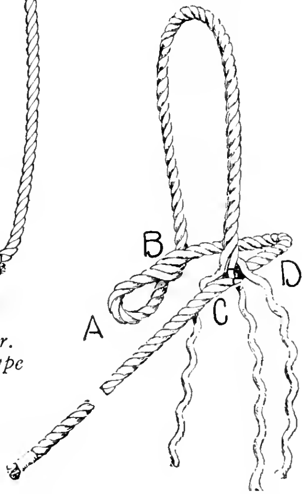


FIG. 191.—*Rope halter. Standard guard loop type*

To make a spliced halter, untwist the strands of the short end down to the mark C. Form



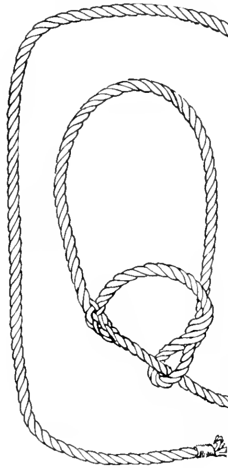


FIG. 192 FIG. 193
Rope halter. Spliced halter

TABLE 3. APPROXIMATE DIMENSIONS FOR ROPE HALTERS

To Be Used For	Rope to be used: Diameter (Inches)	Rope to be used: Kind	Total length for: Standard guard or spliced type	Total length for: Loose guard type	Measurements in inches: End to A: Standard guard or spliced type	Measurements in inches: End to A: Loose guard type	A to B	B to C	B to D	Length remaining for tie rope (Feet)
			Ft. Ins.	*Ft. Ins.*						
Sheep and small calves..	$\frac{1}{4}$	Cotton..	7 3	7 10	26	32	$1\frac{1}{2}$	18	11	4
Small cows...	$\frac{5}{8}$	Manila..	11 2	12 0	46	56	3	34	12	6
Average cows....	$\frac{5}{8}$	Manila..	11 6	12 4	48	58	3	36	14	6
Horses, large cows, and bulls...	$\frac{3}{4}$	Manila..	12 0	13 0	53	64	$3\frac{1}{2}$	39	15	6

the halter over the knee, as described above and as shown in Fig. 192. Raise the outside strand of the long end at D and pass downward under it the middle outside strand of the short end, pulling it down until mark C is at the crossing, as shown in Fig. 192. The strands should now be arranged exactly as shown in Fig. 180. Complete the splice as directed for the side splice and then pass the long end through the eye, as in Fig. 193. Finish the end by whipping (Fig. 55) or by crowning (Fig. 66).

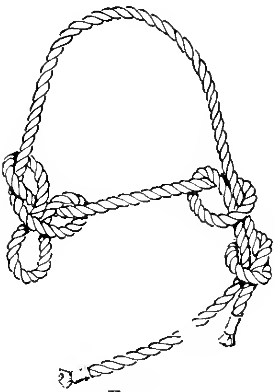


FIG. 194

FIG. 195

Emergency rope halter

Emergency rope halter.—At the required distance from the end of the rope bend it back to form a bight. Holding the short end in the left hand and the long end in the right, tie a harness hitch (Figs. 154 to 156 and Fig. 194). Form the halter over the knee, with the

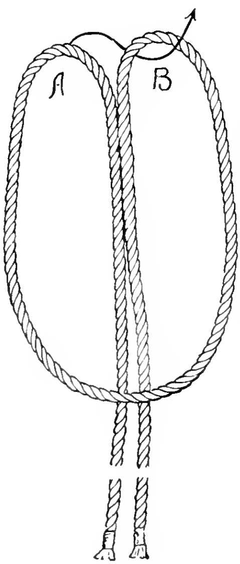


FIG. 196

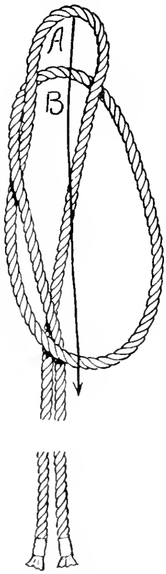


FIG. 197

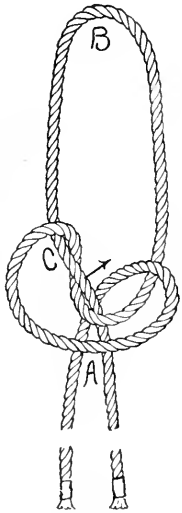


FIG. 198

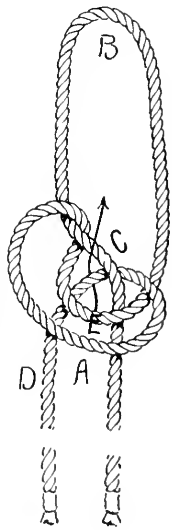


FIG. 199

Emergency rope bridle. First stages

short end over the top, and join the short end to the long end by an "Englishman's tie," consisting of two overhand knots arranged as in Fig. 194. Pull this coupling up tightly and pass the long end through the eye, as shown in Fig. 195.

*Emergency rope bridle or halter.**— In the southwestern part of the United States this is known as a hackamore. The halter shown in Fig. 200 is known to sailors as a running turk's head and it may be used in carrying a jug or other vessel of similar shape.

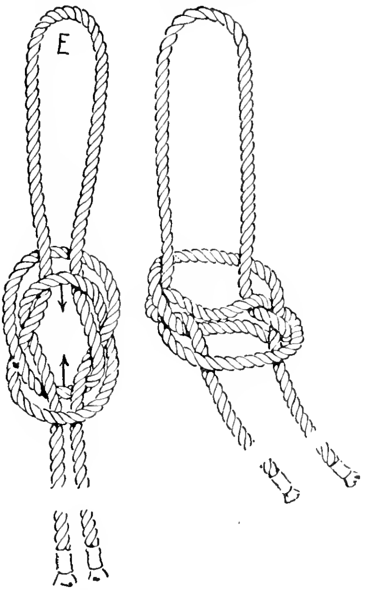


FIG. 200 FIG. 201
Emergency rope bridle completed

Procure enough rope to make both bridle and reins; about 40 feet will be required. Form a bight at the middle of the rope and fold the end of the bight back, laying it over the straight ropes as in Fig. 196. This forms two loops. Pass the left loop, A, upward through the right one, B, as indicated by the arrow in Fig. 196 and as shown in Fig. 197. Fold loop A back, bringing it farther than the original bight was carried, and lay it on the top of the straight ropes as indicated by the arrow in Fig. 197 and as shown in Fig. 198. The left side of loop B we may call rope C; the left-hand straight rope we may call D, and the right side of loop B at the bottom we may call E (see Figs. 198 and 199).

Move C to the right, as indicated by the arrow in Fig. 198 and as shown in Fig. 199. Starting at the left of C and beyond D, reach under D and grasp E at a point between the straight ropes. Draw E down under D and then up through the opening, as indicated by the arrow in Fig. 199. The result will be a running turk's head as shown in Fig. 200, E being at the top of the loop. Draw together the two center ropes, as indicated by the arrows in Fig. 200. This produces a bridle complete with bit, nose piece, head piece, and reins (Fig. 201). Such a bridle is not suitable for continuous service, to be sure, but it will be found useful in emergency.

ACKNOWLEDGMENTS

This lesson would be of little value without the illustrations. The original photographs would not have made good cuts. The drawings

* Shown to the writer during the New York State Fair at Syracuse in 1911, by Mr. Fred G. Ingison of Fayetteville, N. Y.

actually used were made by Professor W. C. Baker of the Department of Drawing, assisted by Mr. Juan E. Reyna, and the writer takes this opportunity to thank these gentlemen for the great amount of skillful and painstaking work that they have contributed.

LIST OF AVAILABLE READING-COURSE LESSONS FOR THE FARM

Old series:

7. Computing rations
8. Sample rations
9. Soiling, silage, and roots
10. Pastures and meadows
22. The composition of milk and cream and their by-products
23. Dairy stables
24. Farm butter-making
25. The dairy herd
28. The plan of the farmhouse
29. Water supplies for farm residences
30. Barns and outbuildings
34. Seed corn for grain and silage
36. Agricultural extension
37. Drainage
40. Tillage and fertilizing in orchards
41. Improving plants by selection or breeding
42. Improving corn by seed selection
43. Methods of breeding and improving the potato crop
44. Horse-breeding in New York State

New series:

2. The soil: its use and abuse
4. Incubation—Part I
6. Incubation—Part II

INDEX

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL. 1. No. 8 — ITHACA, N. Y. JANUARY 15, 1912 — RURAL ENGINEERING SERIES No. 1

KNOTS, HITCHES, AND SPLICES

DISCUSSION PAPER

A discussion paper is sent out with each Reading-Course lesson, for two reasons: (1) We should like to have the reader's ideas on the subjects under discussion. No matter what the lesson says, if you have a different opinion on any of the subjects, do not hesitate to state it on this paper and give your reasons. (2) We should like the reader to use this paper on which to ask us questions. If there are any points which the lesson has not made clear, or if there are problems in your farming, whether on the subject of the lesson or any other, on which you think we may be able to help you, write to us on this paper.

THE NEXT READING-COURSE LESSON WILL BE SENT TO THOSE WHO RETURN TO US THIS DISCUSSION PAPER, WHICH WILL BE AN ACKNOWLEDGMENT OF THE RECEIPT OF THIS LESSON. This paper will not be returned to the reader, but we shall look it over as carefully as we would a personal letter and write to the reader if there are any points about which correspondence is desirable. Under no circumstances will the reader be quoted. As the discussion paper will contain written matter, it will require letter postage.

If you are not interested in this lesson, there are others on other subjects, and we shall be glad to send any of them to you on request. The titles of the series of available bulletins of the former Farmer's Reading-Course, which has been replaced by The Cornell Reading-Courses, Lessons for the Farm, are: 1. (Out of print.) 2. STOCK FEEDING. 3. ORCHARDING. 4. (Out of print.) 5. DAIRYING. 6. FARM BUILDINGS AND YARDS. 7. HELPS FOR READING. 8. MISCELLANEOUS. 9. BREEDING. The titles of series already begun in the new publication are: SOIL, POULTRY, AND RURAL ENGINEERING.

Reading-Course Lessons for the Farm Home may be obtained by addressing Professor Martha Van Rensselaer, Supervisor.

1. What has your experience shown to be the best method of handling a new hay rope so as to avoid kinks?

2. At what part of its length does your hay rope usually wear out?

3. Does it wear on the inside, or from outside injury?

4. Would you say that small pulleys in hay cars cause the rope to wear on the inside to any serious extent?

5. Does your experience show that it pays to buy four-strand rope rather than three-strand?

6. Assuming that a good team can for a moment pull on a hay rope an amount in pounds equal to the total weight of the team, what size of rope would you use for your heaviest team?

7. What is the largest rope that your team should be able to break by a steady pull, according to the figures given in Table 49?

8. How large a rope has this team actually broken by a jerk? Was it a new rope or an old one?

9. What is the weight of this team?

10. What changes do you think should be made in the list of knots that every farmer should know?

11. Name at least one knot that you have found especially useful, and state what use you have made of it. Mention other knots that you have found particularly serviceable and give their special uses.

12. Do you know of a good way, not given in the bulletin, of making any one of the knots that we have described? If so, tell us about it.

13. Do you know of a new knot, useful to farmers, which is not given in this bulletin? If so, give its name, and describe it if possible.

Name. . . . .

Address. . . . .

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. Bailey, *Director*

Course for the Farm, Charles H. Tuck, *Supervisor*

VOL. 1. No. 10 | ITHACA, N. Y. FEBRUARY 15, 1912 | POULTRY SERIES No. 3

FEEDING YOUNG CHICKENS

Clara Nixon

The important objects to be accomplished in the feeding of young chickens are: (1) To bring to maturity or to marketable size and age as large a proportion of the hatch of chicks as possible; (2) to enable the chicks to develop large, strong, well-proportioned frames and good plumage for their variety; (3) to provide for as rapid a growth as is attainable, at as low a cost as is consistent with other requirements. In the fulfillment of these purposes the following factors must be considered: (1) The eggs must be incubated properly; (2) the chicks must not be left too long in the incubator after the completion of the hatch. They should be removed to a nursery, or brooder, when they are thirty-six hours old; (3) the chicks must be strong and vigorous when taken from the incubator; (4) they must be properly cared for and skillfully fed.

ESSENTIALS IN FEEDING

Cleanliness.—All the pens, the food and water dishes, and everything used about the chicks should be carefully cleaned and disinfected at frequent periods. This care should begin before the chicks are put in the brooders and should continue throughout the entire time of brooding. As soon as the litter becomes damp or soiled it should be removed and the pens should be thoroughly swept and disinfected before the litter is renewed. To a considerable degree, careful cleaning will prevent the tracking of filth into the food. The food dishes should be cleaned frequently in order to prevent contamination of the food supply, and the dishes for water should be washed once daily and scalded once each week. Drinking water should be supplied in vessels of such a form as will render impossible the fouling of the water by the chicks. Food should never be allowed to accumulate in the litter, since it is thus likely to become spoiled and unfit for the chicks. Neglect of sanitary precautions furnishes a fruitful source of disease.

Fresh, untainted food.— Spoiled food or musty food of any kind should never be given to young chickens. Moistened food spoils very quickly in summer, and for this reason only a quantity sufficient for one meal should be mixed and any food that becomes even slightly soured or moldy should be thrown away. Cracked grain often heats and becomes musty and, if fed, will cause serious bowel trouble in chicks; therefore, if only one ingredient in a quantity of chick feed of this kind has become musty while in storage or in any other manner, the entire lot should be discarded. Beef scrap manufactured from tainted meats may also prove dangerous food. A convenient method of testing beef scrap is to warm a small quantity of the material by holding it in the hand. If the odor of the warm beef scrap is like that of cooked or even scorched meat, there is probably nothing unwholesome about it; but if the odor is similar to that of decaying flesh, the scrap is wholly unfit for young chickens. Slight mustiness in grain may be detected in the same way.

Quantity and quality of food.— It will readily be conceded that if chicks are not given sufficient food to supply their bodily requirements, they cannot be expected to grow satisfactorily. It is equally true that the food may be abundant but of such a quality that it will not yield sufficient nourishment. For example, chicks fed on a ration consisting largely of bran or some other material containing a large proportion of indigestible fiber could not eat enough of the food to supply the needs of their bodies, although their crops might be constantly full. On the other hand, chicks fed chiefly on beef scrap or on sour milk curd would, in their efforts to fill their crops, get more food material than they could possibly digest. In the first case the chicks would be starved, and in the second they would be overfed. Chick foods sometimes contain a high percentage of small seeds encased in a hard shell, such as millet. The digestive organs of young chickens may not be able to crush this shell, and the chicks may thus eat a large quantity of the grain while obtaining little nourishment from it.

Young chickens should be given as much wholesome food as they will eat, but they should be made to clean it up once a day. If they fail to do this the remaining food should be removed, and no more should be given until signs of hunger appear. The chicks should be kept in such condition that they are eager for food at feeding times, but should be sent to roost with full crops; and unless the attendant is to be at the brooder by daylight or soon after, a little grain should be left in the litter at night so that the chicks may find it the first thing in the morning. The best time to stint the chicks is at the morning meal; they are then more active and will hunt vigorously for every scrap of food left in the litter.

Cracked and ground grains.— Chicks appear to need both cracked and ground grain: the latter because the nourishment is more easily and quickly available, the former because the additional energy needed to reduce the larger food to available form tends to strengthen the digestive system. The difference in the mechanical condition of the food also furnishes a variety in the ration, and the chicks tire less quickly of their food. If ground food is given at night the crops of the chicks are more quickly emptied than is the case when their evening meal is of cracked grain.

Animal foods.— Fowls seem to need animal food. In the natural state the chicks are reared at a season when the supply of insects and earthworms is abundant, and the mother hen exerts herself to procure this food for her brood. Since chicks reared in brooders are under artificial conditions, the supply of insects is very limited and animal food of some sort must be furnished to remedy this deficiency. The material generally preferred for this purpose is beef scrap. If fresh and untainted this gives very good results, when fed in such a manner that the chicks are not obliged to eat more of it than they desire. In an experiment conducted at this Station in 1909,* chicks allowed free access to beef scrap from the first meal ate, in the first six weeks, 5 to 8 per cent of total food in this material. In another experiment, the data of which have not been published, the chicks that had hopper-fed beef scrap with cracked grain and ground food, consumed in beef scrap, during the first eight weeks, 8 to 10 per cent of their total food, excluding green food, and the results were apparently good. One flock, however, was given the mash mixture and beef scrap, with no cracked grain. For this flock the quantity of beef scrap consumed was more at times than all the other food. Eighty-nine per cent of these chicks died of digestive troubles before they were seven weeks old, probably because of their abnormal consumption of a highly concentrated food.

Infertile eggs are sometimes used for the animal food. These should be given with caution, however, as they are very concentrated and may cause digestive troubles if fed in too large quantity.

* See "Seven Methods of Feeding Young Chickens," Bulletin 282, Cornell University Agricultural Experiment Station.

Skimmed milk and its products are greatly relished, but if sour milk curd is fed, care must be taken that the chicks do not get too much. If the milk is given as drink, an unlimited supply at first might cause bowel trouble; after the chicks have become accustomed to it they may have all they want. Skimmed milk is not to be used as a substitute for water.

Commercial milk albumen has been tried in an experiment at Cornell University, but in this case it did not give so good results as did skimmed milk. How far milk products may be substituted for meat scraps and meat meals in chick feeding has not been proved, although in the test of seven methods of feeding chicks, referred to above, those chicks that had no milk ate 5 to 7½ per cent of their total food excluding green food in beef scrap, while those given a mash moistened with skimmed milk or a powdered milk solution ate only 4½ to 5½ per cent of their total food in beef scrap.

Green foods.— Green foods are greatly relished by chicks and seem necessary to their best growth. These foods furnish wholesome nourishment at low cost and supply bulk to a chick ration without excess of fiber. Chicks should be given all the green food they will eat. After the first few days this is best supplied by a grass run. Until the chicks can go out into the yards, green food should be furnished them.

Lawn clippings are often obtainable in the summer. These are much relished, but they should be used when fresh and crisp. Fresh clover or alfalfa is very good; it should be shredded quite fine if given to the youngest chickens. The very young chickens are fond of fresh sod, chickweed, or lettuce, and they are able to pick off the tender leaves; lettuce, however, is often too expensive to use in this way. The older chicks enjoy the leaves and the blossoms of vetch. Sprouted oats are very good and may be provided at any time of the year. The following description of the process of sprouting grain is reprinted from Bulletin 284, Cornell University Agricultural Experiment Station:

" The operation of sprouting grain as a green food requires considerable expense for labor. Sprouted grain, however, appears to have some advantages over other forms of green food, which justify the expense. This is particularly true in the feeding of young chickens during the season when they cannot have access to the ground.

" One of the difficulties which has been experienced in the feeding of sprouted grain is the development of molds. In order to kill smut or mold spores, it is recommended that the grain used for sprouting be treated with formalin. To do this, a large quantity of grain should be treated at one time in order to save expense. One pint of formalin added to thirty gallons of water will treat thirty bushels of oats. The liquid should be sprinkled over the grain, and thoroughly mixed with it. Success will depend largely on the thoroughness of the mixing. The pile of wet grain should then be covered with blankets and allowed to remain for twelve hours. The blankets should be removed and the grain stirred twice a day, until dry, requiring usually about two days. It should then be bagged in sacks which have been sprayed with a formalin mixture of the same strength as used in treating the oats. The grain can then be used as desired for sprouting. The trays should be sprayed thoroughly with the formalin mixture each time they are used.

" For sprouting, soak in warm water one ten-quart pail full of oats for twenty-four hours. Pour this grain on a tray. It will fill the tray level full. Sprinkle each trayful of grain with warm water each morning. The grain must be kept damp all the way through the mass if it is to sprout uniformly. The time required for the grain to sprout and grow will depend largely upon the temperature of the room, which, ordinarily, should be kept at sixty to seventy degrees Fahrenheit, or warmer. In a room not artificially heated, during the spring of the year, in this State, about seven to ten days are required to sprout the grain and grow the leaf about three inches high."

For young chickens it is best to feed the grain when the top has reached a length of two inches; if allowed to grow longer, the sprout is likely to become tough. Chicks will eat both sprouts and roots, and they will eat the grain also as soon as they are large enough to swallow it. For the first week it is better to shred some of the material and scatter it over the food, so that all the chicks will learn to eat the green food. The sprouted grain may be cut in squares from the trays and placed in the pens for the chicks to peck at. Care should be taken to give no more than will be eaten.

The grain may be sprouted in shallow boxes or in well-drained flats kept in a living-room, if needed for only a few chickens. In case a larger quantity is desired a rack similar to that shown in Fig. 202 may be used. This was adapted from a device used at the Maine Experiment Station.

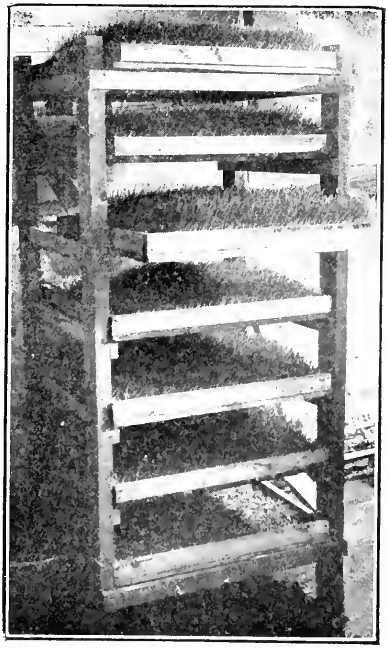


FIG. 202.—*A rack for sprouting oats*

Ash, grit, and charcoal.— Growing chicks need a certain amount of mineral matter for use in bones, muscles, and feathers, consisting in large part of lime in some form. Ash is not supplied in sufficient quantity by the grains and the green foods; in the natural environment the birds probably obtained it from the soil. Most grain foods contain less than one per cent of ash, while meat scrap and meat meal have 4 to 5 per cent; animal meal has 30 to 40 per cent of ash, and bone meal and granulated bone contain 60 to 70 per cent. That additional mineral matter is needed by fowls was proved by experiments at the Cornell University Agricultural Experiment Station, where it was shown that the bones of fowls that were kept from the ground and deprived of additional lime in the form of oyster shells, bone meal, and similar substances, had much lower breaking strength than had those of other fowls kept under similar conditions but supplied with oyster shells. Oyster shells do not seem to be desirable for young chickens, but the mineral matter needed may be supplied easily and cheaply in the form of bone meal or of fine granulated bone. The bone meal seems better for the younger chicks, and it may be given with the dry mash or with the moist foods. If granulated bone is used, care should be taken that it contains no fine, sharp splinters, as these might injure the digestive tract of the chicks.

Grit seems necessary for the health of the chicks, and from the first meal this should be supplied in the food in such a manner that the chicks must find it. They will soon learn to look for it.

Fine granulated charcoal should be included in the food because of its good effect on the health of the chicks. It seems to be a preventive of some digestive troubles. The chicks eat this material with great relish, and they may be given as much of it as they desire.

Palatability of food.— If chicks are forced to eat food that is disagreeable to them, they will eat as little as possible. Such feeding soon results in slow growth and high mortality, especially if the stock is very young; an unpalatable ration is therefore an expensive one, even though the first cost may be small. A single food material that the chicks do not relish may spoil the effect of an entire ration, particularly if the material is in a ground food mixture. Food that the chicks like is looked for eagerly and eaten with a relish, an active scramble often being an accompaniment of the meal. If a sufficient quantity is given so that the smaller chickens are not robbed of their share, all are benefited by the exercise. Eager anticipation is said to promote the flow of the digestive juices, thus aiding in the digestion of food.

Variety.— Variety in a ration is essential for the following reasons: (1) It renders the food more palatable; (2) it is likely to result in a better supply of the materials necessary for growth and for bodily maintenance;

(3) there is less danger of injury from overfeeding or from underfeeding the chicks. If chicks are given only one or two kinds of food, they are likely to become repelled by its sameness. No one nor two foods will supply all the materials needed.

Variety in a ration may be defined as the result of an effort to furnish all the necessary materials and conditions of food. For example: Chicks fed altogether on corn products would be given an excess of fat-forming materials, or carbohydrates, and would receive very little of the food elements required for the formation of bone, muscle, and feathers; on the other hand, chicks fed entirely on beef scrap would receive an excess of muscle-forming material, or protein, with too little of the food elements necessary for the production of fat, heat, and energy. In either case the chicks would be insufficiently nourished, even if they were given all they could eat. A combination of these foods would be more satisfactory, though the ration might still be lacking in bulk. In order to overcome this deficiency some bulky food, such as bran or alfalfa meal, might be added. Either or both of the last-mentioned foods would not make a particularly appetizing mash, and therefore corn meal, and perhaps wheat middlings, should be supplied to render the ground food more tempting; and some bone meal should be added to make up the deficiency in ash. Chicks would tire of corn alone as a cracked grain, and so it should be mixed with wheat and perhaps with hulled oats. This ration would still be very dry and somewhat concentrated, and therefore green food should be supplied.

Such a combination of materials as described would make a good variety of palatable foods, and not a large amount of any one food would be eaten. If there were not enough of one food there would probably be plenty of another, and the chicks would not become too hungry. If they did not have all the mash they could eat, and the lack were made up with cracked grain, they would not become cloyed with concentrated foods.

Changes in ration or in methods of feeding.— Whenever it is desired to change from one food to another, the change should be gradual. To the original ration a little of the new food should be added, the proportion being increased at each feeding time until the change of ration will have been accomplished. If the new ration is a suitable one, the gradual change is likely to prevent any digestive trouble, which might otherwise occur. In case it is desired to give the chicks some concentrated food that they particularly like, such as green cut bone, only a very small quantity should be given at first, the amount being increased by slow degrees until the chicks are receiving as much of the food as it is advisable to give them.

As chicks grow older, the number of feedings should be decreased.

The number should not be dropped at once from five to three, but should be changed first from five to four, then from four to three, chicks in confinement being given for a day or two a little chopped onion or other well-liked food at the usual feeding time. This attention will prevent restlessness, and may avert serious trouble and loss from crowding, toe-pecking, or other disturbance.

Constant supply of clean water.— Fowls seem to crave a large quantity of moisture, especially when eating dry food or rations rich in protein. Serious results may follow if this moisture is not obtainable. It is often observed that when hens are deprived of their water-supply for even a short time, the subsequent loss in egg-production is marked. The apparent effect on the growth of the chicks is not so immediate, but when once their water fountain becomes dry they will show their discomfort by constant efforts to drink. Chicks left too long in an incubator seem to suffer greatly from thirst. The water-supply should be fresh, clean, and constant, and should be furnished in vessels that will not allow the down of the chicks to become too wet. Drinking water may be supplemented, but not superseded, by skimmed milk.

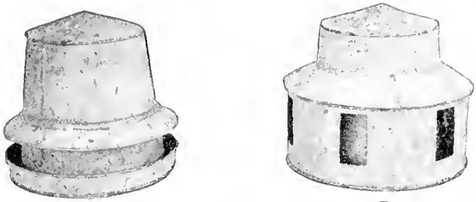


FIG. 203.— *Two styles of water fountain suitable for chicks. A is more desirable than B because in the latter, chicks may crowd into the openings and be unable to get out. To fill the fountain, turn the top part upside down, fill it, cover it tightly with the pan, and reverse the fountain*

Two styles of water fountain are shown in Figs. 203 and 204. The fountain should be large enough to contain at least a half-day's supply of water, sufficiently light to be handled easily, strong enough to be durable, of such a form that it may be washed and scalded without difficulty and will be easy to fill, large enough to enable a considerable number of chicks to drink at the same time, and shaped so that the chicks cannot perch on it and foul the water. A serviceable drinking fountain may be made from a tomato can and a pie tin. The tin should be large enough so that the space between its edge and the

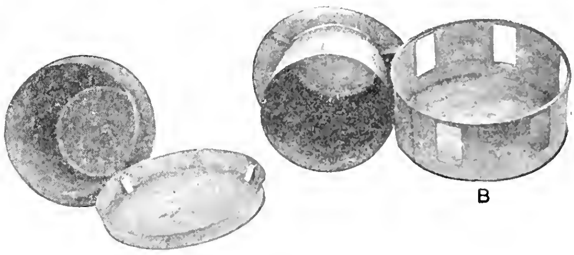


FIG. 204.— *Detail of water fountains. The small braces in the pan of A are not desirable because of the greater danger of spilling the water when reversing the fountain after filling*

side of the can will permit the chicks to drink with ease. The open end of the can should be unsoldered and three or four notches cut in the edge, the notches being a little shorter than the depth of the pie tin. The can may then be filled, covered tightly with the pie tin, and reversed. The water will rise in the tin to the height of the top of the notches.

Access to fresh earth.— Chicks appear to obtain from fresh earth something necessary to their health, and they should be supplied with some fresh soil soon after they are removed from the incubator. Sand or dry earth does not satisfy the need. Fresh sod, a chickweed or a lettuce plant with a handful of soil on the roots, gives the right combination, supplying green food and earth and tempting the chicks to activity.

Exercise.— Healthy chicks kept in small pens and properly fed will grow very rapidly for the first week or ten days, but will of course get little exercise. They usually become restless at this age and appear anxious to get out of the brooder. If after two weeks they are removed to a larger run, it will be found that they are much weaker and less active than others of the same age that have been similarly fed but have had wider range. In most cases the subsequent mortality is considerably higher in flocks that have been confined in small pens.

When chicks are hatched early in the season it is often impossible to give them an outdoor run. An incentive to exercise must then be supplied. Cracked grain scattered in litter, a sod, a chickweed or some other green plant, or a block of sprouted oats will keep the chicks busy for some time unless they are having other foods in too great quantity. A small amount of onion or of fresh, lean meat, chopped fine, will be scrambled after and fought for as long as a scrap remains.

Chicks kept in small yards, if allowed to become idle, are likely to develop bad habits, such as pecking one another's toes, pulling feathers, or crowding. Unless something is otherwise materially wrong, any tendency to these vices may be broken up by attracting the attention of the chicks in another direction and by keeping them occupied. If the tendency is allowed to become a habit, however, it will be hard to overcome. Active, busy, properly fed chicks do not ordinarily acquire bad habits, although they may crowd if the brooder is not opened early in the morning; and in their efforts to get out, there is danger that some may be trampled to death.

Care.— The rapid development of young chickens renders constant care and watchfulness of the utmost importance. Any slight appearance of discomfort or of drooping may be the first indication of a condition that will prove a menace to the flock. It is never safe to wait long for developments; the cause of the wrong condition should be sought and remedied immediately —to-morrow may be too late to save the flock.

By careful observation from the beginning, the person who feeds the chicks may learn to know them and will be able to detect at once a change in their condition that the casual observer would never see. For instance, carelessness in feeding may induce a slight digestive disorder. If the condition is observed at once the evil may be corrected, while continued carelessness will cause serious loss to the owner. Persistent care and watchfulness will very often prevent trouble and loss. The removal of damp litter will obviate a menace to every chick in the brooder, as one of the common molds, Aspergillus, adapts itself readily to the membrane lining the air passages and air sacs of the chick, sometimes causing high mortality. If a bright-colored cord carelessly dropped in the brooder is allowed to remain there, this indigestible material will probably be swallowed, perhaps by two chicks, one at each end of the string. If the ravelings that become loosened on the cloth around the hover are not removed, chicks may be strangled. These are only a few of many complications that should be avoided.

It cannot be too strongly emphasized that untiring care is absolutely essential to the success of any method of chick feeding. Young chickens are very small creatures and the loss of a few may seem a trifling matter; but in a flock of fifty, one chick is two per cent of the flock. Any method of feeding is expensive if it permits a high mortality. Vigilance will often greatly reduce mortality.

GENERAL DETAILS OF FEEDING

Time of first feeding.— It is believed that the chick derives nourishment from the yolk of the egg, which is enclosed within its abdomen just before it breaks from the shell; and that too early feeding prevents, or at least hinders, the proper absorption of this yolk. Chicks begin to show signs of hunger thirty-six to forty-eight hours after hatching. They peck at one another's toes and beaks and rush to the front of the incubator when they hear a tapping on the glass door. If given water, they drink eagerly. They are usually transferred to the brooder at this time and are then given their first meal.

The first meal.— Whatever the method of feeding may be, the first food should contain grit, charcoal, and granulated bone, all of very small-sized grains. These should be mixed with the other foods in sufficient quantity to be easily noticed. Cracked grain may be fed at first in a shallow tray or dish containing a small quantity of bran. If a dry mash is used, this will take the place of the bran. Moist food should be given in trays ten or twelve inches wide, having low vertical sides to prevent loss of the food; enough of these trays should be used to furnish plenty of feeding surface. Bone meal should be supplied in the first moist food given.

Tender green food should be finely shredded and a small quantity scattered over the other food, and a sod or a green plant with soil on its roots should also be given to the chicks.

Should food be kept before young chickens at all times?— For the first two or three days it seems best that the cracked grain, and the bran or dry mash, should be kept before the chicks in order to make certain that all have plenty of food. The moist food should be removed after each meal as soon as all have had opportunity to eat. The latter should be given in small quantities in order to prevent waste, and any food that becomes soiled or soured should be thrown away at once.

When the chicks are four or five days old they should be able to scratch for food in light litter, and the cracked grain fed in this litter should be cleaned up once a day. When dry mash is fed, this is always accessible to the chicks, but it should be given in such quantity that it will be eaten in one day. Any dry mash remaining in the tray should be removed if it becomes soiled.

Training the chicks.— Incubator chicks have no knowledge of what to eat or of where to find food. They will pick up one thing as readily as they will another, if it is of convenient size; for this reason, great care is necessary as to any materials left in the brooder. If sawdust is used as litter, the chicks may eat enough of it to cause high mortality. The use of bran as litter is objectionable on the same ground, although in a lower degree; it contains a large proportion of indigestible fiber, and may be eaten instead of more nutritious food. Bright, clean straw, cut an inch or two in length, makes the best litter.

In order to teach chicks what to eat and where to find it, some signal is necessary. From the first, chicks recognize the call of the mother hen. They will come almost as quickly in answer to a sound of tapping, running directly to the source of the sound and following it from place to place. This signal is very useful in teaching them to find food and drink. When the chicks are called to the food dishes their attention should be directed to the food by picking up a small quantity and scattering it before them, dropping some bits on their down. Repeated tapping on the trays and scattering of the food among the chicks seems to awaken their curiosity, and they soon begin to pick the particles from one another's backs and from the food trays. Chicks quickly imitate one another, and when a few begin eating, their example is followed by others.

The majority of the chicks should eat a little when first fed, although a few of the youngest may not be hungry. The latter may safely wait until the next meal. It may be necessary to push the chicks back under the hover after the first feedings, because they are not yet wise enough to return to a warm place and may become chilled if left outside the hover. In the morning of the second day the hover should be raised and all the chicks should be forced out to the food dishes. By this time the greater proportion will know where to find food and drink; the backward ones should be encouraged, otherwise some of them may starve. A small quantity of cracked grain may now be scattered in light litter, the attention of the chicks being attracted to this action. If some of the grains strike the chicks in falling, the food is more quickly seen.

After the first few days, or as soon as all the chicks have learned to find the different kinds of food, the grit, charcoal, and granulated bone may be put into a separate dish and the green food need not be so finely shredded. Under favorable circumstances the chicks should be allowed to leave the brooder when three days old, but they should not be forced outside. In order to teach the chicks the way back into the brooder, a little train of food may be laid from the ground along the entrance and to the inside of the brooder. When a few of the chicks find this food, most of the others will follow them inside, but care should be taken that even the most backward learn quickly the way to the source of heat. A little food scattered outside the brooder will encourage the chicks to get out on the ground; but the greater part of their food, including some of the green food, should still be put in the brooder. On rainy days, when the chicks remain indoors, it is especially necessary that they be kept busy. The meals should be somewhat lighter on such occasions, and between feeding times a little onion, lean meat, or other "chickens' dainty," cut to a suitable fineness, should be scattered in the litter. Only a quantity sufficient to induce a scramble should be given.

The daily meals.— For the first two weeks the chicks are usually fed five times a day, and should be given all they will eat. After the second or third day they should be required to clean up their food once daily. The number of meals is later reduced to four and then to three, and finally the method is changed to hopper-feeding; the age at which these changes are made being influenced by the conditions under which the chicks are reared. If kept in small yards, the chicks should be fed more often and given a smaller quantity at a feeding than if allowed a larger run. In case chicks accustomed to range are kept for a day in the brooder, it may be best to increase the number of feedings, giving a less amount at each meal.

The morning meal should consist of grain, and the conditions should be such that the chicks will be obliged to hunt for the food. The amount fed must be controlled by the appetites of the chicks. If they become overfed, no more food should be given until they are eager for it. They should not be fed with any particular material that becomes distasteful to them. The subsequent feedings should be sufficient to satisfy the appetite. Green food should be given at least twice a day. At night the chicks should have all the food they will eat, with just a little left over to be eaten by the earliest light. They should not be fed in the morning until they are hungry.

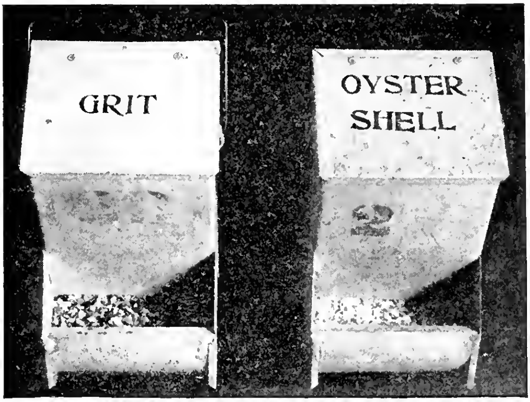


FIG. 205.—*Grit hoppers. These hoppers are used in feeding the mixture of grit, granulated bone, and charcoal to chicks more than one week old. Oyster shells seem to be undesirable for young chickens*

Small hoppers or boxes should be used for grit or for charcoal; one style of hopper is illustrated in Fig. 205. These should be placed in the pens at the end of the first week and should be fastened securely so that they cannot tip over, being so placed that it will be impossible for the chicks to crowd behind them.

The trays used for dry ground food are shown in Fig. 206. These trays are made of smoothly planed wood, and are thirty inches long, four inches wide, and of three different heights: two inches for the youngest chickens, three inches for the next size, and four inches for those still larger. A piece of hardware cloth of one half inch mesh is loosely fitted into the tray, being placed over the food in order to prevent waste.

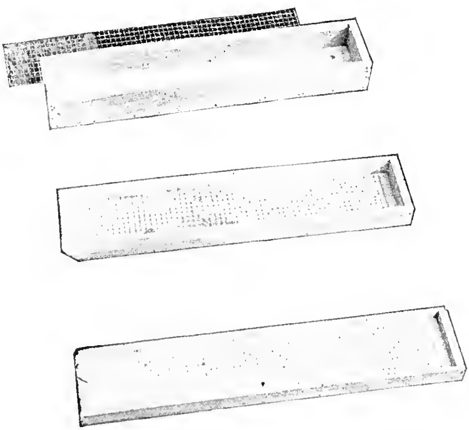


FIG. 206.—*Trays used in feeding baby chicks. A loose piece of wire screening, slightly smaller than the top of the tray, is placed over the food to prevent waste. The mesh of the screening should be of half-inch size*

When the chicks are six to eight weeks old, a covered feed trough may be used as shown in Fig. 207. This trough is made of planed wood, and has a raised cover attached to two upright pieces that slide loosely into guide irons at each end of the trough. It is sometimes necessary to fasten projecting strips of wood along the top edge of the trough, running upright wires between these and the raised cover at intervals of three inches, in order to prevent wasting the food.

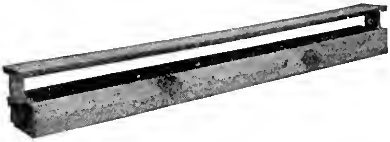


FIG. 207.—*A feed trough for the larger chicks. This is used indoors, or placed under the colony houses. The top is removable, thus making the trough easy to fill and to clean*

Culling.—Chicks of different sizes should not be fed together, as the smaller ones may be robbed of their rightful share of the food. Healthy chicks of the same age and breed and similarly fed are usually much alike in size and in activity. If the flocks show uneven growth, the smaller chicks should be separated from the larger ones. Chicks of the same size may run together, unless those that are older are very small for their age; in such a case the lack of development should be regarded as a sign of disease.

Diseased and healthy chicks should not be allowed to run together. The most frequent cause of the communication of disease from one bird to another is by means of food and water. By providing fresh, wholesome food and drink and by removing the sickly chicks from among the healthy ones, this danger is largely avoided.

Feeding growing stock.— The growing stock should be placed on larger range, the cockerels being removed to separate quarters except such as are to be kept for breeding purposes. These chickens may now be hopper-fed and the ration should be a generous one. The grain ration may contain a larger proportion of corn and no hulled oats. Very early pullets may be fed largely on whole grain if it is desired that they shall not begin laying early. Later pullets may be hurried on to early laying by feeding them with a ration containing a larger proportion of ground grain and of beef scrap.

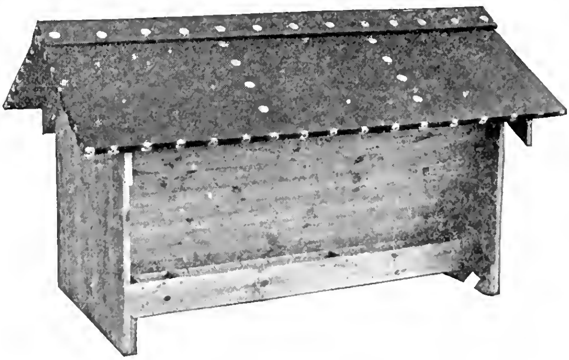


FIG. 208.—*An outdoor hopper used in feeding growing stock when on range*

An outdoor hopper is desirable for growing stock. This should be set in a place sheltered from the prevailing winds and where the sun will shine on it. The Cornell outdoor hopper is illustrated in Figs. 208 and 209. It is divided into separate compartments for whole grain, dry mash, grit, and beef scrap.

The dishes for water should be large and numerous enough to supply a liberal quantity, so that the chickens may never be obliged to go thirsty.

Shall unmixed beef scrap be always accessible to the chicks? — At the Cornell Experiment Station it was found that no injury resulted from feeding unmixed beef scrap to chicks of any age, provided they had plenty of other food suitable to their needs. If the ration was deficient in the necessary food elements, however, the chicks, in their effort to supply the lack, ate enough beef scrap to cause a high mortality in the flock. It was also found that young chickens having constantly before them a mash containing twenty to twenty-five per cent of beef scrap, grew very satisfactorily without hopper-fed beef scrap. Since a good dry mash containing a liberal supply of meat food appears to answer all requirements for young chickens, this is safer food for them than is unmixed beef scrap. A wet mash may also be used, if desired. Growing stock on range, having plenty of exercise and finding an ample supply of insects, will not eat enough beef scrap to cause injury.

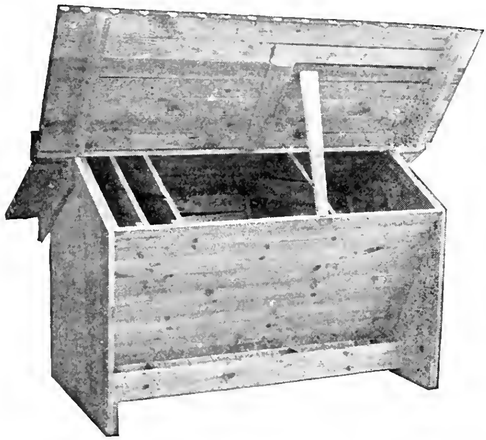


FIG. 209.—*An interior view of the outdoor feed hopper, showing compartments that may be used for grain, dry mash, grit, and other foods*

The use of condimental foods and salt.— Many preparations guaranteed to produce better health and growth in chicks, with perhaps much less food consumption, are on the market. These condimental foods are expensive and in most instances are of little or no value. If chicks are strong and healthy at the start and are reared under proper conditions, they do not need these foods; on the other hand, if they are weak or have been injured by improper care or food, condimental mixtures alone will not correct the wrong.

Salt does not appear to be so necessary to fowls as to other domestic animals, and it may cause death if given in too large quantity; but mash salted as for human food often seems to be better relished than when fed without the salt. Whether or not salt promotes digestion in fowls has not been proved.

The use of prepared chick foods.— Commercial chick foods that are free from mustiness and do not contain too much millet are often fed with excellent results. As a rule, however, they are too expensive in case the number of chicks to be reared is large. The poultryman who prepares his own chick foods usually saves something on the cost, and by using only the best and cleanest of materials he is, with reasonable care, always sure of the quality of food given. A large variety of grains is not necessary to the growth of the chicks. Corn, wheat, oats (minus the hulls), are sufficient; or wheat fed alone as a grain food, or with cracked corn, will give good results.

A good ration for chick feeding.— From the first day to the fourth, the following mixtures may be used:

	By weight
Rolled oats	8 parts
Bread crumbs	8 parts
Sifted beef scrap	2 parts
Bone meal	1 part

This is moistened with sour skimmed milk and fed five times a day. Cracked grain mixture should be left before the chicks in a shallow tray containing a little dry mash like that given in the later feeding.

	By weight
Wheat (finely cracked)	3 parts
Corn (finely cracked)	2 parts
Pin-head oat meal	1 part

Fine grit and charcoal mixed with grain, and a little finely shredded green food, should be scattered in the trays. Plenty of clean water should be supplied at all times.

Subsequent feeding.— The following mash moistened with skimmed milk should be substituted gradually for the bread, rolled oats, and beef scrap:

	By weight
Wheat bran	3 parts
Corn meal	3 parts
Wheat middlings	3 parts
Sifted beef scrap	3 parts
Bone meal	1 part

The moist mash should be fed two or three times a day. Cracked grain should be given at least twice a day, scattered in light litter as soon as the chicks are able to find it. Mash in dry condition should be kept in a shallow tray before the chicks. Grit, charcoal, and fine cracked bone should be fed in separate trays or hoppers. When four weeks old the chicks should be receiving two meals of the mash and three of the grain.

So far as results of experimental work at the Cornell Station are now available, it seems probable that the proportion of beef scrap in these mixtures might be somewhat increased with benefit to the chicks, provided the scrap used were good and wholesome. Opinions differ as to the best method of insuring a plentiful supply of meat food to the chicks. Some poultrymen would add another part of beef scrap to the food mixtures; others would supply beef scrap in a tray or a hopper after the first two or three weeks, giving a limited amount at first and gradually increasing the quantity until beef scrap was before the chicks at all times; still others would allow the chicks all the beef scrap they wished from the first meal. Any one of these methods would probably be satisfactory, as the ration provides plenty of food materials in good proportion and condition.

Beef scrap should always be carefully inspected before it is fed, in order to make sure that it is free from taint and from mustiness. Sifted beef scrap sometimes becomes musty in storage unless it is kept in a very dry place. In any case, beef scrap should never be supplied to chicks in sufficiently large quantities or under such conditions that it may possibly become musty before being consumed.

After three weeks the number of meals should be reduced, first to two mash and two grain, then to one mash and two grain; the grain should be fed morning and night and the dry mash should be constantly accessible. As soon as the chicks will eat larger grains, the wheat need not be cracked, hulled oats may be used instead of pin-head oat meal, and the corn may be more coarsely cracked.

When the chickens are eight weeks old the grain ration may be changed to the following:

	By weight
Corn (large cracked)	3 parts
Wheat	2 parts

If it is desired that the chickens shall develop slowly, the moist food may be gradually discontinued after the third week.

These mixtures may be continued for the growing stock, being fed from hoppers, and clear beef scrap may be added to the ration if desired.

Adaptation of the ration to conditions.— The above method of feeding has been proved good for large numbers of chicks reared in brooders; it may be adapted to the farmer's flock so that materials that would otherwise be wasted may be given to the chicks. A little cooked breakfast food left from the morning meal may be combined with bread crumbs, a few bits of finely chopped lean meat, or a little hard-boiled egg, and, if bone meal is not at hand, some of the powder from a well-burned bone.

Bread slightly moistened with milk may be used without the breakfast food. If finely cracked corn and pin-head oats are not available, wheat screenings usually are, and chicks three or four days old will swallow the smaller kernels. Buckwheat, barley, and rye should not be fed to the chicks.

Table scraps will largely take the place of beef scrap for chicks on a free range, especially if the chicks are reared by hens. If the farmer has animal meal for his stock, it may be used instead of beef scrap in a moist mash, with the table scraps. This will furnish mineral matter if bone meal cannot be obtained. Burned bones will provide bone ash when nothing else is handy.

Good, bright alfalfa or clover chaff (leaves), sifted to remove the dust, is excellent for chicks. It may be scalded and allowed to stand for a few hours, and then given in addition to the green food, or a small amount added to the ground food, after the chicks are a week old.

When chicks are reared by the natural method the mother hen teaches them what to eat and when to eat it, and their owner has far less trouble about their diet. If possible, hen and chicks should be allowed free range. Plenty of food should be furnished for both and whole corn should be included for the hen. Oats in the hull are not good for chicks because of the undesirable shuck.

A useful feed-coop.— In case chickens of all ages must run together, a feed coop is desirable. The foundation of the coop is a strong frame three feet by four feet, and two feet high. On the sides of this frame lath are nailed, far enough apart to admit only the smaller chickens. A tight cover having a hinged trapdoor sufficiently large to allow the food dishes to be passed through, completes the coop. This coop provides a place where the younger chickens may be fed their extra meals and may eat their mash mixture undisturbed. It should be shifted to a clean place from time to time. More than one coop should be furnished, if necessary.

A feeding enclosure large enough to admit a person is preferable when large numbers of chicks are to be reared. This may be of large-mesh woven wire fencing of the necessary height, the mesh being of a size that will admit only the smaller chickens.

It is true that in chick rearing, care and feeding must be largely depended on to produce satisfactory results; but good food and effort are wasted on sickly chicks. An absolutely essential factor in the successful rearing of poultry is native health and vigor in the flocks. In order to make possible the production of vigorous chicks the parent stock must be strong and healthy, and must be kept under conditions as nearly as possible like those of the natural state.

THE CORNELL READING-COURSE FOR THE FARM

This course aims to place before its members consecutive lessons on important branches of farming. Lessons on the same general subject are grouped in a series and given consecutive serial numbers. Some of these series already contain a number of lessons. Reading-Course Lessons for the Farm are published every month and in this way the number in all the series is gradually increased. New series are started from time to time. On the last page of this lesson is given a list of present series together with available lessons in each.

Reading-course members who have signified their desire to study a particular series have been supplied with the first lesson of the series and, on the return of the discussion papers, with such subsequent lessons as are available. Those who have had all of the lessons in any series and who desire to study the subject further are supplied with Cornell University Experiment Station bulletins, if appropriate ones are available, and are referred to other sources of information.

Reading-course lessons have been provided to meet the needs of persons who desire a course of study at home. Points in the lesson not thoroughly understood should be mentioned on the discussion paper and questions asked. We have been much pleased at the study and thought shown by the questions and answers some readers have returned on discussion papers, and feel sure that such readers get the most benefit from the lessons. If you wish to begin a series of lessons, advise us on the discussion paper herewith. It is the only way for us to know what lessons to send you.

READING-COURSE CLUBS

The study of the lessons may be furthered by groups of farmers and their families meeting together in simple informal organizations known as reading clubs. Where these clubs have been tried, good results have been secured. These organizations in themselves have been a means of distributing information, bringing to light valuable local experience, and arousing an interest in improved agriculture. The supervisors of the Cornell Reading-Courses are very glad to cooperate in starting and conducting such groups. Would you be interested in having in your community a good, live reading-course club? By means of the Cornell Reading-Course lessons, interesting programs can be prepared for study clubs. Suggestions on how to start a club may be obtained by addressing The Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, N. Y.

AVAILABLE READING-COURSE LESSONS FOR THE FARM ARRANGED BY SERIES

Back numbers of the former Farmers' Reading-Course

Series	
Stock-feeding	7. Computing Rations
	8. Sample Rations
	9. Soiling, Silage, and Roots
	10. Pastures and Meadows
	34. Seed Corn for Grain and Silage
Dairying	22. The Composition of Milk and Cream, and their By-Products
	23. The Construction of Sanitary Dairy Stables
	24. Farm Butter-Making
	25. The Dairy Herd
Buildings and yards	23. The Construction of Sanitary Dairy Stables
	28. The Plan of the Farmhouse
	29. Water Supplies for Farm Residences
	30. Barns and Outbuildings
Plant-breeding	41. Improving Plants by Selection or Breeding
	42. Improving Corn by Seed Selection
	43. Methods of Breeding and Improving the Potato Crop
Farm crops	9. Soiling, Silage, and Roots
	10. Pastures and Meadows
	34. Seed Corn for Grain and Silage
	42. Improving Corn by Seed Selection
	43. Methods of Breeding and Improving the Potato Crop
Orcharding	40. Tillage and Fertilizing in Orchards
The horse	44. Horse Breeding in New York State
The soil	37. Drainage and Larger Crops

Cornell Reading-Course Lessons for the Farm

The soil (continued)	2. The Soil: Its Use and Abuse
Poultry	4. Incubation, Part 1
	6. Incubation, Part 2
	10. Feeding Young Chickens
Rural engineering	8. Knots, Hitches, and Splices

Residents of New York State may register for one or more of the above series by addressing The Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, N. Y.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published Semi-monthly by the New York State College of Agriculture at Cornell University, Throughout the Year. Application for Entry as Second-Class Matter at the Post Office at Ithaca, N. Y., Pending

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL. 1. No. 10 | ITHACA, N. Y. FEBRUARY 15, 1912 | POULTRY SERIES No. 3

FEEDING YOUNG CHICKENS

DISCUSSION PAPER

A discussion paper is sent out with each Reading-Course lesson, for two reasons: (1) We should like to have the reader's ideas on the subjects under discussion. No matter what the lesson says, if you have a different opinion on any of the subjects, do not hesitate to state it on this paper and give your reasons. (2) We should like the reader to use this paper on which to ask us questions. If there are any points that the lesson has not made clear, or if there are problems in your farming, whether on the subject of the Lesson or any other, on which you think we may be able to help you, write to us on this paper.

THE NEXT READING-COURSE LESSON WILL BE SENT TO THOSE WHO RETURN TO US THIS DISCUSSION PAPER, WHICH WILL BE AN ACKNOWLEDGMENT OF THE RECEIPT OF THIS LESSON. This paper will not be returned to the reader, but we shall look it over as carefully as we would a personal letter and write to the reader if there are any points about which correspondence is desirable. Under no circumstances will the reader be quoted. The discussion paper will require letter postage.

If you are not interested in this lesson, there are others on other subjects, and we shall be glad to send any of them to you on request. The titles of the series of available bulletins of the former Farmers' Reading-Course, which has been replaced by The Cornell Reading-Courses, Lessons for the Farm, are: 1. THE SOIL AND THE PLANT. 2. STOCK FEEDING. 3. ORCHARDING. 4. (Out of print.) 5. DAIRYING. 6. FARM BUILDINGS AND YARDS. 7. HELPS FOR READING. 8. MISCELLANEOUS. 9. BREEDING. The titles of series already begun in the new publication are: THE SOIL, POULTRY, AND RURAL ENGINEERING.

Bulletins in The Cornell Reading-Course for the Farm Home may be obtained by addressing Professor Martha Van Rensselaer, Supervisor.

1. Name the essential factors in the successful rearing of chicks.

2. By what measures would you insure cleanliness?

3. What are the most common sources of animal food for chicks? Which is preferable?

4. How may green food be supplied to chicks?

5. How may mineral matter be supplied to chicks?

6. When should chicks be given their first meal and what should be included in the first food supplied to them?

7. How may incubator chicks be trained to find food and warmth, and to return to the brooder?

8. For what reasons is culling of the flocks necessary?

9. Is home-mixed chick food to be preferred to commercial foods? Why?

10. Give a good ration for chick feeding, and state how it should be fed.

Name....................................

Address..................................

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL. 1. No. 12 ITHACA, N. Y. MARCH 15, 1912 FARM FORESTRY SERIES No. 1

THE IMPROVEMENT OF THE WOODLOT

WALTER MULFORD

In order to get a crop of potatoes, we plant and cultivate; if we want the best orchard, we spray and prune; but we let nature plant and care for the woodlot — and then we wonder why that woodlot does not pay!

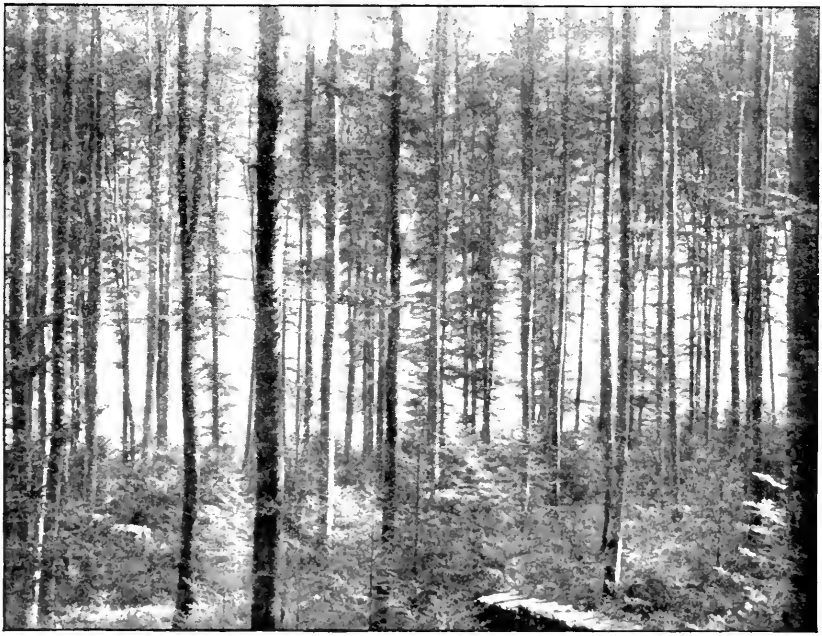


FIG. 210.—*The timber crop can be greatly improved in quality and quantity by proper care. This stand of hardwoods has been given such care*

Look carefully at your woodland. Are all the trees of the kinds that you like best? Are there places where the trees are so crowded that none of them can grow well? Are there young trees growing so far from their neighbors that they will hold their branches most of the way to the ground, and so make knotty lumber? Are there open spaces with no trees at all? Are there decaying, crooked, or forked trees, whose room could be more profitably occupied by better ones? Is there grass in the woodlot? If you care for the woodlot as a place to raise timber rather than to furnish pasture, a cover of grass instead of a leaf mulch is as bad a condition in the woodlot as is a tangle of worthless bushes in the orchard.

It is sometimes said that the woodlot needs no care because timber will grow without help. So it will. And so will the natural meadow yield a crop, but if we want plenty of the best hay we do not trust entirely to the natural meadow. The woodlot will respond to care just as much as will the hayfield, both in the amount of product and in its quality.

The most serious objection made to giving care to the woodlot is that it takes too long to raise the crop. It is true that many years are required to raise timber of considerable size. This is one of the reasons why the government should practice forestry on a large scale. The national, state, county, and city governments will probably raise most of our large-sized timber of the future. It does not take so long to raise small and medium-sized products, however, and there are several reasons why it is usually good business to raise them on the farm.

A large amount of farm land is too poor to be used profitably for the regular farm crops. Instead of being cultivated at a loss, or lying idle, such land should be used to raise timber crops. If there is already some thrifty young timber on the land, it will not be many years before it is large enough to cut. By giving such timber a little care, it can be brought to merchantable size much sooner than if left to itself. Even if the woodlot must be started from seed and therefore a long time must pass before the harvest, its care is an easy and safe way in which to build up a bank account of several thousand dollars for old age or for one's children. Moreover, the time is coming when first-class woodlots of thrifty young timber not yet large enough to cut will have a decided value. Such a woodlot will give the farm as a whole a higher value.

The value of the woodlot should not be judged simply by the sale value of the product raised on it. If there is no woodlot on the farm it will be necessary to buy wood materials; and the buying price is decidedly greater than the price for which the farmer could sell the same products, entirely aside from the cost of haul. The convenience of having wood, posts, and timbers of various sorts at hand when wanted is in itself no small matter. Further, many woodlots increase farm crops by shielding them from wind.

Because of the protection it affords against disagreeable winds, and because of its beauty and the pleasure to be derived from it, the woodlot often makes the farm a still more pleasant place on which to live. For this reason alone the farm frequently commands a higher sale value.

The expense needed in caring for the woodlot is much less than for other crops.

One of the troubles with the farm-help problem is that many farms do not have enough winter work to hold the good help all through the year. The woodlot offers one means of providing winter work for men and teams at times when they might otherwise be idle.

In one way or another the soil should be kept usefully busy. The need of most farms is better cultivation, rather than more land to cultivate. The good lands should receive the best possible tillage, and good woodlots should be maintained on such lands as are not well suited to other crops.

HOW TO CARE FOR THE WOODLOT

There are three principal ways in which a woodlot left to itself is not so good as it might be. There are, therefore, three chief aims to be kept in view in caring for the woodlot: (1) to keep the ground covered with as many trees as can grow to advantage; (2) to have only the best possible trees; (3) to make the trees grow rapidly.

Density of stand

Openings in the forest do several kinds of injury. An open space is idle ground. The trees around it will have many low branches unless their trunks are already cleaned of limbs to a good height, and each branch means a knot in the timber. Every opening tends to dry out the soil by letting in sun and wind, and means a poorer leaf mulch on the ground. Care should therefore be taken that all open spaces are covered with good trees as quickly as possible. This is done by protecting desirable young growth and by planting trees or seed when a good crop will not start of itself.

Young trees need protection from grazing animals, fire, and breakage due to carelessly felled timber. Grazing animals should be kept out of the woods whenever there is not enough young growth to keep the ground well covered. A woodlot which is so clean of undergrowth that it looks like a park is not in so good a condition as one which has young trees coming on wherever there is light enough for them to grow. Even when there is a good supply of young growth, if after turning in animals it is found that they are breaking or browsing the young trees, the animals should be shut out again. This is assuming that the woodlot is valued more as a place to raise timber than as pasture. It should be made either good pasture or good woods; the combination of the two uses does not work well.

It is sometimes said that fire does no injury unless it kills trees of merchantable size. The fact is that even light surface fires may do great injury by killing young growth.

A little care in felling trees will often save many thrifty seedlings and saplings.

Even after every care is taken to favor the natural growth of young trees, it is often well to help out by some planting. This is especially true where many of the trees are not of the best kinds.

Quality of trees

Poor kinds of trees should be discouraged and good kinds favored whenever timber is being cut or new trees started. Not only should the poor kinds be removed, but also poor specimens of good kinds, such as decaying or crooked trees. Whenever possible, such trees should be cut instead of the best ones. Do not take out the clover and leave the thistles!

Rapidity of growth

The income from the woodlot depends largely on how fast the timber grows. Aside from climate, the rate of growth depends principally on three things: first, the species, or kinds, of trees that are being raised; second, the moistness and mellowness of the soil; and third, the amount of light that the tree receives.

Species.—When choosing species to be favored or planted, their rate of growth should be considered. For example, among fence-post trees red cedar grows slowly, locust rapidly.

Soil conditions.— Soil moisture and the mellowness of the soil strongly influence the rate of growth. The growth of timber depends more on these things than it does on the richness of the soil in plant food. A mellow, moist, and well-drained soil is best for the forest.

The best way to keep the soil moist and mellow is to keep a layer of leaf litter on the ground. The litter serves as a mulch in holding moisture; it keeps the soil mellow by supplying organic matter; and it acts as a fertilizer by returning large amounts of plant food to the soil. Every effort should be made to keep a leaf mulch on the ground, except when trying to get new trees started from seed scattered by neighboring timber.

Fire, sun, and wind are likely to destroy the leaf mulch. Slight surface fires do great harm by burning off the mulch, even if no trees are directly hurt; therefore care should be taken to keep fire out. If much sunlight reaches the ground it causes rapid decay of the litter; for this reason, openings in the forest should be filled quickly, so that the ground is kept well shaded. Wind destroys the leaf mulch by blowing the leaves so that they gather in heaps instead of covering the ground evenly; in order to keep out wind, all openings should be filled and the exposed edges of the woodlot kept as dense as possible, especially on the sides exposed to the most trying winds. This may require the leaving of otherwise worthless trees and underbrush, or the planting of more trees on the exposed edges. Norway spruce is a good tree to plant as a windbreak.

Water is lost by allowing sunlight and wind to get to the ground, not only because of injuries to the mulch, but also because both wind and sun greatly increase the evaporation from the soil. By keeping the ground well shaded and providing windbreaks on the exposed sides, this loss of moisture may be decreased.

FIG. 211.—*It is very important that a leaf mulch be kept on the ground; such a mulch is a great help in keeping the soil moist and mellow, and it is also a fertilizer*

Grass is very undesirable in the woodlot. It uses much water that should be used by the trees if the main object is to raise timber. Grass and a good leaf mulch cannot both exist. When grass comes into the woodlot, the chances are that the timber will grow much more slowly. Grass should be kept out by having the ground well shaded.

Amount of light.—The third important factor that determines how fast a tree will grow is the amount of light it receives. The food materials that are later used to make new wood must be worked over in the leaves and the leaves must have light in order to do this. The more leaves there are on a tree, and the more light they have, the better chance the tree has of making a large amount of new wood. If closely crowded by its neighbors, the tree will not have a well-developed top or set of branches (called the crown); therefore, it will not have as many leaves and will not grow so fast as it might otherwise do. By removing a few trees from crowded clumps, relieving the best trees from too great competition, these trees can be made to grow much more rapidly.

There are, however, two dangers in this thinning. A tree growing in an open position will have more branches and the lumber will therefore be more knotty. In order to avoid this, the tree should not be given too much room until the trunk has cleaned itself of branches high enough to give one or more clear saw logs. In the second place, by letting in sun-

FIG 212.—*In making improvement cuttings, cultivate the habit of looking up. This picture was taken with the camera pointing straight up from the ground. A tree has just been removed from the center, and the trees left standing will now have a chance to spread into the space that has just been vacated. The object is to develop as many medium-sized, compact, high-set crowns as possible*

light and wind the soil may be dried out, and perhaps grass and weeds may have a chance to come in because of the light, without which they cannot grow. The slower growth due to this running wild of the soil may more than offset the more rapid growth due to light. Thinning should not be so severe that the soil will dry up seriously or that grass and weeds can start.

Improvement cuttings

In order to accomplish the ends that have been explained, improvement cuttings should be made in the woodlot.

Objects.— Such cuttings have several objects: they should gradually remove poor trees, and increase the proportion of the best ones; they should make the timber that is left standing grow more rapidly; they will usually yield some useful wood materials.

What to cut.— Instead of first selecting the trees to be cut from a crowded clump, it is better to pick out the best trees in the clump and then decide what trees should be removed in order to help the best ones. In choosing the best trees, we should consider not only the species, or kind, of tree,

FIG. 213.—*A stand of young hardwoods in which an improvement cutting has just been completed*

and the straightness and freedom from knots, but also the crown. If the tree has only a few scraggly branches it will probably not be able to develop into a rapidly growing tree, even if given more light. The best crown is one that is set high on the trunk, leaving a clear trunk below, is compact instead of wide spreading, and is about equally developed on all sides. The aim in thinning should be to get as many of the trees as possible to develop crowns of this kind. If a tree that is otherwise good has its crown hemmed in on one or more sides by other trees, it can, if still vigorous, be enabled to develop a good full crown by removing one or more of its neighbors. The trees to be cut should be so chosen that when the thinning is finished the trees left will cast a fairly even shade; there should not be dense thickets alternating with large open spaces.

Among the trees that should be cut whenever possible, the following may be mentioned: poor species of trees; decaying and crooked trees, and those with so many limbs that there is no hope of getting the lower part of their trunks cleaned of branches; overripe trees; trees with large spreading tops, taking up more than their share of room; poor trees overtopping better ones — for example, a soft maple standing over a white pine; trees, even though good in themselves, which are standing so close to better ones as to retard the growth of the latter.

FIG. 214.—*Do not trim out undergrowth to make the woods "look pretty." This undergrowth was planted at considerable cost in order to keep the soil in good condition so that the overhead stand of pine would grow faster*

However, it is by no means always desirable to remove all such trees at one cutting. It may be necessary to leave some to furnish seed; or it may be that there are so many poor trees in the woods that if they were all cut at once the soil would run wild. In such cases, either special measures should be taken to get a young crop of trees started in place of those that are cut, or else the thinning should be done so gradually as not to injure the soil. It is more important to keep a good cover over the land than to get rid of all poor trees at once. Where there are only a few good trees among many poor ones, it is often advisable to cut all of them and plant a new crop.

The underbrush should not be trimmed out in order to make the woods "look pretty." It is better to have as many young trees as possible growing under the older ones, unless the young growth is of poor kinds.

Quantity to cut.— When timber is ripe, the harvesting may be done by taking a few trees here and there, or by clear cutting part or all of the woodlot. But when making an improvement cutting, the object of which is to help the growing timber, the number of trees removed should not be great. It is impossible to give definite rules as to how much can be cut safely; this is entirely a matter of judgment. The following suggestions may be helpful, however. They apply to improvement cuttings, not to the harvesting of ripe timber:

1. Do not give a young tree so much room that the lower part of its trunk will not be cleaned of branches. There is no danger that new branches will start out on those parts of the trunk that have been well cleaned of limbs.

2. Even after the tree is well cleaned, do not give it so much room that it develops a wide-spreading top instead of a compact one.

3. Do not make an opening so large that it will not be filled by the surrounding crowns in a few years, otherwise the soil may run wild.

4. Since an opening should not be very large, it is a good plan not to cut two trees whose crowns adjoin unless there is a special reason for doing so.

5. Do not thin so severely that on a clear day you will see more than one third of the ground with the bright sunlight reaching it; this sunlight should be in small patches here and there.

It is perhaps well to repeat that these suggestions do not apply when timber is being harvested.

How often to repeat cutting.— The improvement cutting should be repeated as frequently as there seem to be many trees that need to be helped by thinning. It is usually not necessary to do this oftener than once in five years.

Thinning of sprouts.— A special form of thinning is often advisable where sprouts come up thickly from stumps. All sprouts coming from a stump are using a part of the water and food taken up by the roots of the mother stump. By thinning the sprouts the rate of growth of those remaining can be greatly increased. No rule can be given as to how many sprouts should be left on each stump; this will depend on how close together the old stumps are, and how vigorous the sprouts seem to be. The aim should be to leave enough trees so that they will shade the ground thoroughly within a few years, and not to make such large openings that the trees will not be cleaned of their lower branches. Usually from one to three sprouts are left on each stump. Such thinning also tends to make the sprouts straighter; if too closely crowded, they are likely to twist into every little opening. The thinning of the sprouts should not be done until they are several years old. If done when they are one or two years old, much of the benefit of the thinning may be lost because a second crop of sprouts may spring up and almost overtake those of the first crop. If the thinning is not done until the sprouts are five years old or more, there is still a possibility that a second crop may start; but the first crop will have such a lead that they should quickly crowd out the younger ones.

Pruning.— The necessity of pruning should be avoided so far as possible, by keeping the trees rather crowded when young. Where the trees have not cleaned themselves, the question arises whether it would pay to prune them by hand. It will not usually pay to prune when it has to be

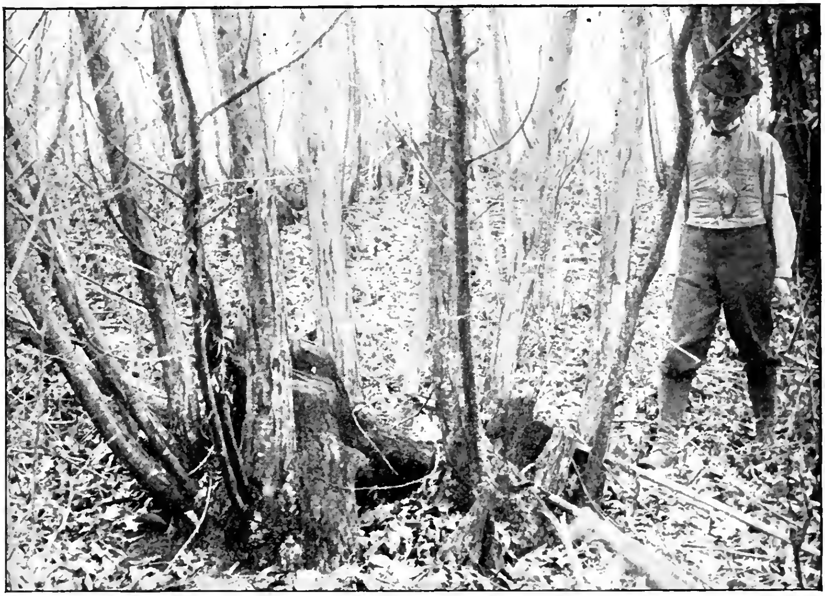


FIG. 215.—*A clump of sprouts, before thinning*
(Courtesy of Connecticut Agricultural Experiment Station)

done with the axe, saw, or pruning shears, although there may be here and there a tree that would be so greatly improved by a few minutes' work that it would be worth while. Sometimes, as with white pine, the dead lower branches will hang on for a long time, causing very knotty lumber. These branches can often be knocked off with a stiff pole far enough up to clean one good saw log. When the branches break easily, such pruning can be done cheaply and should often prove a paying investment.

STARTING NEW TREES IN THE WOODLOT

There are several ways of starting new trees in the openings made by harvesting the timber, and to cover the bare spots now in the woods.

Whatever method is used, grazing animals should be kept out of the woods while the young trees are starting.

By sprouts

The easiest way to start new trees is by sprouts that come from the stumps within a year of the time trees are cut. This method cannot be used with evergreens in New York State, as none of them make sprouts of any considerable size. It is a practicable method only in the southern part of the State, as sprouting is usually poor where the climate is severe.

FIG. 216.—*The same clump as shown in Fig. 215, after thinning. The thinning could have been done a few years sooner to good advantage*

(Courtesy of Connecticut Agricultural Experiment Station)

The vigor of the sprouts can be greatly increased by the following simple means: Sprouting is best if the timber is cut in the late fall or winter, and especially if done just before growth starts; cutting the old timber in the spring or early summer greatly lessens the vigor of the sprouts. The trees should be cut as near the ground as possible. The cut should be smooth, and the stump left slanting in such a way that water will not gather on it. Care should be taken not to tear the bark from the wood.

Sprouts rarely make as large timber as do trees grown from seed; this method is therefore more useful for the raising of poles, railroad ties, fencing, fuel wood, and the like, than for saw logs. The same stump will not usually produce more than two or three generations of sprouts to advantage; after two or three crops of sprout timber have been cut, it is better to start the next crop from seed. The stumps of old trees do not usually produce vigorous sprouts.

By seed blown from neighboring trees

Another method of starting trees is by seed blown from neighboring trees. Light seeds, such as those of pine, spruce, hemlock, and poplar, may be carried long distances by the wind; but it is not safe to rely on thus seeding the ground thoroughly for a distance greater than twice the height of the trees from which the seed comes. Such trees as maple, elm, and ash cannot be expected to scatter seed thoroughly for a distance greater than their own height. Trees with heavy seeds, such as hickory, chestnut, walnut, beech, and oak, do not scatter their seed far, and this method cannot be used with such trees.

A better stand of young trees will be obtained if the seed falls on bare soil instead of on a thick leaf mulch. Usually much of the litter has been destroyed in the larger openings in the woods, and this is a good thing at the time when young trees are to start, although at all other times we should keep the litter carefully. If the soil has become hard, or covered with dense sod, it will help things greatly to loosen the soil and to break up the sod somewhat. This can often be done by letting hogs root around in the woods. The animals must be kept out as soon as the seed falls. Sometimes it will be found practicable to loosen up the ground a little with a disc harrow. Even if only small patches of loose soil appear, these patches will give seed falling on them a much better chance to start. In some cases even the plowing of single furrows here and there can be done to advantage, not attempting to make the furrows straight, but dodging stumps and roots wherever necessary.

When harvesting timber this method of relying on seed from neighboring trees to start the new crop is often advisable. Sometimes the harvesting is done by cutting single trees or small groups here and there in the woods, wherever there are ripe trees; in this case the seed need not be blown far in order to fill up the openings. At other times considerable areas are to be cut clear. In such cases it is often a good plan to do the cutting in strips, cutting all the timber from one strip and then allowing that strip to be seeded from the neighboring standing timber. As soon as the young crop is safely started, another strip can be cut, and so on across the woodlot. The strips should run as nearly as possible at right angles to the direction of the strongest winds, and should be not more than once to twice as wide as the height of the neighboring timber. The first strip should be cut on the side of the woodlot away from the strongest winds, so that seed from the trees left standing will have the best possible chance of being scattered all over the cut area. On the last strip on the windward side it will be necessary to start the young crop in some other way.

When the clear-cutting method is used, care should be taken not to leave half-grown trees standing alone; such trees are almost sure to develop very wide-spreading crowns, taking up much room that should be occupied by better trees. On the other hand, it may be desirable to leave groups

FIG. 217.—*Starting a new crop of trees by seed blown from neighboring timber. The trees on the strip in the center have grown from seed blown from the timber on the left. The strip on the right was similarly seeded a few years previously, by timber then standing on the strip in the center. Another strip at the left will now be cut. The few trees of the old crop left standing are to remain until the crop now starting is harvested, in order to make large saw logs*

of small trees that are just starting, and perhaps some tall trees that have already been cleaned of branches to a good height.

The method of harvesting ripe trees singly or in small groups here and there will ordinarily be used whenever the woodlot is made up of trees of all sizes, only a few of which are of merchantable size at any one time. It is also an advisable method when the woodlot is wanted as a windbreak to shelter buildings or fields, and on very steep slopes where the soil washes rapidly if exposed. Clear cutting of a part of the woodlot is a good method when most of the timber is of about the same size, and therefore becomes merchantable at about the same time.

By sowing seed broadcast

If it is desired to have for the new crop a kind of tree of which there are not many in the woods, seed can be collected or bought and scattered broadcast on the ground. The same method can be used when so large an area is to be cut clear that there will be no timber left near enough to seed the ground.

This method, however, is usually very unsatisfactory. A large part of seed scattered on the surface is destroyed by birds and other animals, or dies because it does not find the proper conditions for germinating. For this reason, a great deal of seed must be sown, and the expense is often considerable. Even when plenty of seed is used, it is very uncertain whether a good crop of young trees will be obtained. This method should not be used at all with large seeds, such as acorns and nuts. If one wishes to try it with pine, spruce, hemlock, or locust, three to six pounds of seed per acre should be sown. Broadcasting is best done just before growth starts in the spring. If possible, it is well to scatter the seed on one of the last snows. It should not be tried on more than a small area the first year, in order to see whether it will succeed.

If the surface soil can be loosened a little, this greatly increases the chances of success; and if the seed can be partly covered by going over the ground with a bundle of brush or a harrow, the chances are still better. Usually, however, the ground is such that neither of these things can be done, except perhaps by turning in hogs.

By planting trees or seed

By far the surest way of starting young trees is to sow the seed in a garden and take care of the trees there until they are large enough to be planted; or to make "seed spots," that is, to plant the seed where the trees are to remain. This method also gives the desired kind of trees, and is the quickest way of getting the open spaces covered. The expense of planting is often not so great as that of broadcasting seed, or as the loss in timber value or in time due to delaying the lumbering in order to get natural seeding from the side in strips. In many other cases, planting may be decidedly more expensive than some other method. In any case, this method requires more work than does any other.

For convenience in describing planting, trees may be divided roughly into three classes: evergreens, large-seeded hardwoods, and small-seeded hardwoods.

Evergreens.—Starting evergreens (pine, spruce, hemlock, cedar, and the like) and tamarack (larch) by seed spots is not recommended, as there is great danger of failure. It is better to plant trees that have been raised in a garden or a nursery. Evergreen tree seeds are gathered early in the fall and are not sown in the garden until the next spring. They may be kept over winter in bags hung in a cool, moist place. The successful raising of evergreen trees in the garden requires considerable experience, and it is not usually wise for the busy farmer to attempt to raise them from seed unless he wishes to do a good deal of planting, making it worth while to learn how to raise the trees.* It will probably be better to buy them from a commercial nursery or from the State. The State Conservation Commission at Albany sells trees at cost, as long as their supply lasts, to persons who wish to do forest planting in New York State.

Two-year-old pine seedlings may be used for planting if the trees do not have to fight with heavy sod or with other adverse conditions; if conditions are unfavorable, three-year-old pines should be planted. Three-year-old spruces and hemlocks may be used where the conditions are good, four- and five-year-old trees where they are bad. Trees that are three years old or more when finally planted, should have been transplanted once in the garden.

Large-seeded hardwoods.—With large-seeded hardwoods (oak, walnut, hickory, chestnut, beech) and with locust, the seed-spot method is usually best. If the seeds are destroyed by animals, or if for any reason the trees fail to start well, it may be necessary to sow the seed in the garden and to plant the trees when one year old. The former method is successful in most cases. All the above trees have large roots, and considerable expense is saved by avoiding transplanting. The seeds should be gathered in the early fall; the locust seed may also be gathered later, as the pods hang on the trees for a long time. The seed should not be sown until spring, except white oak, which should be sown as soon as gathered. Locust seed can be kept over winter in bags hung in a dry, cool place; acorns and nuts should be buried in soil. The latter can be done by digging a pit outdoors in a well-drained spot, placing the nuts in the bottom in a layer two to four inches deep. It is well to cover acorns, chestnuts, and beechnuts with six inches to a foot of leaves, straw, or hay, and this again with the soil that was thrown out of the pit. A pit about one foot deep is convenient for these seeds. Hickory nuts and walnuts should be left so near the surface that frost will get at them, and the cover of leaves or straw should be omitted. The outside of the seed should be dry before placing it in the pit, otherwise it may heat or mold. A sand or

*Persons wishing to raise evergreen trees from seed, or to collect and take care of evergreen tree seeds, should send for Bulletin 76 of the United States Forest Service, "How to Grow and Plant Conifers in the Northeastern States." This bulletin, which is by Mr. C. R. Pettis, Superintendent of State Forests of New York State, may be obtained free, as long as the supply lasts, by writing to The Forester, Washington, D. C. No copies of the bulletin can be distributed from Ithaca.

sandy loam soil is the best in which to bury the seeds, but a heavy soil will do if in a well-drained place. The pit should be watched to see that animals do not disturb it.

Instead of putting the seeds in a pit outdoors, they may be kept in boxes in an unheated building. A layer of soil, the more sandy the better, is placed in the bottom of the box, then a layer of seeds, then another layer of soil, and so on. A good arrangement is to have the layers of soil about six inches deep, and those of seeds two to four inches deep. Look at the seeds once in a while to see that they are not molding because of too much moisture, or are not drying out. Drying can be detected by cutting open a few of the seeds in order to see whether they are keeping their usual plump, moist, fresh look. The seeds should be taken from the pits or boxes and planted in the garden or in seed spots just as early in the spring as the ground can be worked.

Small-seeded hardwoods.—With the small-seeded hardwoods, such as maple, ash, and elm, it is well to sow the seed in rows or in broadcast beds in the garden, giving them good care for one or two years before planting. One year is ordinarily enough if the trees are thrifty and if the conditions under which they are to be planted are fairly good; otherwise they should be kept in the garden for two years. The seed of elm and of soft maple should be gathered in the spring as soon as they are ripe, and sown within a few days. The sugar maple and the ash seeds should be gathered in the fall and stored over winter in boxes of soil, as described for the larger seeds. With these seeds, however, it is better to have the layer of seed only one or two inches thick, and the layers of soil need be only about four inches deep. The seeds should be sown as early in the spring as possible.

Wild stock.—Trees for forest planting can sometimes be obtained from the woods or the roadsides. This wild stock does not have so good roots as do trees that have been cared for in a garden, and more trees are likely to die after transplanting than is the case when nursery stock is used. However, where fairly good wild stock can be procured cheaply, it is sometimes a good plan to try it, on a small scale at first. Care should be taken that a good supply of small roots is left on the tree in taking it up. For forest plantations, evergreens more than about a foot high, and hardwoods more than about eighteen inches high, should not be used, as the cost of planting larger trees is too great. For ornamental planting, much larger wild stock can be used.

Distance of planting.—In this country, trees are usually planted either five or six feet apart in each direction; in Europe, closer planting is customary. Seed spots are ordinarily spaced the same as though trees were being planted. Spacing the trees six feet in each direction means 1,210 trees per acre; spacing five feet, 1,740 trees; four feet, 2,720 trees. The expense of planting is therefore greatly increased by close spacing. The advantages of close planting are that the ground is shaded sooner, thus getting the soil in good condition more quickly; and that the lower branches die while still small, thus greatly increasing the chance that the trees will shed the branches. Six by six feet is probably close enough for hardwoods, and on good soil for evergreens that grow fairly rapidly after the first few years, such as pine and larch. If on poor soil, or if planting an evergreen that grows very slowly for a number of years (as spruce or hemlock), it may be well to plant five by five feet. The spacing should be kept fairly regular, but it is not worth while to spend much time in being sure that each tree is in exactly the right spot.

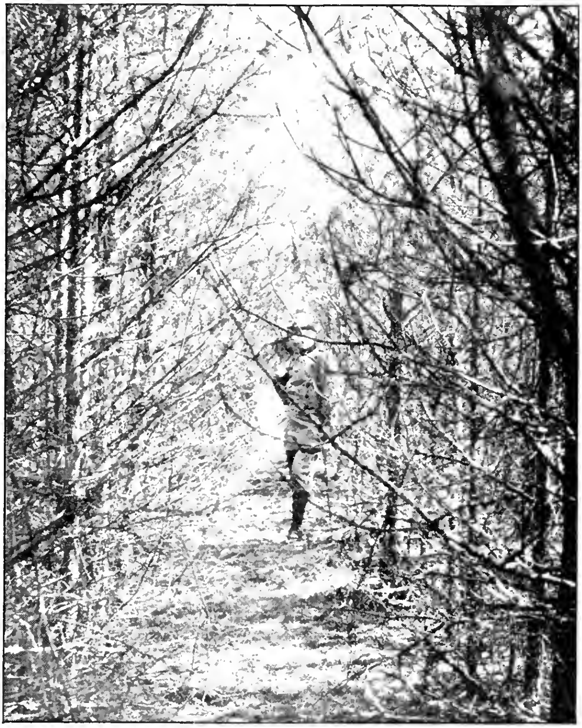


FIG. 218.—*Young trees should stand sufficiently close together to insure a thorough shading of the ground within a few years, and to cause the lower branches to die while still small*

The above spacing applies to planting where there are not already some trees. Planting is also frequently desirable where the ground is partly covered with young timber or with underbrush, in order to get more trees of the best kinds or to fill up small openings. In such work the trees will be planted wherever there is a chance, rather than where they will make regular spacing. The number of trees planted per acre will vary widely; if the average spacing is about ten feet, about 400 trees per acre will be used.

Planting season.—Planting should begin as early in the spring as the ground can be worked. Hardwood trees should not be planted after the buds have opened. It is better to finish the planting of evergreens, also, before growth starts, but they can be planted after the new shoots are rather long. Early fall planting can be done, at least with hardwoods. There is danger of fall-planted trees being winter-killed or lifted by frost, and the only especial advantage in fall planting is to lessen the rush of spring work. Seed spots should not be made in the fall, except with white oak.

When shipments of trees are received, such trees as are not to be planted the same day should be "heeled in"; that is, placed very close together in a trench and the soil packed firmly about the roots, with the tops shaded from the bright sun. In this way they can be kept all through the planting season. It is well to wet the roots before or after heeling in.

Method of planting.—When planting, the roots of evergreens must be kept moist all the time; exposure to sun or wind for even a few minutes may be fatal. The trees can be carried in pails of water or wrapped in wet burlap. Hardwood roots are not so sensitive, but they should not be needlessly exposed.

The grub hoe or the mattock is the tool most employed in planting, or, where the soil is light and easily dug, the spade is used. Grass and other plants should be removed from a spot about twelve to sixteen inches square. A hole is dug in the center of this spot, just large enough to receive the roots comfortably, the tree being set a little deeper than it grew in the garden. The roots should be spread out fairly well in the hole; they should not be rolled into a ball. It is well to prune long, stringy roots. The soil should be packed firmly around the roots, but a little mulch of loose soil should be left on top in order to check evaporation. The work should be tested now and then by pulling at a tree just planted; if it is not firm in the ground, the soil has not been sufficiently packed.

In making seed spots, grass and weeds should be stripped from about the same sized spots as though trees were being planted. Then a little soil is loosened in the center of the spot, and a hole dug deep enough so that the seed can be covered with about twice as much soil as the size of the seed itself. Three to five hardwood seeds are planted in each spot. All the seeds will not produce trees, and it is usually cheaper to go over the ground after two or three years and take out the extra trees than to plant again in places that have failed.

Plowing and harrowing the ground before planting will greatly lessen the amount of labor required. After harrowing, the ground can be marked out with a corn marker. Trees can then be planted with a spade, and seeds with a garden hoe or a corn planter.

Cost of planting.—When planting with the mattock on unplowed ground, a man should be able to plant 300 to 600 trees or 400 to 1,500 seed spots per day, according to conditions. If the ground is plowed and harrowed, the speed of planting can easily be doubled. The total cost of planting, including buying the trees or seed and doing the planting, usually averages five to twelve dollars an acre. This is assuming that all labor is paid for at the usual rates per day. But if on the farm the planting is done by the regular help, and also if the seed is collected and the trees raised at home instead of being bought, the actual cash outlay may be very small. The planting can be done very early in the spring, before the rush of regular farm work begins. It costs more to plant evergreens than to start such trees as oak and hickory by seed spots, but this fact should not

FIG. 219.—*A group of white pines recently planted in an opening in a hardwood woodlot*

discourage the planting of pine and spruce, which yield larger crops than do the hardwoods.

Few species.—An attempt should not be made to start too many different kinds of trees, especially at first. It is wise to select the one or two or three kinds that seem best adapted to the land to be planted. It is easier and usually better to plant each kind alone on some part of the area, unless there is some special reason for mixing them.

Planting under other trees.— Locust, poplar, yellow poplar (tulip tree), hickory, catalpa, red oak, white ash, white pine, Scotch pine, western yellow pine, and tamarack (larch) should not be planted under other trees unless the old timber is to be removed within a very few years. This is because these trees will not grow well when shaded from overhead, except when very young. Basswood will endure a moderate amount of shade. Sugar maple, beech, hemlock, and spruce can be planted in heavy shade.

The method to use

The sprout method can be used to advantage with hardwoods in the southern part of the State, when the stumps are still vigorous and when only the smaller wood products are wanted.

Relying on seed from neighboring trees is a good method wherever only a few trees are being cut here and there and the neighboring trees are the kinds that are desired in the new crop. It is also a good method to try when considerable areas are to be clear cut, if the neighboring timber is of the right kind and has light seed.

The method of scattering seed broadcast on the ground should not be used on a large scale until it has been tried in a small way to see whether it will yield anything.

The planting of trees or seeds is recommended in all cases when one wishes to increase quickly the proportion of the best kinds of timber, and it should be done when other methods fail.

OTHER SUGGESTIONS

When is a tree ripe?

There is much uncertainty in the minds of persons who wish to take good care of their woods as to when a tree has reached the proper size for cutting. In general, a tree is ripe and should be cut, unless there is some special reason for leaving it, when it has reached the time at which it will yield the greatest profit. It is not an easy matter to determine this time, which varies with many conditions. One of the things we most need to know in order to determine the average age or size at which it is best to cut timber, is the rate of growth of timber trees at different times in their life. As yet we have few figures on the growth of timber in New York State. Until we have such information, the decision as to whether a tree is ripe will be entirely a matter of judgment, in which some of the following suggestions may be helpful:

General quality.—If the timber is desired for certain products, such as telegraph poles or railroad ties, the right time to cut it is, of course, when it has reached a good size for making poles or ties. Poor kinds of trees should be cut in order to give room for better kinds, whenever possible. Trees that are decaying rapidly are beyond their time of most profitable growth and therefore are overripe. In some trees, however, decay goes on so slowly that it may not offset the greater value due to the growth of new wood and the increasing market value of timber. The ground occupied by very crooked or low-forked trees, or by trees that will make very knotty timber, is usually not yielding so good an income as though these trees were replaced with better ones.

Crown.—With good, sound trees of medium or large size, it is not so easy to decide whether the tree is ripe. For example, if we have some good oaks that are twelve or sixteen or twenty-four inches in diameter, or even larger, are they ripe? As already explained, this question cannot be answered until we know more of the rate of growth of our timbers. However, much help can be derived by looking at the crown: trees with compact, medium-sized, healthy-looking crowns are probably growing well, while those that have poor, ragged crowns and a general appearance of not being vigorous may be assumed to be ripe. An important exception is found in many trees that have rather poor crowns simply because they are closely crowded by their neighbors; such trees may grow well if given more room. Trees that have very wide-spreading crowns, taking up much more than the usual amount of space for a tree of their diameter, should usually be cut. These so-called " wolf trees " take up too much room for the growth they are making.

Width of annual rings.—Some idea as to whether the timber is growing fast can also be obtained by noticing the width of the rings on stumps and logs in the neighborhood. Each of these rings is the growth of one year. By knowing what is the usual width of ring in the locality, and then by cutting a little notch in a few standing trees in your woods, a general idea can be gained as to whether the timber is doing well. It should be noted that even if the rings become somewhat narrower as the tree grows older, the amount of wood laid on each year may be just as great. This is because the last rings are laid on around a larger circle and up a taller trunk than were the earlier ones. If there is a sudden, decided narrowing of the rings, however, it shows slower growth.

Increase in value.—As a tree grows larger the wood is worth more, because large-sized products bring higher prices than do small ones. It should also be remembered that even if the trees are not making much new wood each year, yet the market value of good timber is increasing. The holding of good timber, so long as it remains thrifty, is usually a paying investment, unless the land is very valuable for other purposes.

Summary.—In deciding whether or not to cut a tree, the following points should be considered: whether the tree has reached a good size to make the product desired; whether or not it is a good kind; its soundness, and the cleanness and straightness of the trunk; the crown development and the general appearance of vigor; and, whenever possible, the width of the annual rings. Size by itself is not a sure sign of ripeness. When in doubt it is best to keep the tree; the rise in the value of timber will warrant doing this.

Desirable trees for New York State

The species of trees to be planted or favored in the cutting will depend on what kind of product is desired and on the conditions under which the tree is to be grown, especially the climate, soil, and amount of shade the tree will have to endure. The following list is by no means complete, and is intended only to suggest some of the best trees for general use in this State and to point out some troubles with certain of our trees:

FIG. 220.—*A stand of Norway spruce. Some of the lower dead branches could be easily knocked off*

Among the evergreens, white pine and Norway spruce are the best trees for general use under most conditions in New York. Both of these will endure the climate in any part of the State. White pine grows slowly for the first few years, but after that it grows well. It is not suitable for very dry sand or gravel, or for heavy, wet land, but is at home on all other soils. It grows well on sandy soils if they are not unusually dry. Although it will endure shade at first, it will not grow well under other trees after the first few years.

Norway spruce will do well on any moist soil, provided the soil is fairly well drained; it should not be planted on dry soil. Starting very slowly, its growth after the first few years is good. It will endure heavy shade and is therefore a good tree to use in planting land already partly wooded. It is able to grow on very shallow soil if such soil is moist.

On very dry sands or gravels where the white pine will not do well, the Scotch pine is a good tree. It grows very rapidly when young, but later in life it does not grow so fast as does white pine. The value of its timber is decidedly less than that of white pine. Because of its slower growth (except in early life) and because of its poorer timber, its use is not recommended on soils where white pine will grow. The Scotch pine will not endure much overhead shade, and it should not be planted under other trees. The western yellow pine (" bull pine ") will probably prove to be a better tree than Scotch pine for very dry soils; but as yet it has not been planted in the East long enough to make this certain.

Among the hardwoods, red oak, white ash, and basswood are excellent, except in the colder parts of the State; sugar maple is fairly satisfactory in all parts of the State. All of these, except maple, are fairly rapid growers; the maple grows comparatively slowly. All need moderately moist and well-drained soil. If the soil is dry, white pine should be planted; if very dry, Scotch pine or western yellow pine. White ash and red oak will not endure much overhead shade; basswood is moderately shade-enduring; sugar maple, like spruce, will endure heavy shade and can be planted under other trees.

The locust (black locust) is often used as a fence-post tree. The great trouble with it is that borers (grubs) often attack the plantations, frequently killing half of the trees, although many plantations suffer no injury. Even when the percentage of loss is large, the locust is still a desirable fence-post tree. It can be put on any soil that is fairly deep and not swampy. It is a good tree to hold steep banks. It grows very fast for twenty or thirty years, but later in life its growth is slow. It will not endure overhead shade, and therefore should not be planted among other trees in the woodlot except in openings of considerable size. It is not satisfactory in the coldest parts of the State, where it suffers from severe early fall frosts.

Catalpa should not be planted in New York State, except perhaps in the warmest parts and on good soils. Catalpa is a rapidly growing tree on good soils in a mild climate. Many of the failures in severe climates have come because of not having the hardy variety; but even the hardy catalpa does not make profitable growth in a cold climate, especially if on poor soil. It should not be one of the trees commonly used in this State. Where it is planted, none but the hardy variety should be used, and it should not be put in the shade of other trees.

Chestnut should not be planted in this State at present. The chestnut bark disease is so fatal and is spreading so rapidly that this tree is an unsafe investment until we learn whether or not the disease can be checked.

If the danger from the disease disappears, chestnut will be one of the most desirable timbers for the warmer sections of the State.

White oak grows so slowly that, in spite of its excellent timber, it is not a satisfactory tree for private owners to plant. Thrifty young white oak timber already in the woods, however, should be given good care.

Hemlock is not advised for general planting where the object is to raise timber. It does not transplant easily, grows slowly, and the timber is inferior to other kinds that can be raised on the same soil. On any soil in this State where hemlock will grow, Norway spruce can be grown to better advantage. Where hemlock is already in the woods, however, it is well worth caring for when it does not interfere with better trees. It will grow under heavy shade.

Austrian pine is sometimes used in forest planting, but it has no advantages for New York over the other pines mentioned above, and is not to be recommended for woodlot purposes.

SUMMARY

1. The timber crop can be improved by care, for the same reasons that other crops can be improved.

2. Although it takes longer to raise this crop than any other, it can be raised on land otherwise unprofitable or idle.

3. Such a crop will in the end yield a comfortable bank account: and the value of the woodlot to the farm is greater than the sale value of the crop, in the convenience and the saving of money by having various wood products at hand; in protecting buildings and fields from wind; and in the beauty of the farm. The time is coming when thrifty young timber, not yet large enough to cut, will have a good sale value.

4. The care of this crop causes little expense, and the woodlot offers one means of solving the problem of how to keep good farm help profitably employed all the year.

5. The three principal aims in caring for the woodlot should be: to keep the ground thoroughly covered with trees; to have only the best possible trees; to make them grow rapidly.

6. In order to make timber grow fast, care should be taken in choosing the kinds of trees to raise; the soil should be kept moist and mellow by protecting the leaf mulch; the best trees should be given a fair amount of light by making improvement cuttings.

7. Methods of starting new trees, either to fill openings now in the woods or to replace timber to be harvested, are as follows: by sprouts; by seed falling from neighboring trees; by sowing seed broadcast; by planting trees or seed.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, CHARLES H. TUCK, *Supervisor*

VOL. 1. No. 12 | ITHACA, N. Y. MARCH 15, 1912 | FARM FORESTRY SERIES No. 1

THE IMPROVEMENT OF THE WOODLOT

DISCUSSION PAPER

A discussion paper is inclosed with each Reading-Course lesson in order that the best results may be obtained by the reader. Questions are asked so that the more important points will be given attention. We hope you will answer these questions either from the lesson or from practical experience. You will be surprised to see how this will clarify your knowledge and help you to remember what has been read. The answering of these questions is optional with the reader, but IT IS NECESSARY TO SIGN AND RETURN THE DISCUSSION PAPER IN ORDER TO RECEIVE THE NEXT LESSON.

Each discussion paper returned will be read over carefully and will not be quoted. It will require letter postage, which is the only expense connected with the course. We regret that we cannot reply to every discussion paper personally, but we shall write to those persons who need definite information that we can supply.

The discussion paper has other uses. You may indicate on it any new series of Reading-Course lessons that you wish to study. Whenever space allows, the last page of the lesson will show the series available and the lessons in each. If you wish to select the lesson you desire to study next, you may do so and advise us on the discussion paper. When the lessons in any series have been studied, references for further study will be supplied on request. THE SPACE BELOW ON THIS PAGE IS RESERVED FOR YOU TO WRITE US CONCERNING ANY OF THESE POINTS RELATING TO YOUR COURSE OF STUDY.

1. About what proportion of the land in your county is not in use as farm land: less than one fourth; one fourth to one half; one half to three fourths; or over three fourths?

2. Is a considerable part of this area bare waste land, or is it nearly all covered with timber or with brush?

3. About what proportion of the land of the county do you believe to be suitable for farming?

4. Is there any original timber left in your neighborhood?

5. What kinds of forest trees are most abundant in your neighborhood?

6. What are some of the other kinds of forest trees growing in your neighborhood?

7. What evergreen tree would you believe to be the most profitable one to raise? What hardwood tree?

8. Do forest fires often occur in your region? Do they cause much damage?

9. Have you ever taken any pains to keep the woodlot in good condition or to improve it? If so, what have you done?

10. Have you any suggestions as to how your woodlot can be improved?

Name...................................

Address.................................

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

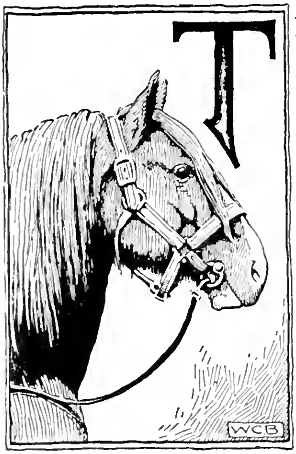
L. H. Bailey, *Director*

Course for the Farm, Royal Gilkey, *Supervisor*

VOL. 1. No. 14 — ITHACA, N. Y. APRIL 15, 1912 — THE HORSE SERIES No. 1

HORSE BREEDING TO INCREASE THE FARM INCOME

M. W. Harper



THE horse is the most valuable farm animal in the United States, and he is more valuable in New York than in any other State in the Union with two exceptions, namely, Rhode Island and North Dakota.* Notwithstanding the high value, New York is a horse-consuming State, annually using up many thousands more horses than are here produced. Several millions of dollars leave the State each year for the purchase of "western" horses. Not only are the greater number of the horses used in our cities produced in the West, but a very large percentage of the horses employed on the eastern farms are produced on farms in Ohio and westward.

NUMBER OF HORSES PURCHASED

There are no data available whereby we may accurately calculate the number of horses purchased for use within the State, but the number is estimated to be approximately 80,000 annually. In addition, many pass through the hands of New York State horse dealers on their way to near-by cities and points of export. Thus, more than 80,000 horses

*Advance Sheet, 13th United States Census.

are purchased by our horse merchants each year from States that make a business of supplying this demand.

While the price paid for western horses varies greatly, it has been estimated during the past few years that these horses have cost the consumer fully $200 per head, on the average. Assuming that the estimates are approximately correct, both as to numbers purchased and price paid,

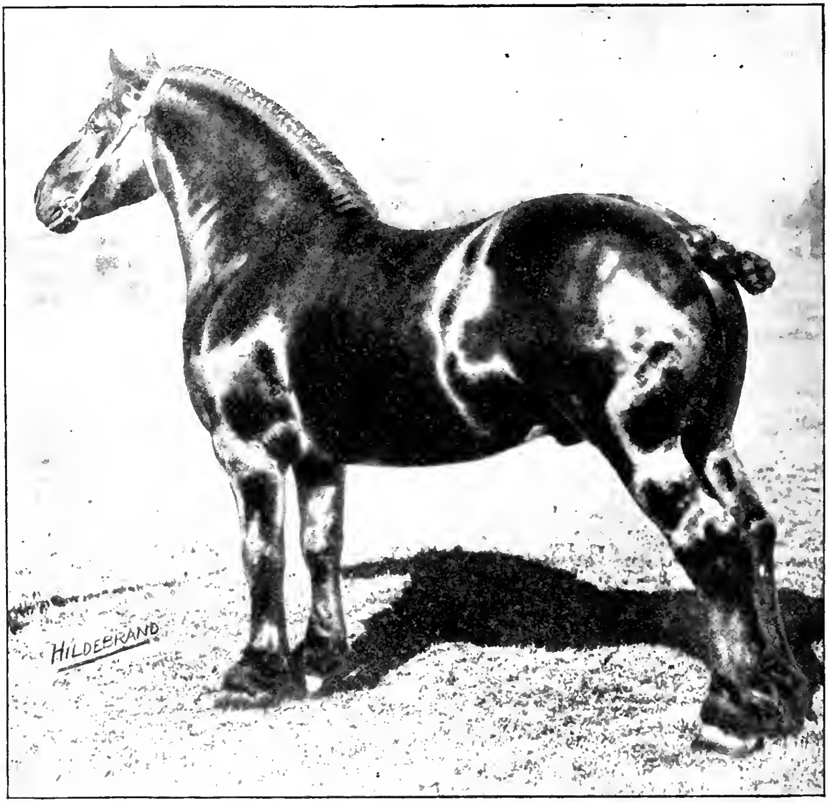


Fig. 221.—*A pure-bred Percheron draft horse*

then at least $16,000,000 is the sum that passes to the New York horse merchant on its way to the horse producer in the West.

WHERE THE HORSES ARE REARED

While complete data are not available, an advance sheet of the 13th United States Census furnishes figures whereby we may approximate the number of horses produced in each State. In this sheet a table is given showing the total number of horses and the number of "mature horses" in each State in the Union. By subtracting the number of mature horses from the total number we obtain the number of colts foaled from January 1, 1909, to April 15, 1910, which includes all colts under fifteen and one-half months of age. In this classification all horses over fifteen and one-half months of age are considered mature. For every 100 mature horses, New York State possesses 5.1 colts under fifteen and one-half months of age; the North Central States, 14.1 colts; the South Central States, 13.9 colts; the Mountain States, 22.2 colts; the Pacific States, 16.8 colts; and the South Atlantic States, 10.3 colts.

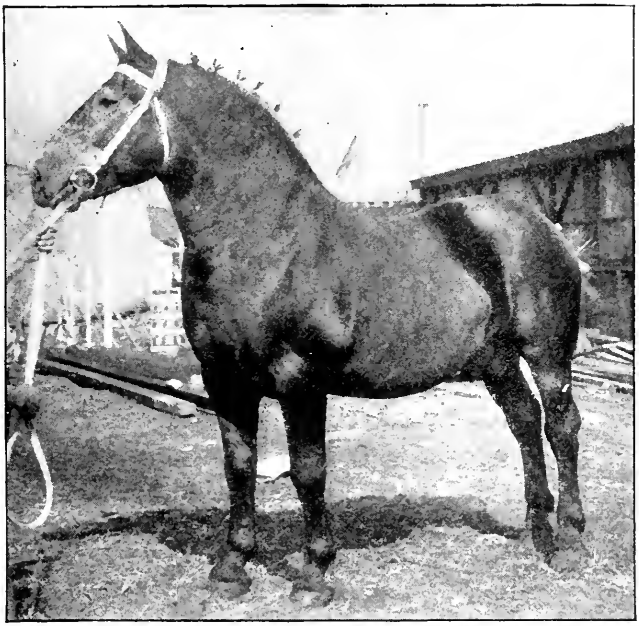


FIG. 222.—"*Coco,*" *prize-winning pure-bred Percheron stallion*

The advance sheet also reveals the fact that during the past decade the number of horses in New York State has decreased from 628,438 in 1900 to 590,150 in 1910, and that during the same period the average price of mature horses has increased from \$78.77 to \$138.71, or an increase of 76 per cent. It would seem that the facts in the case were not fully understood nor appreciated, which may explain the indifference of our farmers with respect to breeding horses. They are accustomed to regard New York as a dairy State, and look on horses as a secondary consideration, thus losing sight of one of the most remunerative branches of our agriculture.

NEW YORK STATE A GOOD MARKET

Since horses are so largely produced in one section of the country and consumed in another, great horse-markets have developed to facilitate the exchange. During the past decade these markets have made phenomenal growth, particularly in New York City and Buffalo. During the year 1909 a single firm sold at private and public sale approximately

36,000 horses, in 1910 about 40,000, and in 1911 approximately 35,000. It is estimated that at least half of these horses came from Ohio and westward. Of those coming from the West it is stated that 10 per cent weighed more than 1,500 pounds and 20 per cent weighed less than 1,200 pounds,

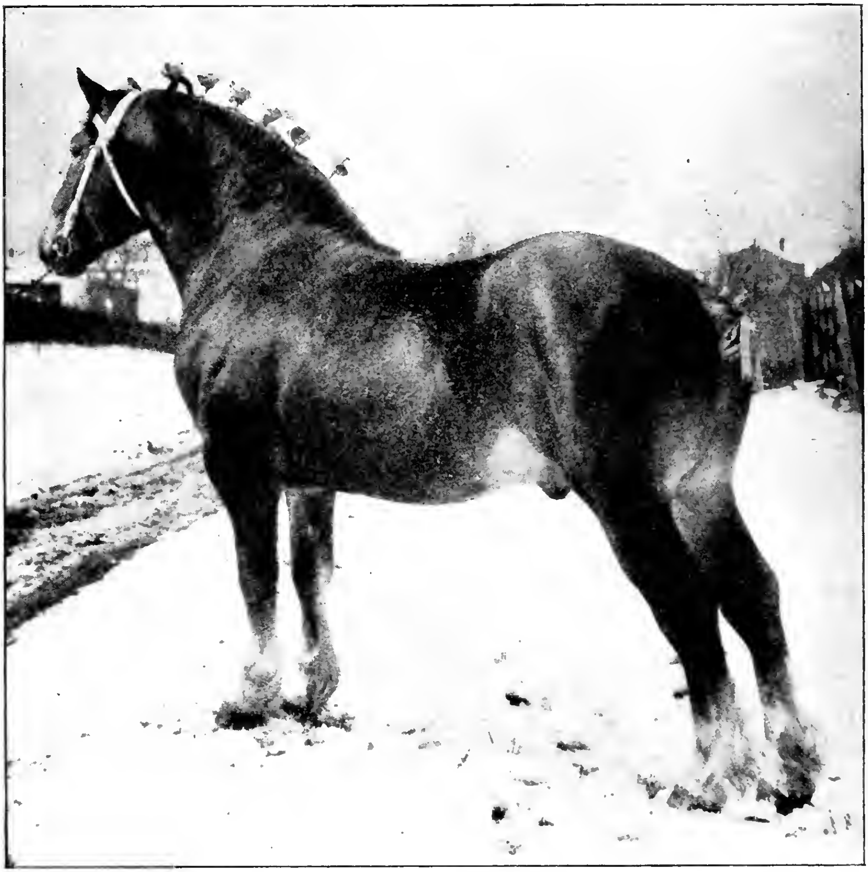


FIG. 223.—*A pure-bred Belgian draft horse*

thus leaving 70 per cent weighing between 1,200 and 1,500 pounds. From these figures it will be seen that the market in New York demands a horse weighing upward of 1,200 pounds and carrying some draft blood. This is a significant fact that should be impressed on our farmers, for as we study the native horses of the State we are profoundly impressed with the predominance of Morgan and trotting blood and the comparative absence of draft blood.

The development of such large horse-markets has attracted buyers from all over the world and has created a demand that is difficult to supply, which, in connection with our own heavy consumption from both country and city, affords the very best horse-market that can be found. This is particularly true of heavier types of horses so much in demand for city traffic.

COST OF RAISING A HORSE

While the cost of producing a horse will depend entirely on conditions and will vary greatly in different parts of the country, yet, in order to gain an idea of the approximate cost of raising a horse, we have been keeping account of the food, both hay and grain, consumed by growing horses. With food at the market price (1910-1911-1912), it cost approximately $145 to raise a light horse up to three years of age, $160 to raise a medium-weight horse, and $175 to raise a draft horse up to the same age. This cost includes a very liberal grain ration, practically all the hay the animals would eat, the service fee, and the like; no doubt it can be reduced on the average farm, where there is often much food with little market value. It is interesting to note the small increase in cost between the light, medium, and heavy horse, the draft horse costing only $30 more than the light horse.

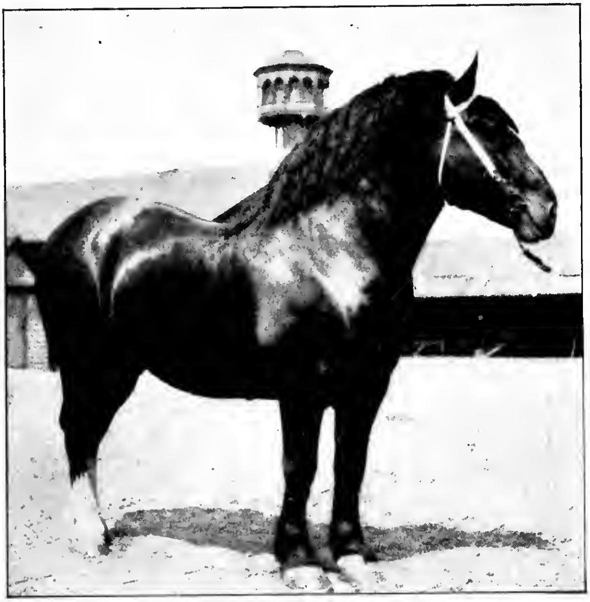


FIG. 224.—*Prize-winning pure-bred Belgian stallion*

Profit from raising a horse

Occasionally the remark is made that it is cheaper to buy a horse than to raise one. With a view of obtaining some light on this question, we compared the average selling price with the above cost price for the same period of time. The average selling price for the three years was approximately \$140 for the light horse, \$200 for the medium, and \$300 for the heavy horse. It is interesting to note the great increase in price between the light, medium, and heavy horse, the heavy horse selling for more than twice as much as the light horse.

According to this computation, the farmer engaged in raising light horses

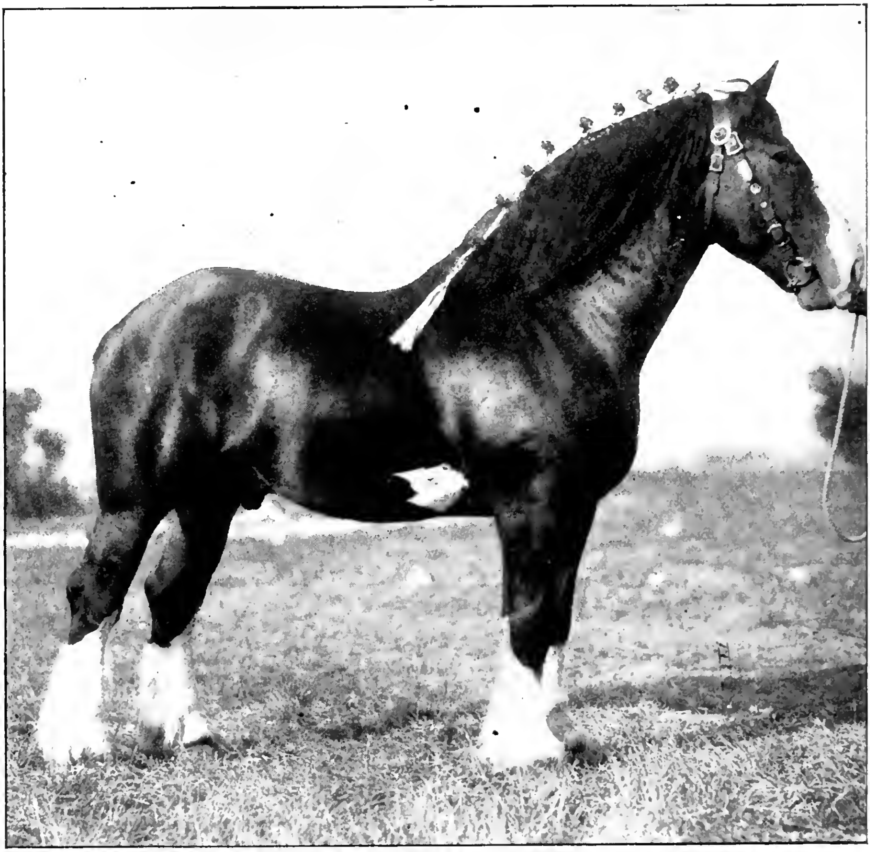


FIG. 225.—*A pure-bred Shire draft horse*

and selling them on the market is losing money by the transaction; while the farmer breeding horses of medium weight is making \$40 on each animal, and, most interesting of all, the farmer breeding heavy horses is realizing a profit of \$125 on each animal sold. This shows conclusively that the greater profit is obtained in the production of the large horse.

Conditions favorable to horse breeding

From a study of conditions in New York and in the horse-producing States, we fail to note any difference that gives the West an advantage.

In fact, New York has an advantage over many horse-producing States in that the land is cheaper and the best of foods are grown for the development of quality and endurance in the horse. As a rule, the foods grown in New York contain a higher percentage of protein than do those grown in the Central States. Protein-rich foods in winter and an abundance of cheap pasture in summer afford ideal conditions for raising horses of sufficient quality and endurance to withstand the severe work demanded of them.

Fig. 226.—*A pair of 1,700-pound draft geldings*

While the future influence of the automobile and the motor wagon cannot be foretold, past experience is encouraging to the horse breeder. It is not likely that the motor wagon will affect the horse market, at least for some time, any more seriously than did the railroad and electric cars. During the past decade, in which the automobile has been an active competitor, the price of the horse has risen 76 per cent. If the motor wagon and the automobile were going to exterminate the horse or very materially reduce the demand, such increase in value would be impossible.

At present, it cannot be denied that the automobile is affecting the price of fancy and pleasure horses; but past experience and present conditions indicate that the time is near at hand when automobiles will be as common and as cheap in proportion as bicycles, and that the fancy and pleasure horse will be as great a luxury as ever.

From this brief review of existing conditions, it would seem to be to the advantage of the New York farmer to put himself in a position to supply the horses demanded by the markets within the State and thus hold the millions of dollars that annually go to the farmers of the horse-producing section of the country, especially since this can be done with

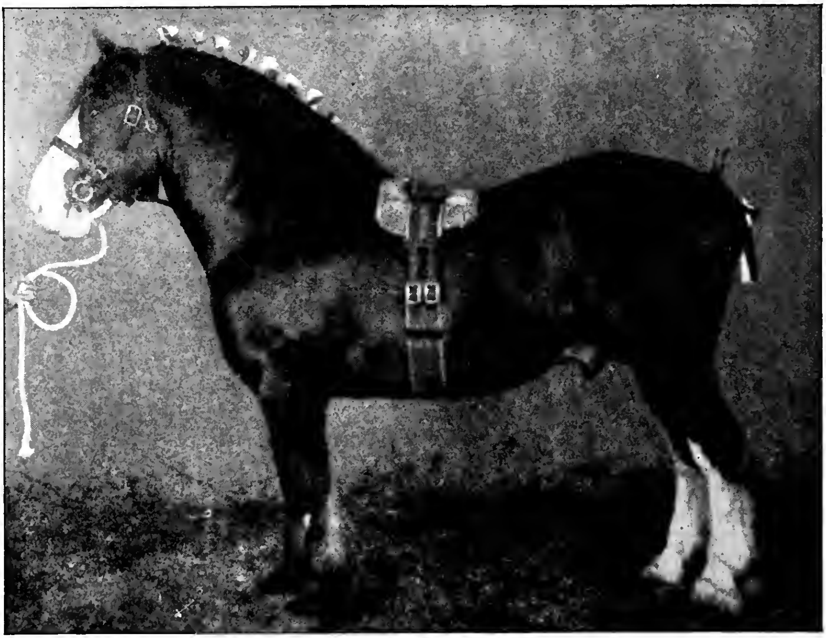


FIG. 227.—*A pure-bred Clydesdale draft horse*

little difficulty, with small cost, and without interfering with general farm operations.

PLAN OF BREEDING

A clearly defined plan of procedure should be thought out before the farmer makes the attempt to breed horses. In order to do this, a good knowledge of horses and horse breeding should be obtained. Breeding establishments and horse-producing farms should be visited. One should familiarize himself with the methods of successful horse breeders, should note the conditions that lead to success and those that lead to failure. The intending horse breeder should take account of his likes and dislikes. He may prefer the light, active type to the heavy, phlegmatic drafter. He should study his conditions: some conditions will be favorable to the production of one class, some to another. It should be kept clearly in mind, whatever the type or class chosen — whether it is light or heavy, for speed or for draft — that none but superior horses will sell at remunerative prices. There will always be an overproduction of common horses, which will be the first to be affected by oversupply and other business depressions and the last to be revived. The market should also be studied.

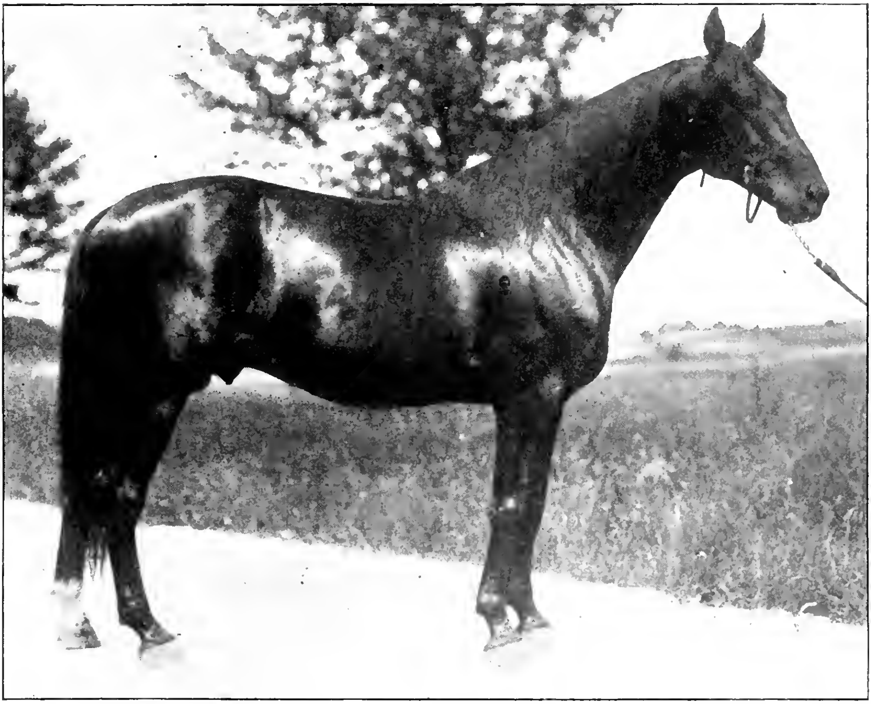


Fig. 228.—*A pure-bred trotting stallion*

In some sections of the State the demand will be for a certain class and in other sections another class will be in most demand.

Cooperative breeding

From observations made in localities where horses are bred in a commercial way, it would seem advisable to breed on the cooperative plan. It is apparent that the formation of horse-breeding associations in townships and counties throughout the State would do much to advance the progress of the industry. Such associations should be formed of breeders who possess the same class or breed of mares. It would be the work of such an association to protect the interests of its members, provide suitable stallions each year for use with the mares owned by the members, advertise stock, attract buyers, hold sales, make exhibits at the county, district, and state fairs, hold meetings for discussion of horse-breeding matters, and educate the farmers of the locality to better methods of breeding, feeding, and developing marketable horses.

Procuring Stallions

The fact that mares are often bred to unsuitable stallions is, in many instances, due to the difficulty of finding the right horse close at hand, rather

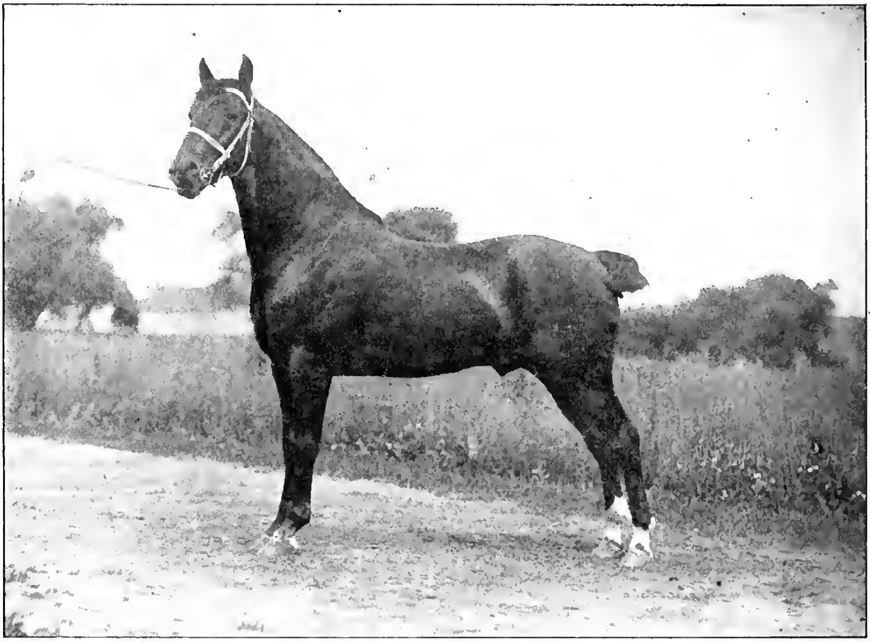


FIG. 229.—*A pure-bred hackney coach stallion*

than to indifference or carelessness on the part of the breeder. A fitting start may be made in grading-up in a certain district, and in a few years no horse of the same blood may be found to continue the good work in the right direction. The consequence is that a horse of different breed, unsuitable in many respects, is used until a more suitable sire can be procured or happens to enter the district.

It often occurs that a stallion is unexpectedly thrust on a district by a salesman of some importing firm. A company is formed for the purchase of the horse and the price is usually high, as it must contain many and sometimes questionable expenses. The "company plan" of purchasing a stallion is therefore objectionable. It is much better for the farmers interested in horse breeding to get together, choose one of their own number, and send him to the importing stable or horse-breeding firm to purchase the stallion. He will have an opportunity to select his horse and will get it much cheaper.

Undoubtedly any reputable breeder or importer of horses would be glad to send into any district the horse desired by a company of farmer-breeders and in close accord with their requirements in regard to pedigree, character, quality, size, and price. It is equally likely that the same firm would be willing, for a certain consideration in price, to replace the stallion when he could no longer stand in that particular district. If such a plan were followed persistently, each district so acting would secure much better results than at present.*

STALLION LAWS

The first stallion law was enacted in the State of Wisconsin in 1905 and went into effect January 1, 1906. Since that time seventeen other States have enacted laws of a similar nature. Many of the laws are very similar in their provisions, while others differ considerably; but they all aim to accomplish the same end, namely, to bar all stallions affected with any unsoundness or infectious diseases from standing for public service, and to provide a means whereby the public will be able to know whether the stallions are pure-breds or grades. With laws of this kind in force in so many States, it is becoming imperative that a similar law should exist in every State; otherwise, the States not having a stallion law will be made the dumping ground for stallions that are rejected for public service in the States where the laws are in existence. This is becoming a serious matter in New York and steps should be taken at once to exclude unsound stallions from the State.

UNIFORMITY

Each community should produce horses uniform in type. As it is now, each district produces a number of types. For this reason, buyers in search of a particular type or breed of horse do not know where to find it, and buy here and there, throughout a wide territory and at a great outlay for traveling expenses, individual horses of the right type, until the lot has been gathered together. When each farmer in a district is breeding according to his individual ideas, he has to find a separate and individual market or buyer for his product and the price paid is consequently small. These districts may sell large numbers of horses annually, but the horses

* For a partial list of the owners of pure-bred horses, see Bulletin No. 17, Department of Agriculture, State of New York, Albany. N. Y.

are of nondescript type and character. Such horses neither make a name for the district as a horse-breeding center, nor attract buyers willing to pay appreciative prices. The individual farmer will do better to cast in his lot with the majority of his neighbors and breed the same type that they are breeding, even though that type may not be the one that suits his fancy best or even the one that is best suited to the district.

Under the system suggested, the buyer of any particular type or breed should be able to go to a district noted for the production of the class of animal required and there find it in sufficient numbers, uniform in type and quality, to meet all needs. Could this be done, buyers would save much time and expense and would be ready and willing to pay better prices for the full supply of horses thus easily found.

SOUNDNESS

It is of great importance that the stallion should be free from all forms of unsoundness or diseases that are hereditary, transmissible, or communicable to the offspring. It is equally important that the mares bred to him should be sound in the same way, for not until both mare and stallion used for breeding purposes are free from unsoundness can we hope to raise the excellence of our horses to the degree possible as the result of intelligent breeding and development.

Many imported and home-bred stallions are unsound and transmit to their progeny the predisposition to like unsoundness. This is equally true of mares used for breeding purposes throughout the State, for many breeders have fallen into the grievous way of considering any broken-down, halt, maimed, blind, or otherwise unsound mare fit for breeding purposes when no longer able to work.

It would seem logical to expect that if we used unsound sires and dams their progeny may prove equally unsound, or if one parent is unsound its unsoundness may offset the soundness of the other parent and at least endow the offspring with a tendency to like unsoundness. It is certainly poor policy to knowingly use unsound stallions or mares and thus promote unsoundness. If a stallion possesses any one of the following diseases or unsoundnesses, this is usually considered a sufficient reason for refusing him patronage:

Cataract, amaurosis (glass eye), periodic ophthalmia (moon blindness);
Laryngeal hemiplegia (roaring or whistling);
Pulmonary emphysema (heaves, broken wind);
Chorea (St. Vitus' dance, crampiness, shivering, stringhalt);
Bone spavin, ringbone, sidebone, navicular disease;
Bog spavin, curb, with curby formation of hock;
Glanders, farcy, maladie du coit, urethral gleet, mange, and melanosis.

THE BREED AND TYPE

Choose the breed that best suits the conditions, the markets, and the tastes of the breeders. There is no best breed or type for all conditions. The lighter types naturally belong on land devoted to grass, to dairy industry, to fruit growing, and to market gardening, where but little plowing and other heavy work is required and the necessity of reaching the market, the station, or the creamery requires quick-moving horses.

On grain farms, where there is much plowing and other heavy work to be done, heavy horses are needed. On general-purpose farms the draft horse finds his true place. Draft horses can be reared with less risk than the lighter and more active types. They can be put to light work much younger and do not require so much training. Coachers, saddlers, and roadsters require a large amount of training before they can be marketed, if good values are to be obtained. This training requires skill, time, and money, which should be taken into account. A well-bred and well-trained coach team will bring a good price, but the amount of skill, time, and money required to breed and train such horses is too great for the general farmer.

Furthermore, draft horses are in great demand in New York State for city traffic. They are the last to be affected by a business depression and the first to recover; they are the least affected by automobiles, motor cars, and the like; they are not affected by fads, fancies, or fashions, and always command a remunerative price. From this it would seem to be of advantage to the general farmer to produce horses weighing upward of 1,200 pounds, as the heavier they are, the greater the profit in their production.

TABLE OF BREEDS

The following table contains the names of the various breeds of horses; also, the type, size, uses, native country, name of the society promoting the breed, and the name and address of the secretary of the breed society. If specific information is desired regarding any particular breed, an inquiry may be addressed to the secretary.

TABULATION OF THE BREEDS OF HORSES

Breed	Type	Height (hands)	Weight (pounds)	Uses	Origin	Registered by	Secretary	Address
Percheron	Draft	$15\frac{1}{2}$–17	1,800–2,300	Heavy hauling	France	Percheron Society of America	W. Dinsmore	Union Stock Yards, Chicago, Ill.
French Draft	Draft	$15\frac{1}{2}$–17	1,800–2,300	Heavy hauling	France	National French Draft Horse Association	C. E. Stubbs	Fairfield, Iowa
Clydesdale	Draft	16–$16\frac{1}{2}$	1,800–2,300	Heavy hauling	Scotland	American Clydesdale Association	R. B. Ogilvie	Union Stock Yards, Chicago, Ill.
Shire	Draft	16–17	1,800–2,300	Heavy hauling	England	American Shire Horse Association	Chas. Burgess	Winona, Ill.
Belgian	Draft	16–17	1,600–2,300	Heavy hauling	Belgium	American Association of Importers and Breeders of Belgian Draft Horses	J. D. Connor, Jr.	Wabash, Ind.
Suffolk	Draft	16–17	1,600–2,000	Heavy hauling	England	American Suffolk Horse Association	A. Galbraith	Janesville, Wis.
Hackney	Coach	$15\frac{1}{2}$–$15\frac{3}{4}$	1,000–1,200	Park driving	England	American Hackney Horse Society	Gurney C. Gwe	308 West 97th Street, New York
French Coach	Coach	15–16	1,200–1,400	Carriage driving	France	French Coach Horse Society of America	Duncan E. Willett	Oak Park, Ill.

Tabulation of the Breeds of Horses — (*Continued*)

Breed	Type	Height (hands)	Weight (pounds)	Uses	Origin	Registered by	Secretary	Address
German Coach...	Coach	16–16½	1,300–1,500	Heavy carriage driving	Germany	German Hanoverian and Oldenburg Coach Horse Association of America	J. Crouch	Lafayette, Ind.
Cleveland Bay....	Coach	16–16¾	1,200–1,600	General utility	England	Cleveland Bay Society of of America	R. P. Stericker	Oconomowoc, Wis.
American Trotter.	Light harness	15¼–15¾	900–1,200	Business and pleasure driving, racing	United States	American Trotting Register Association	W. H. Knight	355 Dearborn Street, Chicago, Ill.
Morgan*.........	Light harness	14¾–15¾	900–1,150	Business and pleasure driving, racing	United States	American Morgan Register Association	T. E. Boyce	Middlebury, Vt.
Thoroughbred....	Saddle	14½–16½	900–1,050	Racing, hunting	England	The Jockey Club	W. H. Rowe	Fifth Avenue and 64th Street, New York
Arabian.........	Saddle	14–14½	....	Riding	Arabia	Arabian Horse Club of America	Henry W. Bush-Brown	Newburgh, N. Y.
American Saddler.	Saddle	15¼–15¾	950–1,050	Business and pleasure riding	United States	American Saddle Horse Breeder Association	J. N. Ball	Louisville, Ky.

*Sometimes considered merely as a family of the American Trotter.

TABULATION OF THE BREEDS OF HORSES — (*Concluded*)

Breed	Type	Height (hands)	Weight (pounds)	Uses	Origin	Registered by	Secretary	Address
Shetland	Pony	9–11	300–400	Children's riding or driving	Shetland Islands	American Shetland Pony Club	Miss Julia M. Wade	Lafayette, Ind.
Welch	Pony	12½–15½	....	Riding, driving	Wales	Welch Pony and Cob Society of America	J. Alexander	Aurora, Ill.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. 1. No. 14 | ITHACA, N. Y. APRIL 15, 1912 | THE HORSE SERIES No. 1

HORSE BREEDING TO INCREASE THE FARM INCOME

DISCUSSION PAPER

A discussion paper is inclosed with each Reading-Course lesson in order that the best results may be obtained by the reader. Questions are asked so that the more important points will be given attention. We hope you will answer these questions, either from the lesson or from practical experience. You will be surprised to see how this will clarify your knowledge and help you to remember what has been read. The answering of these questions is optional with the reader, but IT IS NECESSARY TO SIGN AND RETURN THE DISCUSSION PAPER IN ORDER TO RECEIVE THE NEXT LESSON.

Each discussion paper returned will be read over carefully and will not be quoted. It will require letter postage, which is the only expense connected with the course. We regret that we cannot reply to every discussion paper personally, but we shall write to those persons who need definite information that we can supply.

The discussion paper has other uses. You may indicate on it any new series of Reading-Course lessons that you wish to study. Whenever space allows, the last page of the lesson will show the series available and the lessons in each. If you wish to select the lesson that you desire to study next, you may do so and advise us on the discussion paper. When the lessons in any series have been studied, references for further study will be supplied on request. THE SPACE BELOW ON THIS PAGE IS RESERVED FOR YOU TO WRITE US CONCERNING ANY OF THESE POINTS RELATING TO YOUR COURSE OF STUDY.

1. To what breed or class of stallions do you have access in your vicinity?

2. Which breed seems to be preferred by the farmers? Why?

3. Do the farmers in your vicinity raise the horses used on their farms, or do they buy occasionally?

4. How much money do you estimate is expended in your township for horses raised elsewhere?

5. Why cannot the farmers get together and raise the horses used in the State, and thus save the money that goes to the western farmer in exchange for his horses?

6. Do you believe the "farmers' cooperative plan" (not the company plan) herein suggested could be made to work in your vicinity? If not, why?

7. Under your conditions would it pay to keep one or more mares, weighing upward of 1,200 pounds, for raising colts?

8. What do you consider the greatest difficulty in horse breeding in your vicinity?

Name.......................................

Address.......................................

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL 1. No. 16 | ITHACA, N. Y. MAY 15, 1912 | DAIRYING SERIES No. 1

PRACTICAL DAIRY PROBLEMS

H. E. ROSS, E. S. GUTHRIE, AND W. W. FISK

The object of this bulletin is not to teach arithmetic, but to apply its principles to dairy work. The successful dairyman must keep close watch of every operation in his business. This applies just as much to the small dairyman as to the operator of a large dairy plant; for, while the total loss in a small dairy plant may not be great, the percentage loss is just as great as, and in many cases greater than, in a large one.

In this lesson the principles of arithmetic have been applied to practical problems. This makes the bulletin more helpful in aiding the dairyman to understand his business better. In many cases the problems are based on figures taken directly from creamery records.

For the purpose of ready reference an index is given at the end of the lesson.

CONVERTING POUNDS TO QUARTS AND QUARTS TO POUNDS

In converting quarts of milk to pounds or pounds to quarts, it is necessary to know that a quart of milk weighs 2.15 pounds. While it is true that the composition of milk is variable, the variation in weight is not great enough to affect the practicability of always calling the weight of one quart of whole milk 2.15 pounds.

The weight of a quart of cream is not constant because the percentage of fat in cream is very variable. The following table gives the weight of a quart of cream of different percentages of fat:

Percentage of fat	Weight of one quart of cream in pounds	Weight of one gallon of cream in pounds
20	2.115	8.460
25	2.10	8.40
30	2.088	8.352
40	2.055	8.220
50	2.028	8.112

Problem 1:

40 quarts of milk is equal to how many pounds?
1 qt. of milk weighs 2.15 lbs.
40 qts. weigh 2.15 lbs. $\times$ 40 = 86 lbs. Answer.

Problem 2:

79 55 pounds of milk equals how many quarts?
2.15 lbs. of milk equals 1 qt.
In 79.55 lbs. there would be 79.55 $\div$ 2.15 = 37, number of quarts. Answer.

In the same way, by referring to the table given above and finding the weight of a quart of cream of a certain percentage of fat, we may convert quarts of cream to pounds and pounds to quarts.

Problem 3:

What would be the weight of 20 gallons of 30-per cent cream?
One gallon of 30% cream weighs 8.352 lbs.
20 gal. weigh 8.352 lbs. $\times$ 20 = 167.04 lbs. Answer.

COMPUTING THE POUNDS OF FAT IN DAIRY PRODUCTS

In order to find the number of pounds of fat in dairy products it is necessary to know the number of pounds of the product and its percentage of fat.

Problem 4:

Compute the pounds of fat in the following:

A	Whole milk	82 pounds, testing 3.8 per cent fat
B	Cream	80 pounds, testing 39 per cent fat
C	Cream	80 pounds, testing 40 per cent fat
D	Cream	83 pounds, testing 20 per cent fat
E	Buttermilk	85 pounds, testing .12 of 1 per cent fat
F	Skimmed milk	84 pounds, testing .03 of 1 per cent fat
G	Whey	85 pounds, testing .32 of 1 per cent fat

Answers:

A 82 $\times$ .038 = 3.116, number of pounds of fat
B 80 $\times$ .39 = 31.2, number of pounds of fat
C 80 $\times$ .40 = 32.0, number of pounds of fat
D 83 $\times$ .20 = 16.6, number of pounds of fat
E 85 $\times$ .0012 = .102, number of pounds of fat
F 84 $\times$ .0003 = .0252, number of pounds of fat
G 85 $\times$ .0032 = .272, number of pounds of fat

COMPUTING PERCENTAGE OF FAT, POUNDS OF PRODUCT, OR POUNDS OF FAT, HAVING ANY TWO OF THESE QUANTITIES GIVEN

Problem 5:

How many pounds of milk testing 4.5 per cent fat would be required to furnish 157.5 pounds of fat?

? lbs. milk × .045 = 157.5

Therefore, 157.5 ÷ .045 = 3,500, number of pounds of 4.5% milk. Answer.

Problem 6:

250 pounds of cream contained 75 pounds of fat. What did the cream test?

250 × ? = 75 lbs. fat

Therefore, 75 ÷ 250 = .30

.30 × 100 = 30%, fat test. Answer.

Problem 7:

How many pounds of 22-per cent cream can be obtained from 3,500 pounds of 4-per cent milk?

In 3,500 lbs. of 4% milk there are 140 lbs. of fat (3,500 × .04 = 140).

This amount of fat will be contained in the 22% cream. We then have a certain number of pounds of cream testing 22%, to find the number of pounds of cream.

? lbs. cream × .22 = 140

Therefore, 140 ÷ .22 = 636.36, number of pounds of cream. Answer.

STANDARDIZING MILK AND CREAM

Standardizing milk or cream consists in raising or lowering the fat content to a fixed standard. This is done by adding to the material to be standardized, milk or cream of a higher or lower percentage of fat. In standardization there are two classes of problems involved: first, one in which a certain fixed amount of milk is to be made up or a certain amount of standardized milk is desired; and second, one in which a certain amount of milk or cream is to be used and enough of another product added to make the mixture test a certain percentage of fat. In the latter case the amount of the mixture is indefinite.

The original method of computing problems in standardization is long and difficult, but a scheme has been devised which is comparatively simple.* The method is as follows:

Draw a rectangle and place in the center of it the percentage of fat desired. Place at the left-hand corners of the rectangle the percentages

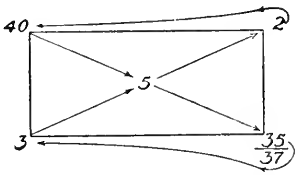
* By R. A. Pearson, at that time Professor of Dairy Industry, Cornell University.

of fat in the materials to be mixed. Subtract the number in the center from the larger number at the left of the rectangle. Place the remainder on the diagonally opposite right-hand corner of the rectangle. Subtract the smaller number on the left-hand corner from the number in the center and place the remainder on the diagonally opposite right-hand corner of the rectangle.

The two numbers on the right-hand corners of the rectangle represent the number of pounds of material required. If these two numbers are added they will express the number of pounds of the mixture, which will contain a percentage of fat expressed by the number in the center of the rectangle. In each case the number on the right-hand corner corresponds in fat test to the number on the left-hand corner directly opposite.

Problem 8:

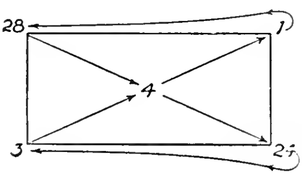
How many pounds of 40-per cent cream and 3-per cent milk must be mixed to make a milk testing 5 per cent? Using our diagram as described above we have the following result:



This means that if 2 lbs. of 40% cream are mixed with 35 lbs. of 3% milk, the result will be a 37-lb. mixture testing 5%. Answer.

Problem 9:

How many pounds of 28-per cent cream and 3-per cent milk will be required to make 500 pounds of a mixture testing 4 per cent? In this problem a definite number of pounds of the mixture is required.



According to the diagram, 1 lb. of 28% cream is required to every 24 lbs. of 3% milk to make a mixture testing 4%. This would make 25 lbs. of the mixture, but 500 lbs. is the amount desired. In other words, the number of pounds desired is 20 times larger than the number of pounds on hand ($500 \div 25 = 20$). The amounts must be kept in the proportion of 1 : 24. Therefore, in order to get a 500-lb. mixture it is necessary to multiply both the 1 and the 24 by 20. This would give a result of 20 lbs. of 28% cream and 480 lbs. of 3% milk, which mixed will equal 500 lbs. of 4% milk. Answer.

This problem may also be worked by simple proportion:

$1 : 25 :: x : 500$

$25x = 1 \times 500$

$25x = 500$

$x = 20$, number of pounds of 28% cream there will be in the 500-lb. mixture. Answer.

If there are 20 lbs. of 28% cream in the 500-lb. mixture, the remainder will necessarily be 3% milk.

Therefore, $500 - 20 = 480$, number of pounds of 3% milk. Answer.

The number of pounds of 3% milk can be found directly by simple proportion:

$24 : 25 :: x : 500$

$25x = 24 \times 500 = 12{,}000$

$x = 480$, number of pounds of 3% milk. Answer.

Proof:

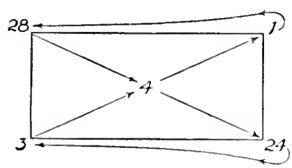
In working problems in standardization it is always wisest to prove the answer, as this is the best method of checking the work for mistakes. According to the conditions of the problem there would be 500 lbs. of 4% milk. This amount of milk would contain 20 lbs. of fat ($500 \times .04 = 20$). According to the results the 500 lbs. would be made up of 480 lbs. of 3% milk and 20 lbs. of 28% cream. The 480 lbs. of 3% milk would contain 14.4 lbs. of fat ($480 \times .03 = 14.4$). The 20 lbs. of 28% cream would contain 5.6 lbs. of fat ($20 \times .28 = 5.6$).

$14.4 + 5.6 = 20$

Since the 500 lbs. contain 20 lbs. of fat, and the materials of which the 500 lbs. is made up furnish the 20 lbs. of fat, the problem is worked correctly.

Problem 10:

How many pounds of 3-per cent milk must be mixed with 150 pounds of 28-per cent cream to make a mixture testing 4 per cent? In this problem the number of pounds to be made up is not definitely known.



Working the problem by the rectangle scheme, we find that 1 part of 28% cream is required for 24 parts of 3% milk. According to the terms of the problem, 150 lbs. of 28% cream must be used, and this is 150 times as large as in the above proportion. The 28% cream and 3% milk must be kept in the proportion of 1 : 24, and since the amount of 28% cream is to be increased 150 times, the 3% milk must also be increased 150 times. This would give 150 lbs. of 28% cream (1×150) and 3,600 lbs. of 3% milk

($150 \times 24 = 3,600$), making in all 3,750 lbs. ($150 + 3,600 = 3,750$) of a 4% mixture.

This problem may also be worked by simple proportion:

$24 : 1 :: x : 150$

$x = 3,600$, the number of pounds of 3% milk required.

Proof:

The 3,750 lbs. of 4% milk will contain 150 lbs. of fat ($3,750 \times .04 = 150$)

If the 150 lbs. of 28% cream and 3,600 lbs. of 3% milk furnish 150 lbs. of fat, the problem is correct.

$3,600 \times .03 = 108$, number of pounds of fat in milk

$150 \times .28 = 42$, number of pounds of fat in cream

$108 + 42 = 150$, number of pounds of fat in mixture. Answer.

VALUE OF FAT USUALLY LOST IN WHEY

Problem 11:

A cheese factory determines to make whey butter from 10,000 pounds of whey. It tests .32 of 1 per cent fat. With an overrun of 12 per cent, and butter worth 25 cents per pound, compute the value of the whey butter for one day.

$10,000 \times .0032 = 32$, number of pounds of fat

$32 \times .12 = 3.84$, number of pounds overrun

32 lbs. + 3.84 lbs. = 35.84 lbs. butter

25 cents $\times$ 35.84 = \$8.96, value of whey butter for one day. Answer.

COMPUTING FAT RECOVERED DURING SEPARATION

Problem 12:

A farmer separating 200 pounds of milk testing 5 per cent fat loses some fat in the skimmed milk, some milk or cream is spilled, and a little adheres to the utensils. He gets 30 pounds of cream testing 33 per cent fat. What percentage of the fat in the whole milk does he recover in the cream?

$200 \times .05 = 10$, number of pounds of fat in milk

$30 \times .33 = 9.9$, number of pounds of fat in cream

$9.9 \div 10 = .99$

$.99 \times 100 = 99$, percentage of fat of the whole milk recovered in the cream. Answer.

COMPARATIVE VALUE OF DIFFERENT METHODS FOR DISPOSING OF MILK AND ITS PRODUCTS

Many dairymen lose money when selling cream, by not charging a price in proportion to the price obtained for milk. In computing a relative price for milk and cream it is best to reduce each to a fat-percentage basis.

Problem 13:

Milk dealer X sells milk testing 4 per cent fat at 8 cents per quart. For how much per quart should he sell cream testing 32 per cent fat in order to receive a price for the cream that is relative in amount to the price received for the milk?

Milk dealer Y sells milk testing 3.5 per cent fat at 8 cents per quart. How much should he receive per quart for cream testing 29 per cent fat, that would be relative to the price of the milk?

(X) 100 lbs. of 32% cream will contain 32 lbs. of fat ($100 \times .32 = 32$)
100 lbs. of 4% milk will contain 4 lbs. of fat ($100 \times .04 = 4$)

Therefore, a given quantity of cream will contain 8 times as much fat as the same quantity of milk ($32 \div 4 = 8$). The cream should therefore be worth 8 times as much as the milk. Since the milk sold for 8 cents per quart, the cream should sell for 8 cents $\times$ 8, or 64 cents. Answer.

(Y) 100 lbs. of 29% cream will contain 29 lbs. of fat ($100 \times .29 = 29$)
100 lbs. of 3.5% milk will contain 3.5 lbs. of fat ($100 \times .035 = 3.5$)
$29 \div 3.5 = 8.28$

The cream should be worth 8.28 times as much as the milk, or 8 cents $\times$ 8.28, which is 66 cents. Answer.

Problem 14:

Which of the following is the most profitable method of disposing of milk testing 4 per cent fat: (a) at $3\frac{1}{2}$ cents per quart; (b) to a cheese factory at $1.20 per 100 pounds (considering that 85 per cent of milk is whey which is returned and is valued at 15 cents per 100 pounds); (c) cream testing 21 per cent fat to a special trade at 18 cents per quart; (d) cream testing 40 per cent fat to a creamery at 27 cents per pound for the fat; (e) to make butter on the farm and sell it for 30 cents per pound and the buttermilk for 10 cents per gallon, overrun 12 per cent?

Note: In all cases consider the skimmed milk to be worth 18 cents per 100 pounds.

(a) 100 (lbs. milk) $\div$ 2.15 (lbs. per qt.) = 46.5, number of quarts in 100 lbs. milk
$.03\frac{1}{2} \times 46.5 =$ $1.62. Answer.

(b) $100 \times .85 = 85$, number of pounds whey in 100 lbs. milk
15 cents $\times$ .85 = 12 cents, value of whey
$1.20 (value of milk) + $.12 (value of whey) = $1.32. Answer.

(c) $100 \times .04 = 4$, number of pounds fat in 100 lbs. milk
4 (lbs. fat) $\div$ .21 (test of cream) = 19.04, number of pounds cream

$19.04 \div 2.115 = 9$, number of quarts cream
18 cents $\times$ 9 = \$1.62
100 (lbs. milk) — 19.04 (lbs. cream) = 80.96, number of pounds skimmed milk
\$.18 (value of skimmed milk per cwt.) $\times$ .8096 = \$.14
\$1.62 (value of cream) + \$.14 (value of skimmed milk) = \$1.76. Answer.

(d) $100 \times .04 = 4$, number of pounds fat in 100 lbs. milk
\$.27 $\times$ 4 = \$1.08, value of fat
4 (lbs. fat) $\div$ .40 (test of cream) = 10, number of pounds cream
100 (lbs. milk) — 10 (lbs. cream) = 90, number of pounds skimmed milk
\$.18 (value of skimmed milk per cwt.) $\times$ .90 = \$.16
\$1.08 (value of cream) + \$.16 (value of skimmed milk) = \$1.24. Answer.

(e) $100 \times .04 = 4$, number of pounds fat in 100 lbs. milk
4 (lbs. fat) $\div$ .30* (test of cream) = 13.33, number of pounds cream
4 (lbs. fat) $\times$ .12 (overrun) = .48, number of pounds overrun
4 + .48 = 4.48 lbs. butter
13.33 (lbs. cream) — 4.48 (lbs. butter) = 8.85, number of pounds buttermilk †
1 gal. buttermilk = 8.7 lbs.
Therefore, 8.85 lbs. buttermilk = approximately 1 gal.
\$.10 $\times$ 1 = \$.10, value of buttermilk
\$.30 $\times$ 4.48 (lbs. butter) = \$1.34, value of butter
100 (lbs. milk) — 13.33 (lbs. cream) = 86.67, number of pounds skimmed milk
\$.18 (value of skimmed milk per cwt.) $\times$ .8667 = \$.15
\$.10 (value of buttermilk) + \$1.34 (value of butter) + \$.15 (value of skimmed milk) = \$1.59. Answer.

Note: It must be noted that no allowance is made for waste or for cost of handling.

COMPUTING THE AVERAGE PRICE OF BUTTER FOR ONE YEAR

Problem 15:

In a creamery where the amount of butter sold and the price received per month were as follows, what was the average price received per pound of butter for the year?

January, 5,000 pounds at 30 cents per pound

*In order that the cream may churn nicely, it should test about 30%.

† In determining the approximate amount of buttermilk it is safe, in creameries of medium size, to subtract the weight of the butter, not the fat alone, from the weight of the cream. In a small churn there is a greater percentage of loss.

February, 4,900 pounds at 30.5 cents per pound
March, 5,100 pounds at 31 cents per pound
April, 5,500 pounds at 29 cents per pound
May, 9,000 pounds at 25 cents per pound
June, 12,000 pounds at 23 cents per pound
July, 10,000 pounds at 24 cents per pound
August, 8,000 pounds at 25 cents per pound
September, 7,000 pounds at 26 cents per pound
October, 6,000 pounds at 27 cents per pound
November, 5,400 pounds at 27.5 cents per pound
December, 5,100 pounds at 28 cents per pound

This problem is worked as follows:

January,	$.30	×	5,000	=	$1,500.00
February,	$.305	×	4,900	=	$1,494.50
March,	$.31	×	5,100	=	$1,581.00
April,	$.29	×	5,500	=	$1,595.00
May,	$.25	×	9,000	=	$2,250.00
June,	$.23	×	12,000	=	$2,760.00
July,	$.24	×	10,000	=	$2,400.00
August,	$.25	×	8,000	=	$2,000.00
September,	$.26	×	7,000	=	$1,820.00
October,	$.27	×	6,000	=	$1,620.00
November,	$.275	×	5,400	=	$1,485.00
December,	$.28	×	5,100	=	$1,428.00
			83,000		$21,933.50

$21,933.50 ÷ 83,000 = $.26426, average price per pound for the year Answer.

COMPUTING THE AVERAGE PERCENTAGE OF FAT IN THE MILK OF A HERD

Problem 16:

Compute the average test of fat of this herd:

Brownie 20 pounds milk testing 4.2 per cent fat
Spot 50 pounds milk testing 3 per cent fat
Red 20 pounds milk testing 4.5 per cent fat
Nancy 10 pounds milk testing 5 per cent fat
Lucy 40 pounds milk testing 3.5 per cent fat

This problem is solved as follows:

Brownie 20 × .042 = .84, number of pounds fat
Spot 50 × .03 = 1.50, number of pounds fat

Red	$20 \times .045 =$	$.90$, number of pounds fat
Nancy	$10 \times .05 =$	$.50$, number of pounds fat
Lucy	$40 \times .035 =$	1.40, number of pounds fat
	140	5.14

5.14 (lbs. fat) $\div$ 140 (lbs. milk) $= .0367$

$.0367 \times 100 = 3.67\%$, fat test. Answer.

The common *incorrect* method of solving this problem is as follows:

$4.2\% + 3.0\% + 4.5\% + 5.0\% + 3.5\% = 20.2\%$, sum of tests

$20.2\% \div 5$ (number of tests) $= 4.04\%$, *incorrect average.*

Note: Had all the cows given the same amount of milk, the latter method would give the correct answer.

COMPUTING THE PERCENTAGE OF FAT IN A VAT OF CREAM AFTER STARTER IS ADDED

If there is added to a vat of cream some skimmed-milk starter, the number of pounds of fat in the cream is not changed but the percentage of fat is decreased.

Problem 17:

A vat contained 300 pounds of 35-per cent cream. To this amount of cream was added 25 per cent of skimmed-milk starter. What percentage of fat was there in the mixture?

Note: There is not enough fat in skimmed milk to be considered.

The 300 lbs. of cream was increased by 25% of its own weight.

$300 \times .25 = 75$, number of pounds of starter added

$300 + 75 = 375$, number of pounds of cream and starter

Another way to find the number of pounds of the mixture is to regard the weight of the cream as 100%. Since 25% was added, the weight of the mixture was 125% of what it was before adding the starter. $300 \times 1.25 = 375$, number of pounds of cream and starter.

In the original amount of cream there was 105 pounds of fat ($300 \times .35 = 105$). There was the same number of pounds of fat after the starter was added. We have given, therefore, the number of pounds of the mixture and the number of pounds of fat in the mixture, to find the percentage of fat. This is done by dividing the number of pounds of fat by the total weight of the mixture.

$105 \div 375 = .28$

$.28 \times 100 = 28\%$, fat in mixture. Answer.

Problem 18:

A creameryman separates 700 pounds of cream testing 41 per cent fat. Patron X brings 150 pounds of cream testing 30 per cent fat, and patron Y brings 100 pounds of cream testing 35 per cent fat. The creameryman dumps these two batches of cream into the ripening vat with the 700 pounds, and then adds 200 pounds of whole-milk starter testing 3.4 per cent fat. Compute the fat test of the cream in the ripening vat.

700	×	.41	=	287.00
150	×	.30	=	45.00
100	×	.35	=	35.00
200	×	.034	=	6.80
1,150, total number of pounds cream and starter				373.80, total number of pounds fat

373.8 (lbs. fat) ÷ 1,150 (lbs. in mixture) = .325
.325 × 100 = 32.5%, fat test of cream. Answer.

ESTIMATING CHEESE YIELD OF MILK, USING FAT CONTENT AS A BASIS OF CALCULATION

The results of careful experiments show that within reasonable limits the yield of cheese increases with the percentage of fat in the milk.

Percentage of fat in the milk	Pounds of cheese from 100 lbs. of milk	Pounds of cheese for 1 lb. of fat in milk
3.0	8.28	2.76
3.5	9.41	2.68
4.0	10.56	2.64
4.8	12.51	2.60

Problem 19:

How much more cheese can be made from 2,000 pounds of milk testing 4 per cent fat than from 2,000 pounds of milk testing 3.5 per cent fat?

2,000 × .04 = 80 (lbs. of fat)

If each pound of fat in milk testing 4% fat yields 2.64 lbs. of cheese, then

80 × 2.64 = 211.2, number of pounds of cheese from 2,000 lbs. of milk testing 4%

2,000 × .035 = 70 (lbs. of fat)

If each pound of fat in 3.5% milk yields 2.68 lbs. of cheese, then

70 × 2.68 = 187.6, number of pounds of cheese from 2,000 lbs. of 3.5% milk

211.2 lbs. cheese — 187.6 lbs. cheese = 23.6 lbs. cheese. Answer.

Problem 20:

A farmer producing 225 pounds of milk daily, testing 3.5 per cent fat, lives an equal distance from two cheese factories. Cheese-maker A is very careless in his methods and the average loss of fat in his whey is .37 per cent; while cheese-maker B takes more pains and the average loss of fat in his whey is .29 per cent. When cheese is selling at 13 cents per pound, now much more will the farmer receive in 30 days if he delivers his milk to B rather than to A?

225 lbs. milk × 30 = 6,750 lbs. of milk delivered

.37% — .29% = .08% more fat retained in cheese made by B than by A

6,750 (lbs. of milk) × .85 = 5,737.5, approximate weight in pounds of whey

5,737.5 × .0008 = 4.59, number of pounds more fat retained in cheese by B than by A

If each pound of fat yields 2.68 lbs. of cheese,

4.59 × 2.68 = 12.3, number of pounds more cheese made by B than by A

$.13 × 12.3 = $1.60. Answer.

Problem 21:

Two farmers each deliver daily 385 pounds of milk to the same cheese factory. A's milk tests 3.5 per cent fat and B's tests 4.5 per cent fat. If they are paid for their milk on the basis of the yield of cheese, how much more will B receive than A in one month, cheese selling for 13 cents per pound?

385 lbs. milk × 30 = 11,550 lbs. milk delivered by each in 30 days

11,550 × .035 = 404.25, number of pounds fat delivered by A

Each pound of fat in 3.5% milk yields 2.68 lbs. of cheese (see table, p. 159).

404.25 × 2.68 = 1,083.39, number of pounds of cheese from A's milk

$.13 × 1,083.39 = $140.84, amount that A should receive for his milk

11,550 × .045 = 519.75, number of pounds fat delivered by B

Each pound of fat in 4.5% milk yields 2.61 lbs. of cheese

519.75 × 2.61 = 1,356.55, number of pounds of cheese from B's milk

$.13 × 1,356.55 = $176.35, amount that B should receive for his milk

$176.35 — $140.84 = $35.51, amount that B should receive more than A for his milk. Answer.

COMPUTING OVERRUN IN BUTTER

Overrun is the gain in butter over the fat, or it is the sum of the moisture, salt, and casein of the butter minus the losses in manufacture.

Problem 22:

(a) Butter-maker X has 1,000 pounds of cream testing 35 per cent fat. From it he makes 400 pounds of butter. Compute the percentage of overrun and the value of the overrun at 25 cents per pound.

1,000 × .35 = 350, number of pounds fat
400 (lbs. butter) — 350 (lbs. fat) = 50, weight in pounds of overrun
50 ÷ 350 = .142
.142 × 100 = 14.2%, overrun. Answer.
$.25 × 50 = $12.50, value of overrun. Answer.

(b) Butter-maker Y is more careful in preventing leaks and wastes, and he understands the butter-making business better than does X. From 1,000 pounds of cream testing 35 per cent fat he makes 420 pounds of butter. Compute the percentage of overrun and its value at 25 cents per pound.

1,000 × .35 = 350, number of pounds fat
420 (lbs. butter) — 350 (lbs. fat) = 70, weight in pounds of overrun
70 ÷ 350 = .20
.20 × 100 = 20%, overrun. Answer.
$.25 × 70 = $17.50, value of overrun. Answer.

Note: Butter-maker Y has made from the same amount of fat $5 worth more butter than has X.

Problem 23:

Mr. Smith has a herd of ten cows, from each of which he receives yearly 250 pounds of fat that he makes into butter. His average overrun was 12 per cent until he bought a moisture test and began to prevent some of his losses. His average overrun is now 15 per cent. With the price of butter at 25 cents per pound, how much greater are his receipts per year?

250 lbs. (fat per cow) × 10 = 2,500 lbs., fat for the herd
2,500 × .12 = 300, number of pounds overrun at 12%
2,500 (lbs. fat) + 300 (lbs. o errun) = 2,800, number of pounds butter
$.25 × 2,800 = $700, value of butter with 12% overrun
2,500 × .15 = 375, number of pounds overrun at 15%
2,500 (lbs. fat) + 375 (lbs. overrun) = 2,875, number of pounds butter
$.25 × 2,875 = $718.75, value of butter with 15% overrun
$718.75 — $700.00 = $18.75, increase in receipts. Answer.

A shorter method of solution:

15% overrun — 12% overrun = 3%, increase in overrun
2,500 × .03 = 75, number of pounds increase in overrun
$.25 × 75 = $18.75, increase in receipts. Answer.

Problem 24:

A creamery receiving 900 pounds of fat daily is making an overrun of 18 per cent. The butter has been selling for 25 cents per pound. Which would be more profitable: to increase the overrun to 20 per cent, or to secure an advance in price of $\frac{1}{2}$ cent per pound? Compute this in one day's make.

900 × .02 = 18, number of pounds increase in overrun

$.25 × 18 = $4.50, amount gained by increasing overrun

900 × .18 = 162, weight in pounds of overrun

900 lbs. + 162 lbs. = 1,062 lbs. butter

$.005 × 1,062 = $5.31, amount gained by increasing price

$5.31 — $4.50 = $.81 per day, or $24.30 per month, in favor of securing an advance in price. Answer.

BUTTER YIELD OF CREAM

Problem 25:

How much cream testing 30 per cent will it be necessary to churn in order to produce 360 pounds of butter, overrun on fat 20 per cent?

Since there is an overrun of 20%, a certain number of pounds of fat must have been multiplied by 1.20 in order to produce 360 lbs. of butter.

? lbs. of fat × 1.20 = 360

Therefore, 360 ÷ 1.20 = 300, number of pounds of fat

It now remains to find the number of pounds of 30% cream from which the fat was taken.

? lbs. cream × .30 = 300

Therefore, 300 ÷ .30 = 1,000, number of pounds of 30% cream. Answer.

VALUE OF SALTED VS. UNSALTED BUTTER

Problem 26:

A creamery that has been receiving 1,000 pounds of fat daily has been making salted butter and getting an overrun of 18 per cent. It has an offer of an increase in price from 25 cents to 25$\frac{1}{2}$ cents for unsalted butter. Considering that the overrun would be 2$\frac{1}{2}$ per cent less for unsalted butter, which is the better proposition?

1,000 × .18 = 180, number of pounds overrun for salted butter

1,000 (lbs. fat) + 180 (lbs. overrun) = 1,180, number of pounds butter

$.25 × 1,180 = $295, value of salted butter

1,000 × .155 = 155, number of pounds overrun for unsalted butter

1,000 (lbs. fat) + 155 (lbs. overrun) = 1,155, number of pounds butter

$.255 × 1,155 = $294.52, value of unsalted butter

$295.00 — $294.52 = $.48, in favor of the salted butter. Answer.

COMPUTING THE AMOUNT OF CREAM NECESSARY TO MAKE A CREAM-GATHERING ROUTE PROFITABLE

Problem 27:

(a) How many pounds of cream testing 35 per cent fat must a hauler gather per day to pay his daily wages of \$3, considering that the same price (25 cents) is paid for the fat that is received for the butter, that the overrun is 18 per cent, and not considering the cost of manufacture?

(b) How many pounds of cream testing 35 per cent fat must a hauler gather per day to pay his daily wages of \$3, considering that the same price (25 cents) is paid for the fat that is received for the butter, that the overrun is 18 per cent, and that the cost of manufacture is 3 cents per pound of butter?

Note: Very often when a cream route is newly started it will not pay for itself, but if it is handled properly it will become a paying route. Therefore, in (a) the cost of manufacture is not considered; also it should be noted that the overrun is the only source of profit so long as the same price is paid for the raw product as is received for the finished one.

(a) 1 lb. (of cream) × .35 = .35 lb., amount of fat
.35 × .18 (overrun) = .063, number of pounds overrun
\$.25 × .063 = \$.01575, value of overrun per pound of 35% cream
\$3 (wages) ÷ \$.01575 = 190.47, number of pounds of cream necessary for the hauler to gather in order to pay expenses, as per (a). Answer.

Proof:

190.47 × .35 = 66.6645, number of pounds fat
66.6645 × .18 (overrun) = 11.9996, number of pounds overrun
\$.25 × 11.9996 = \$2.9999, wages per day

(b) 1 lb. (of cream) × .35 = .35 lb., amount of fat
.35 × .18 (overrun) = .063, number of pounds overrun
.35 + .063 = .413, number of pounds butter to 1 lb. cream
\$.25 × .35 = \$.0875, cost of 1 lb. cream
\$.03 × .413 = \$.01239, cost to manufacture butter from 1 lb. of cream
\$.0875 + \$.01239 = \$.09989, total cost of butter in 1 lb. of cream
\$.25 × .413 = \$.10325, receipts of butter from 1 lb. of cream
\$.10325 — \$.09989 = \$.00336, profit on 1 lb. cream
\$3 (wages) ÷ \$.00336 = 892.85, number of pounds of cream necessary for the hauler to gather in order to pay expenses, as per (b). Answer.

Proof:

892.85 × .35 = 312.4975, number of pounds fat
312.4975 × .18 (overrun) = 56.2495, number of pounds overrun
312.4975 + 56.2495 = 368.747, number of pounds butter

$.03 (cost of manufacture) × 368.747 = $11.062
$11.062 (cost of manufacture) + $3.00 (wages) = $14.062
$.25 × 56.2495 (lbs. overrun) = $14.062

CREAMERY DIVIDENDS

Problem 28:

A creamery with a capital stock of $6,200 receives 184,475 pounds of fat. It pays 30.22 cents per pound for the fat. It makes an overrun of 22.53 per cent and sells the butter for an average price of 31.26 cents per pound. The sum of $334.50 is received for buttermilk. The operating expenses amount to $13,793. It is to be considered that $5,200 of the $6,200 capital stock is for building, land, and equipment. With a depreciation in value of 15 per cent on the $5,200, what dividend could be declared?

Note: The amount of butter made, the overrun, prices paid and received, and operating expenses are actual creamery figures.

Usually the depreciation in average creamery property is about 15%. This 15% should be put in a sinking fund to be used in purchasing new apparatus, etc.

$.3022 × 184,475 = $55,748.34, amount paid for fat
$55,748.34 + $13,793.00 (expenses) = $69,541.34, total expenditure
184,475 × .2253 (overrun) = 41,562.21, number of pounds overrun
184,475 + 41,562.21 = 226,037.21, number of pounds butter
$.3126 × 226,037.21 = $70,659.23, receipts for butter
$70,659.23 + $334.50 (receipts for buttermilk) = $70,993.73
$70,993.73 — $69,541.34 = $1,452.39, net profit without depreciation
$5,200 (value of property) × .15 = $780, depreciation
$1452.39 — $780.00 = $672.39, net profit
$672.39 ÷ $6,200 = .10845
.10845 × 100 = 10.845% dividend, or 10.845 cents on a dollar. Answer.

COMPUTING THE RATE IN A COOPERATIVE CREAMERY

In a cooperative creamery the patrons are often paid a certain rate per pound for their fat. This rate is obtained by subtracting the total expenses from the gross receipts and dividing the remainder by the total number of pounds of fat delivered by the patrons. The quotient is the rate to be paid each patron per pound for his fat.

Problem 29:

The following table gives the pounds of milk, fat tests, and pounds of fat delivered by ten creamery patrons. Find the rate and the amount of money due each patron.

Patron no.	Pounds of milk	Test (per cent)	Pounds of fat
1	1,500	4.0	60.00
2	1,000	3.9	39.00

Patron no.	Pounds of milk	Test (per cent)	Pounds of fat
3	940	4.2	39.48
4	860	3.8	32.68
5	3,500	5.0	175.00
6	1,400	4.5	63.00
7	780	4.7	36.66
8	600	4.6	27.60
9	970	4.3	41.71
10	775	3.9	30.22
Total			545.35

This gives a total of 545.35 lbs. of fat delivered. With an overrun of 20% there would be obtained from the 545.35 lbs. of fat, 654.42 pounds of butter ($545.35 \times 1.20 = 654.42$), which at 32 cents per pound would equal \$209.41 (\$.32 × 654.42 = \$209.41). Let us assume that the cost of making the butter was \$10. Subtracting this from \$209.41, there is left \$199.41 to pay for the fat (\$209.41 — \$10.00 = \$199.41). Dividing \$199.41 by 545.35 we get .36565, rate to be paid per pound of fat. Answer.

Multiplying each patron's fat by this rate will give the money to be paid each one. The amounts are shown in the following table:

Patron no.	Pounds of fat	Rate	Amount of payment	
1	60.00	.36565	\$21.94.	Answer.
2	39.00	.36565	14.26.	Answer.
3	39.48	.36565	14.44.	Answer.
4	32.68	.36565	11.95.	Answer.
5	175.00	.36565	63.99.	Answer.
6	63.00	.36565	23.04.	Answer.
7	36.66	.36565	13.40.	Answer.
8	27.60	.36565	10.09.	Answer.
9	41.71	.36565	15.25.	Answer.
10	30.22	.36565	11.05.	Answer.

Note: The rate should always be carried to the fifth decimal place, and when the fifth decimal place is a zero the rate should be carried to six decimal places. If the rate were not so carried out, there would be a considerable amount of money undivided.

CALCULATING THE RATE ON THE FAT BASIS IN A COOPERATIVE CHEESE FACTORY

Milk is frequently bought for cheese-making on a fat basis and the patrons are paid according to the amount for which the cheese sells. The rate is obtained in the same way as in the case of a butter factory.

56

Problem 30:

In order to illustrate the method of paying for milk on a fat basis at a cheese factory, let us take the weights of milk and the fat tests given in the foregoing table. Find the rate and the amount of money due each patron.

There were delivered 545.35 lbs. of fat, and considering a yield of 2.68 lbs. of cheese for every pound of fat (a common estimate) there would be 1,461.538 lbs. of cheese ($545.35 \times 2.68 = 1,461.538$). If this cheese sold at 15 cents per pound it would bring \$219.23 ($\$.15 \times 1,461.538 = \$219.23$). A common price charged by cheese-makers for manufacturing is \$1.35 per cwt. of cheese. It would therefore cost \$19.73 to make the cheese ($\$1.35 \times 14.6153 = \$19.73$), and this would leave \$199.50 to pay the patrons for their fat. Since there would be \$199.50 to pay patrons and 545.35 lbs. of fat, each pound of fat would be worth as much as 545.35 is contained in \$199.50, which is \$.36582. Answer.

The following table shows the amount of money due each patron for his fat:

Patron no.	Pounds of fat	Rate	Amount of payment	
1	60.00	.36582	\$21.95.	Answer.
2	39.00	.36582	14.27.	Answer.
3	39.48	.36582	14.44.	Answer.
4	32.68	.36582	11.95.	Answer.
5	175.00	.36582	64.02.	Answer.
6	63.00	.36582	23.05.	Answer.
7	36.66	.36582	13.41.	Answer.
8	27.60	.36582	10.09.	Answer.
9	41.71	.36582	15.26.	Answer.
10	30.22	.36582	11.06.	Answer.

CALCULATING THE RATE ON A FAT-PLUS-2 BASIS IN A COOPERATIVE CHEESE FACTORY

This method of paying for the milk is used in many cheese factories because it is believed to approximate more closely the cheese yield than does the use of the fat alone. When this is done the method of finding the rate is precisely the same as when finding the rate on the fat basis, except that 2 is added to the percentage of fat in each patron's milk.

Problem 31:

Compute the rate and the amount of payment due each patron by the fat-plus-2 method, using the same weights and tests of milk that are given in problem 29.

The following table gives the pounds of milk delivered, the percentage of fat, the percentage of fat plus 2, and the number used in figuring the rate, as compared with the pounds of fat delivered.

Patron no	Pounds of milk	Test (per cent)	Fat plus 2	Number used in figuring rate
1	1,500	4.0	6.0	90.00
2	1,000	3.9	5.9	59.00
3	940	4.2	6.2	58.28
4	860	3.8	5.8	49.88
5	3,500	5.0	7.0	245.00
6	1,400	4.5	6.5	91.00
7	780	4.7	6.7	52.26
8	600	4.6	6.6	39.60
9	970	4.3	6.3	61.11
10	775	3.9	5.9	45.72
Total				791.85

Taking the same amount of money to be divided as in the case where the payment was made on the fat basis, this is $199.50 to be divided among the patrons for their milk delivered.

Dividing $199.50 by 791.85 gives a rate of .25194. Answer.

In the following table there is given the amount of money each patron should receive for his milk:

Patron no.	Number used in figuring rate	Rate	Amount of payment	
1	90.00	.25194	$22.674.	Answer.
2	59.00	.25194	14.864.	Answer.
3	58.28	.25194	14.683.	Answer.
4	49.88	.25194	12.566.	Answer.
5	245.00	.25194	61.725.	Answer.
6	91.00	.25194	22.926.	Answer.
7	52.26	.25194	13.166.	Answer.
8	39.60	.25194	9.977.	Answer.
9	61.11	.25194	15.396.	Answer.
10	45.72	.25194	11.518.	Answer.

CALCULATING THE RATE ON THE FAT-AND-CASEIN BASIS IN A COOPERATIVE CHEESE FACTORY

Since casein enters so largely into the composition of cheese, patrons of cheese factories are sometimes paid for their milk on the basis of both its fat and its casein content. When this is done the method of finding the rate is essentially the same as when the patrons are paid on a fat basis. The number of pounds of fat and that of casein are added and the net profit is divided by this sum. The quotient is the rate to be paid each patron per pound for the fat and casein he has delivered.

Problem 32:

In the following table are given the weights of milk, the fat test, the casein test, and the weight of the fat and the casein in the milk of ten creamery patrons. The number of pounds of fat and casein was of course obtained by multiplying the number of pounds of milk each patron delivered by the fat and the casein test, and adding the results. Compute the rate and the amount of payment due each patron.

Patron no.	Pounds of milk	Fat test (per cent)	Casein test (per cent)	Pounds of fat and casein
1	1,500	4.0	2.7	100.50
2	1,000	3.9	2.5	64.00
3	940	4.2	2.8	65.80
4	860	3.8	2.5	54.18
5	3,500	5.0	3.0	280.00
6	1,400	4.5	2.9	103.60
7	780	4.7	2.8	58.50
8	600	4.6	2.6	43.20
9	970	4.3	2.7	67.90
10	775	3.9	2.4	48.82
Total				886.50

Taking the same amount of money to be divided as in the case of payment made on a fat basis, there is $199.50 to pay for the fat and casein. The total amount of fat and casein delivered was 886.50 lbs.

Dividing $199.50 by 886.50 gives a rate of .22504. Answer.

The following table gives the amount of money each patron would receive for his fat and casein:

Patron no.	Pounds of fat and casein	Rate	Amount of payment	
1	100.50	.22504	$22.616.	Answer.
2	64.00	.22504	14.402.	Answer.
3	65.80	.22504	14.807.	Answer.
4	54.18	.22504	12.192.	Answer.
5	280.00	.22504	63.011.	Answer.
6	103.60	.22504	23.314.	Answer.
7	58.50	.22504	13.165.	Answer.
8	43.20	.22504	9.722.	Answer.
9	67.90	.22504	15.280.	Answer.
10	48.82	.22504	10.986.	Answer.

PREMIUMS COMPUTED ON A PRO RATA BASIS

Premiums are often awarded to competitors pro rata, that is, according to a percentage basis. A certain percentage is taken as a standard, and all candidates must at least attain this standard before they are entitled to a premium. The amount that each competitor receives depends on his standing above the percentage basis, and also on the number of competitors who are entitled to a reward. The pro rata method of distributing prizes is advantageous because it tends to prevent unworthy competitors from receiving a prize, and all who attain a certain standard of excellence receive some prize, the amount of which is in proportion to the score received.

Prizes for dairy products are usually distributed pro rata. This is a very convenient method, for the quality of dairy products is expressed in terms of percentage.

Problem 33:

A prize of \$15 is to be distributed pro rata for the best samples of creamery butter. Candidates must receive a score of 90 per cent or above in order to obtain a prize.

A received a score of 90.5 per cent
B received a score of 91 per cent
C received a score of 94 per cent
D received a score of 95.5 per cent

To how much money is each entitled?

Since 90% is the lowest score a candidate can receive and obtain a prize,

A would be entitled to $1\frac{1}{2}$ points
B would be entitled to 2 points
C would be entitled to 5 points
D would be entitled to $6\frac{1}{2}$ points

This is a total of 15 points obtained by all the candidates, and since there are \$15 to be divided each point would have a value of \$1 (\$15 ÷ 15 = \$1). The amount of money to which each successful competitor is entitled is found by multiplying \$1 by the number of points that he received. The amounts each one would receive are as follows:

A \$1 × 1.5 = \$1.50. Answer.
B \$1 × 2 = \$2.00. Answer.
C \$1 × 5 = \$5.00. Answer.
D \$1 × 6.5 = \$6.50. Answer.

INDEX

THE CORNELL READING-COURSE FOR THE FARM

This course has been provided to meet the needs of persons who desire to study agriculture but are unable to leave their present work. It consists of definite series of lessons on practical agricultural problems, with several numbers in each series. Readers enroll for one or more series and receive lessons one at a time. The Reading-Course for the Farm, therefore, is a means of conducting a course of study at home and of keeping in constant touch with the latest ideas on agriculture.

A supplement containing questions (for this reason called a discussion paper) is sent with each lesson. It is recommended that the reader answer the questions, but he is not required to do so. It is necessary, however, that the discussion paper be signed and returned, as an indication that the reader desires the following lesson in the series. Readers are encouraged to use the discussion paper for asking questions on any points not made clear in the lesson. If assistance is desired for solving agricultural problems, requests for information may be made on the discussion paper. Such requests are referred to members of the College Staff for personal reply.

The Cornell Reading-Course for the Farm is not a "correspondence course" as the term is commonly understood, but it is a means of providing information on elementary agricultural subjects and on important farm and general rural problems. It aims to lead the reader to express his own opinions on different subjects and to discuss his own experience. Such readers as desire to go further may receive suggestions for advanced study. The lessons are numbered for each year from 2 to 24 by *even numbers*, being published alternately with the Lessons on the Farm Home.

The Cornell Reading-Course for the Farm is an enlargement and revision of the former Farmers' Reading-Course. Some of the bulletins of the Farmers' Reading-Course are still available. As these cannot be mailed at pound rates, postage should be included when they are called for, allowing one cent for each bulletin. On the last page of this lesson is a list of available back numbers of the former Farmers' Reading-Course and lessons of the present course, arranged by series.

AVAILABLE READING-COURSE LESSONS FOR THE FARM ARRANGED BY SERIES

Back numbers of the former Farmers' Reading-Course

(One cent postage should be included for each lesson desired)

Series	
Stock-feeding.........	7. The computing of balanced rations
	8. Sample rations for milch cows
	9. Soiling crops, silage, and roots
	10. Pastures and meadows
	34. Seed corn for grain and silage
Dairying.............	22. The composition of milk and cream, and their by-products
	23. The construction of sanitary dairy stables
	24. Farm butter-making
	25. The dairy herd
Plant-breeding........	41. Improving plants by selection or breeding
	42. Improving corn by seed selection
	43. Methods of breeding and improving the potato crop
Farm crops...........	9. Soiling crops, silage, and roots
	10. Pastures and meadows
	34. Seed corn for grain and silage
	42. Improving corn by seed selection
	43. Methods of breeding and improving the potato crop
Orcharding...........	40. Tillage and fertilizing in orchards
The horse............	44. Horse breeding in New York State
The soil..............	37. Drainage and larger crops

Cornell Reading-Course Lessons for the Farm

(Mailed free)

The soil (continued)...	2. The soil: Its use and abuse
Poultry..............	4. Incubation.— Part I
	6. Incubation.— Part II
	10. Feeding young chickens
Rural engineering......	8. Knots, hitches, and splices
Farm forestry.........	12. The improvement of the woodlot
The horse (continued)..	14. Horse breeding to increase the farm income
Dairying (continued)...	16. Practical dairy problems

Residents of New York State may register for one or more of the series named above by addressing The Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, N. Y.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. Bailey, *Director*

Course for the Farm, Royal Gilkey, *Supervisor*

VOL 1. No. 16 | ITHACA, N. Y. MAY 15, 1912 | DAIRYING SERIES No. 1

PRACTICAL DAIRY PROBLEMS

DISCUSSION PAPER

A discussion paper is inclosed with each Reading-Course lesson in order that the best results may be obtained by the reader. Questions are asked so that the more important points will be given attention. We hope you will answer these questions, either from the lesson or from practical experience. You will be surprised to see how this will clarify your knowledge and help you to remember what has been read. The answering of these questions is optional with the reader, but IT IS NECESSARY TO SIGN AND RETURN THE DISCUSSION PAPER IN ORDER TO RECEIVE THE NEXT LESSON.

Each discussion paper returned will be read over carefully and will not be quoted. It will require letter postage, which is the only expense connected with the course. We regret that we cannot reply to every discussion paper personally, but we shall write to those persons who need definite information that we can supply.

The discussion paper has other uses. You may indicate on it any new series of Reading-Course lessons that you wish to study. Whenever space allows, the last page of the lesson will show the series available and the lessons in each. If you wish to select the lesson that you desire to study next, you may do so and advise us on the discussion paper. When the lessons in any series have been studied, references for further study will be supplied on request. THE SPACE BELOW ON THIS PAGE IS RESERVED FOR YOU TO WRITE US CONCERNING ANY OF THESE POINTS RELATING TO YOUR COURSE OF STUDY.

1. Are you selling cream by the quart? If so, are you obtaining its true value?

2. Have you ever sold cream standardized to test a certain percentage of fat? If so, what do you think of that method?

3. What is the value of the fat lost in the whey at your cheese factory?

4. What percentage of the fat in the whole milk do you lose in the process of separation, and how do you account for this loss?

5. In computing the test of the milk from the entire herd, as per problem 16, which method have you been accustomed to use?

6. What are the reasons for buying or selling milk according to its value, rather than according to quantity only?

7. What percentage of yield in cheese or of overrun in butter are you getting? Show all figures.

8. What do your buttermilk and skimmed milk test, and what do these tests indicate?

9. Which do you consider the better method of paying for milk to be used in the form of milk: by weight or volume, or on a fat basis? Give reasons for your answer.

10. Do you find the problems in this bulletin sufficiently clear? If not, what is the difficulty? We shall be glad to have suggestions.

Name..

Address..

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. Bailey, *Director*

Course for the Farm, Royal Gilkey, *Supervisor*

VOL 1. No. 18 | ITHACA, N. Y. JUNE 15, 1912 | FRUIT GROWING SERIES No. 1

THE RENEWAL OF THE NEGLECTED ORCHARD

C. S. Wilson

An important problem before fruit growers is the renewal of neglected orchards throughout the State of New York. Outside of the so-called

Fig. 230.—*A renewed orchard, now returning good profits*

fruit districts of the State are large numbers of neglected orchards that are bringing practically no income to their owners. In many cases the trees are comparatively young and in fairly good condition. If well cared for, these orchards would be very profitable; most of them should net fifty to one hundred dollars or more per acre. It would seem to be worth while to bring these orchards into good condition.

PRODUCTIVE AGE OF ORCHARDS

The first question that presents itself in considering the problem of the neglected orchard is, up to what age will it pay to renew an orchard?

That is, how can we tell whether or not our particular orchard will bring us good net returns, provided it is well cared for? This question may be answered in part by the study that has been made of orchards in six or seven counties in New York State. The results of this study are recorded in the orchard surveys of these counties. In Wayne county Professor Warren, of the New York State College of Agriculture at Cornell University, found that the orchards did not reach their maximum production until they were about forty years old and that they continued to produce good crops far beyond that age. The same condition was found to be true in other counties where surveys were made. These figures refer, of course, to orchards that have received some care. It is probable that the neglected orchard has suffered in proportion to the lack of care, and that the causes which have prevented the trees from producing good crops have shortened, to a certain extent, the life of the trees. It is reasonable to assume, however, that trees which are less than forty years old, and are in good condition, are worth renewing.

TREATMENT FOR RENEWAL

There are several factors to be considered in the work of renewal of the neglected orchard. The most important of these are drainage, thinning out the orchard, changing from sod to cultivation, fertilizing, pruning, and spraying.

Drainage

The drainage problem, although probably not the most important, is one that should receive some consideration. In many neglected orchards in New York State there are spots that are not sufficiently well drained to be conducive to the best growth of the trees. One can readily recognize these spots. Some orchards have large areas on which the trees are unproductive because of lack of drainage. In a few orchards the trees will never bring good net returns until the land has been thoroughly underdrained. In planning the renewal of any orchard, therefore, the problem of drainage should be considered. The drains are laid with a view of draining particular parts, or, when thorough drainage is necessary, between every other row.

Thinning out the orchard

In most of the older orchards in New York State the trees were planted too close, generally 30 by 30 feet or 33 by 33 feet. An indication of this defect is shown by the interlocking of branches. As the trees continue to grow they become more and more crowded for room and the branches reach higher and higher for air and sunshine, thus forcing the bearing surface to the uppermost part of the trees. When such conditions prevail there is no doubt as to the advisability of cutting out some of the trees.

Even when this crowding is not so evident, the trees are often too close. In apple orchards in which branches begin to interlock, the fruit is rendered inferior in size and in color—two factors of great importance. In order to color up the fruit, it may be necessary to cut out some of the trees so that the sunshine can get down around the sides of those that remain. A good method to follow in cutting out trees is to remove every alternate

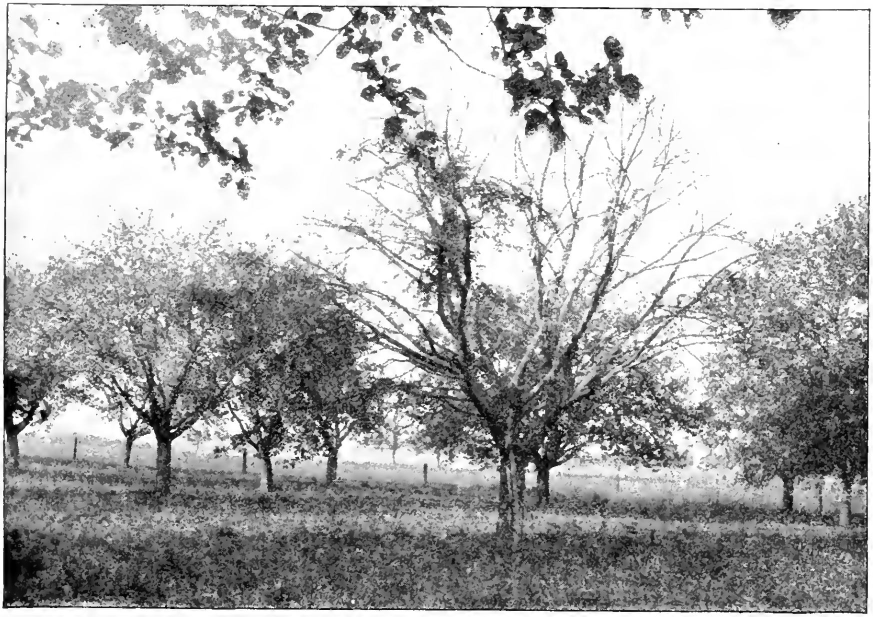


FIG. 231.—*The result of lack of drainage*
(Courtesy of Bureau of Soils, United States Department of Agriculture)

oblique row. This means taking out every alternate tree in each row so that the tree that is cut out in one row is opposite the tree that is left in the next row.

A careful map of the orchard should be made before beginning to cut the trees, and such trees as are in poor condition indicated thereon. With this map it is easy to tell which oblique rows should be eliminated in order to remove the greater number of poor trees.

Changing from sod to cultivation

The neglected orchards in the State are in sod, and probably have been in sod for several years. In many cases a crop of hay is taken from the ground, or sometimes the orchard is used for pasture. Generally it is desirable to break up this sod and bring the orchard into good cultivation. This work should be done with care, in order not to disturb too many of the roots. One may proceed in several ways, as follows:

(a) Where the branches are high enough to make cultivation possible beneath the trees, the ground should be plowed early in the spring. The sod can be broken up, perhaps, with a cutaway harrow, and later destroyed further by a spring-tooth harrow. Although this method of cultivation will not be entirely satisfactory the first year, nevertheless the ground

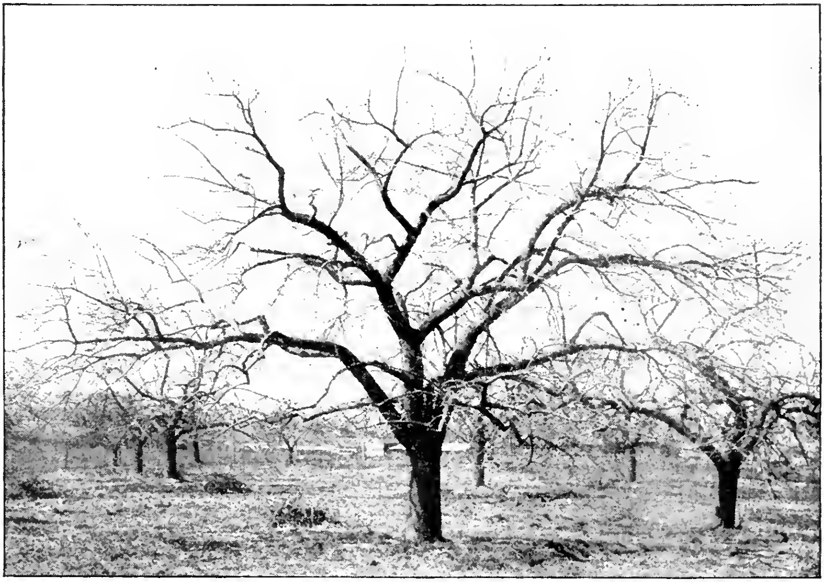


FIG. 232.—*A neglected Baldwin tree that produced a large crop of fine fruit after one year of care*

will be broken up well enough to make a good seed bed for a cover crop, which should be planted about the first of August. Buckwheat may be used as a cover crop for the first year; the character of root growth of this plant helps to break up the sod further, and by the following spring cultivation is easy. Each spring thereafter the orchard should be plowed and cultivated thoroughly until about the first of August, at which time a cover crop should be planted. The best crops for this purpose are buckwheat, rye, mammoth clover, vetch, crimson clover, and cowhorn turnips. These may be sown separately or in combination, the latter being preferable.

(b) In many orchards the branches are so low that one cannot cultivate close to the trees. In such cases the following plan gives good results:

In spring the ground is plowed between rows and as close to the trees as possible. The remaining strip of ground may be covered with a heavy mulch and the plowed strip cultivated. This plan can be followed each summer.

(c) It may be impossible in some cases, however, to cultivate even a part of the ground beneath the trees. In such cases it is advisable to pasture the orchard with hogs and to apply liberal dressings of stable manure. The hogs are permitted to run in the orchard without rings in their noses, which allows them to root as much as they wish. By this method the hogs will break up much of the sod. An orchard thus managed is partially changed from sod to cultivation.

(d) Again, where cultivation is not possible a system of mulching may be practiced, which gives excellent results. The grass is cut the first summer and permitted to remain on the ground as it falls. To this grass an additional mulch of straw or similar material may be added until finally the mulch is sufficient to partly smother out the sod. When a mulch of this kind is added each year good crops of fruit are produced.

Fertilizing

Nearly all the neglected orchards in New York State lack plant food. Nitrogen should be added to stimulate the growth of the trees. The best source of nitrogen for this purpose is stable manure, an application of which should be made in the spring before plowing, at the rate of about ten loads per acre. After the trees begin to make sufficient growth, which will usually be in the course of two or three years, the application of nitrogen may be decreased. Nitrogen will also be supplied by the cover crop, which is planted in the fall, in cases where cultivation is possible.

Aside from nitrogen, the neglected orchard needs potash and phosphoric acid. These can be made more available by thorough cultivation, thus utilizing to a greater extent the phosphorus and potash that are already in the soil; or additional phosphoric acid and potash may be applied in the form of a commercial fertilizer. A good formula for a commercial fertilizer to apply to one acre of land is as follows:

Muriate of potash..................	200 pounds
Basic slag.........................	500 pounds

Pruning

No systematic pruning has been practiced in the neglected orchard for many years, and therefore it is probable that the heads of the trees are too thick. The grower should prune the first year with a view of removing all dead and diseased branches and thinning out the heads of trees to such an extent as to produce vigorous young growth the following summer. The pruning should not be so severe that it results in the production of a large number of water sprouts, or disturbs the normal bearing of the tree. When the heads are very high some growers recommend that the larger branches be headed in about one third their length; the resulting growth produces practically a new head, which is closer to the ground. This method is called dehorning. It has proved successful in some cases, but the general opinion in New York State is that dehorning should not be practiced. If a tree is in such condition as to require so severe treatment, it would be economy, as a rule, to pull the tree out by the roots rather than to try to renew it; or, in other words, if it is necessary to dehorn, the orchard is generally not worth renewing.

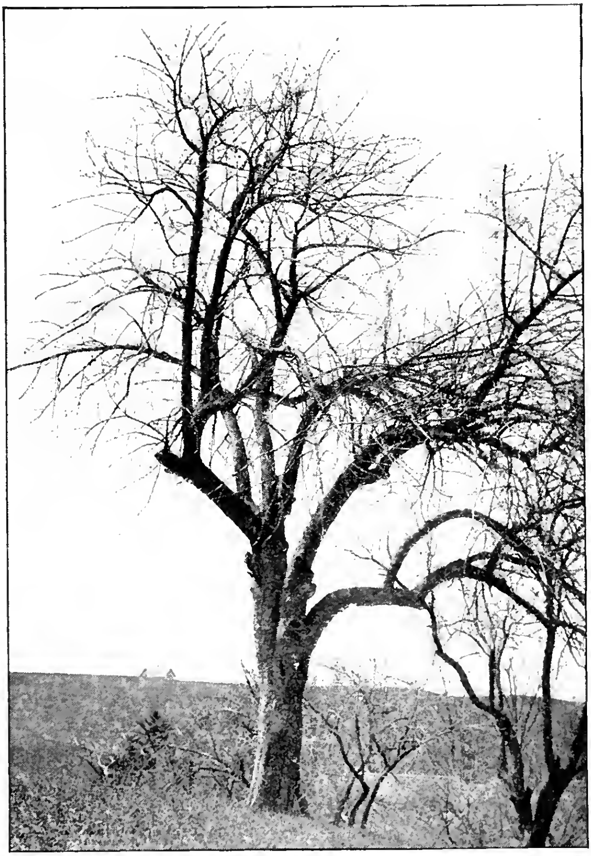


FIG. 233.—*A tree with hollow trunk and branches. It is not economy to renew an orchard when many of the trees are in this condition*

The best time to prune is in the spring, just before growth starts. The work may be done, however, at any time during the dormant season. The grower should plan to commence the work during the warm days of winter, so that he can complete it before the spring rush begins. Wounds that are larger than two inches in diameter should be painted. The best covering for this purpose is white lead, to which boiled linseed oil has been added. The paint should be mixed thicker than usual. A little lampblack may also be added to make the color of the paint conform to the color of the bark. This avoids the white spots, which are otherwise so prominent.

Spraying

The spraying of the neglected orchard is done in the same way as the spraying of orchards that are well cared for. The following spraying plan, which is taken from Bulletin 283 of the Cornell University Agricultural Experiment Station, is suggested for the apple:

I. Dormant season before leaf buds open, but just as they are swelling:

(a) Lime-sulfur as a contact spray for

San Jose scale 32° to 33° Beaumé 1–8.

Blister mite 32° to 33° Beaumé 1–11.

(b) Add arsenate of lead, 2 pounds to 50 gallons, to the lime-sulfur as a poison for bud moth and cigar case-bearer.

II. After leaf buds open but before blossoms open, that is, when they are just beginning to show some pink. Watch the weather and get the spray on before rain falls, not after:

(a) Lime-sulfur solution, 32° Beaumé 1–40, or bordeaux 3–4–50, for apple scab (the fungus).

(b) Arsenate of lead, 2 to 3 pounds to 50 gallons, added to lime-sulfur or bordeaux as a poison for bud moth, cigar case-bearer, and cankerworm.

This application should never be omitted during cold, rainy seasons.

III. After petals have begun to fall, beginning when about two thirds have fallen. Have spray on before rains come. This is important.

(a) Lime-sulfur, 32° Beaumé 1–40, or bordeaux 3–4–50, for apple scab and leaf spot.

(b) Arsenate of lead, 2 to 3 pounds to 50 gallons, used with lime-sulfur or bordeaux for codling moth, cankerworm, and bud moth.

This is the most important of all the applications.

IV. Ten days to two weeks later. Before rain period.

(a) Lime-sulfur, 32° Beaumé 1–40, or bordeaux 3–4–50, for apple scab and leaf spot.

(b) Arsenate of lead, 2 to 3 pounds to 50 gallons, used with lime-sulfur or bordeaux for codling moth and cankerworm.

V. Eight to nine weeks after blossoms fall:

Same as IV for late scab infections and late attacks of codling moth. In most seasons this application is not necessary.

If aphis appears, spray before leaves curl with whale-oil soap, 1 pound to 6 gallons, or with kerosene emulsion diluted with six parts of water, or use one of the tobacco extracts.

SCRAPING THE BARK

Some growers recommend the removal of the old bark. The purpose of this is the destruction of insects that may harber beneath loose pieces.

This work should be carefully done, in order to avoid breaking through the bark into the growing part of the tree, thus exposing wounds that are likely to afford a foothold for fungous diseases. The work can be done conveniently with a short-handled hoe. The advisability of scraping the bark is questioned by many growers; it is an operation that is not essential in the renewal of an old orchard.

In many cases canker has attacked the branches, and where this has been the case the diseased areas should be removed with a sharp knife

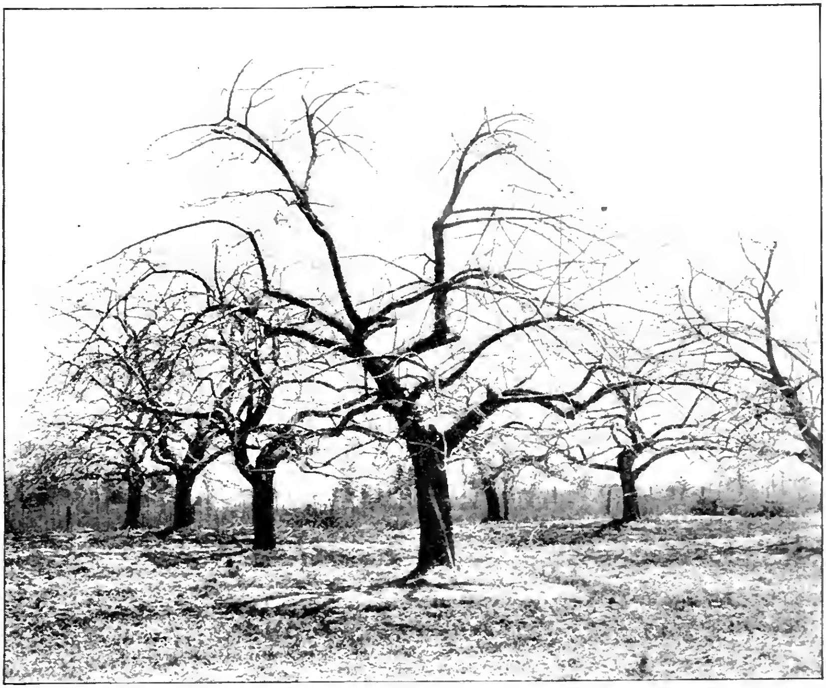


FIG. 234.—*A Tompkins King, formerly neglected, now renewed and productive*

and the wounds disinfected with a solution of corrosive sublimate, one ounce dissolved in seven gallons of water.

EACH ORCHARD A PARTICULAR PROBLEM

The directions given above are general and will be applicable in most cases. It should be remembered, however, that each orchard presents an individual problem. The causes that have led to neglect will differ with the various orchards, and therefore it is reasonable to conclude that the methods of treatment of these orchards will be somewhat different. Each orchard is a problem that requires careful consideration, if the best results are to be achieved.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL 1. No. 18 | ITHACA, N. Y. JUNE 15, 1912 | FRUIT GROWING SERIES No. 1

THE RENEWAL OF THE NEGLECTED ORCHARD

DISCUSSION PAPER

A discussion paper is inclosed with each Reading-Course lesson in order that the best results may be obtained by the reader. Questions are asked so that the more important points will be given attention. We hope you will answer these questions, either from the lesson or from experience. You will be surprised to see how this will clarify your knowledge and help you to remember what has been read. The answering of these questions is optional with the reader, but IT IS NECESSARY TO SIGN AND RETURN THE DISCUSSION PAPER IN ORDER TO RECEIVE THE NEXT LESSON.

Each discussion paper returned will be read over carefully and will not be quoted. It will require letter postage, which is the only expense connected with the course. We regret that we cannot reply to every discussion paper personally, but we shall write to those persons who need definite information that we can supply.

The discussion paper has other uses. You may indicate on it any new series of Reading-Course lessons that you wish to study. Whenever space allows, the last page of the lesson will show the series available and the lessons in each. If you wish to select the lesson that you desire to study next, you may do so and advise us on the discussion paper. When the lessons in any series have been studied, references for further study will be supplied on request. THE SPACE BELOW ON THIS PAGE IS RESERVED FOR YOU TO WRITE US CONCERNING ANY OF THESE POINTS RELATING TO YOUR COURSE OF STUDY.

1. How do you account for the neglect of many orchards in the State?

2. Beyond what age do you think that it would be unwise to try to reclaim a neglected orchard?

3. What factors should the grower consider in the renewal of a neglected orchard?

4. Make a diagram showing the proper position of drains in relation to the trees, provided it is necessary to underdrain the soil thoroughly.

5. Considering that an orchard has been planted 30 by 30 feet on the square, make a diagram showing what trees should be cut out in thinning.

6. How many different ways may one proceed to change a sod orchard over into cultivation?

7. What method of soil management (tillage, sod, or mulch) do you consider the best for orchards in general in New York State? Give reasons.

8. What fertilizers do the neglected orchards need, and how may these be supplied?

9. How heavily would you prune a neglected orchard the first season?

10. Make out a spraying plan that applies to your own orchard.

11. Do you consider the scraping of bark an important factor in the renewal of old orchards? Give reasons for your answer.

Name....................................

Address............ ....

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. Bailey, *Director*

Course for the Farm, Royal Gilkey, *Supervisor*

VOL. 1. No. 20 — ITHACA, N. Y. JULY 15, 1912 — FARM CROPS SERIES No. 1

ALFALFA FOR NEW YORK

E. G. Montgomery

Alfalfa is one of the oldest cultivated plants of Asia and of southern Europe. It was brought into Mexico by the Spaniards during the sixteenth century. About 1854 it was introduced into California and its culture has developed rapidly since that time in all States as far east as the Missouri River. The plant has been cultivated continuously for more than one hundred years in the limestone region of New York, with considerable success; nevertheless, according to the Twelfth United States Census there were only 5,582 acres producing alfalfa in New York in 1899, against

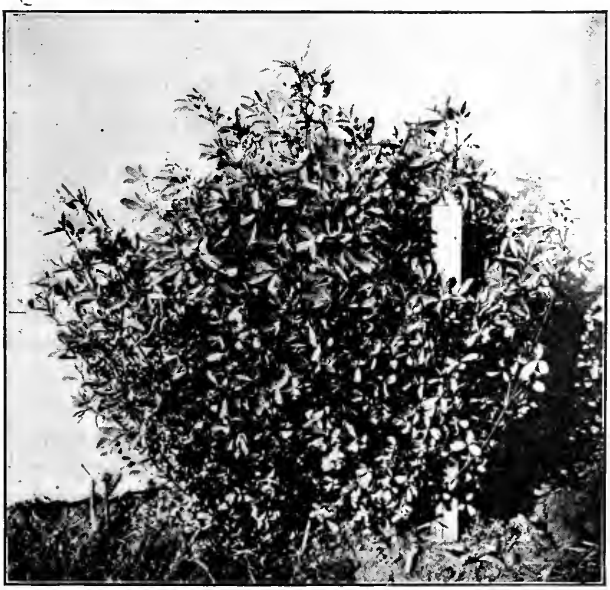

NEBR. AGR. EXPT. STA.

Fig. 235.—*Alfalfa plant*

almost 500,000 acres in Colorado, and more than 250,000 acres in Kansas and California. The Thirteenth Census, however, shows 35,343 acres in New York in 1909, a sixfold increase in ten years.

Doubtless the reason for the slow development of alfalfa-growing in New York and other Eastern States is lack of sufficient lime and of the bacteria necessary for cultivation of the crop in practically all soils except those of certain restricted areas. This deficiency was not known until a few years ago; but with our present knowledge of the subject and means for overcoming such difficulties, there is no reason why alfalfa culture should not have a rapid development in the Eastern States.

VALUE OF THE CROP

According to the Thirteenth Census, New York State produced in 1909 the following yields of hay and nutrients per acre:

Crop	Acres harvested	Yield per acre (tons)	Digestible nutrients per acre (pounds)	Digestible protein per acre (pounds)
Alfalfa	35,343	2.46	2,632	599
Red clover	87,267	1.31	1,222	172
Timothy hay	1,078,358	1.08	1,070	61

Average yields are always low, as large areas of poor land are included. According to Bulletin 221 of the Cornell University Agricultural Experiment Station, successful alfalfa growers in this State report yields varying from 3 to 7 tons per acre, the average being 4 tons. This can be expected from any good alfalfa field.

The food value of alfalfa is very high since it is rich in protein, being our cheapest source of that material. Valuing the various digestible nutrients in alfalfa and other standard hays, the comparative value per ton is reported to be about as follows, in Farmers' Bulletin 339, United States Department of Agriculture:

Feed	Value per ton
Fresh alfalfa	$7.00
Fresh clover	5.96
Alfalfa hay	20.16
Clover hay	14.12
Timothy hay	9.80
Cowpea hay	19.76

While alfalfa hay has almost the same analysis as bran, yet it is not so digestible, being much coarser. With bran valued at $22.50 per ton, alfalfa would be worth $16.50 per ton, according to feeding experiments conducted at the New Jersey Agricultural Experiment Station.

THE ALFALFA FAMILY

Alfalfa is related, in a botanical sense, to both red clover and sweet clover, being one of that large group of leguminous plants with three-parted leaves known as *Trifolieae*.

In the *Medicago* genus, to which alfalfa belongs — so called because alfalfa was originally supposed to have come from Media — there are at least fifty species. Those most commonly found in cultivation are the common alfalfa (*M. sativa*), burr clover (*M. denticulata*), black medick (*M. lupulina*), yellow alfalfa (*M. falcata*), and sand lucern (*M. media*); the common alfalfa (*M. sativa*), however, is the only one of the family in extensive cultivation.

Varieties

Of common alfalfa there are four principal varieties: (a) Peruvian, a tall, coarse-stemmed variety, adapted only to warm climates; (b) common alfalfa, adaptable under favorable conditions as far north as northern New York; (c) Turkestan alfalfa, and (d) Grimm alfalfa, two similar varieties that will grow in somewhat colder and drier regions than will common alfalfa.

In New York State common alfalfa is the variety principally grown. The Turkestan and Grimm varieties, while more resistant to cold, are less productive, and should be tried only in the colder and more exposed localities.

SOIL REQUIREMENTS FOR ALFALFA

The best alfalfa soils are medium to heavy in texture, with porous subsoil. At one time it was thought that alfalfa was adapted only to deep soils with porous subsoil, so that the roots might penetrate easily to a depth of several feet; at present, however, alfalfa is grown in every State, on practically every type of productive soil except those that are acid. On very heavy soils or on those with a hardpan subsoil, while alfalfa often will grow very well, it is much more likely to winterkill; and on some of the hardpan soils of New York, alfalfa culture is uncertain because of winterkilling.

Tile drainage on these heavy soils not only improves the yield, but also increases the ability to withstand winter freezing. In fact, alfalfa will winterkill on even the best land if it is not properly drained. It is particularly sensitive to standing water during the winter months. In general, the water table should be not nearer than two feet from the surface for more than a few days at a time, and is better at about four feet below the surface.

The root system of alfalfa varies with soil conditions. In a porous soil, easy to penetrate, the taproot will extend almost straight downward for 10 to 20 feet, or until the water table is reached. However, if a stratum of hard soil is encountered, the taproot will break up into a much-branched root system. In a very compact soil the roots may not penetrate more than 3 or 4 feet, even when the plants are several years old.

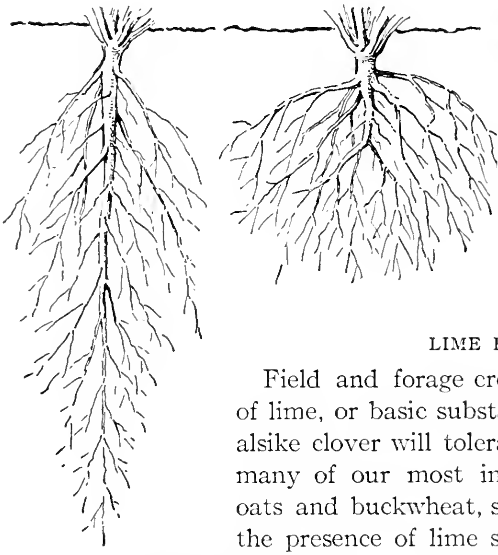


FIG. 236.— *Drawing showing distribution of roots on a deep porous soil, and on a compact soil. In the first case a long taproot is developed, while in the second case the taproot breaks up into many branches*

LIME REQUIREMENTS

Field and forage crops vary in their requirements of lime, or basic substances in the soil. Redtop and alsike clover will tolerate some acid in the soil, while many of our most important field crops, such as oats and buckwheat, seem to be quite indifferent to the presence of lime so long as the soil is not acid. Certain crops, notedly red clover and alfalfa, are very sensitive to the lack of lime. In order to grow alfalfa, *lime must be applied to at least three fourths of the cultivated soils of New York.*

By areas in New York State

The map herewith (Fig. 237) shows the State divided into four principal soil areas, according to lime requirements for alfalfa. Where the soil has been derived in general from a limestone formation, as in Section I, it usually will not be necessary to add more lime. The presence of limestone pebbles or stones ordinarily indicates sufficient lime, while the absence of limestone pebbles usually, but not always, indicates the need of lime.

When lime is required, in Section I generally 500 to 1,000 pounds of quicklime will be sufficient, or twice this amount of ground limestone. In Section II, 1,000 to 2,000 pounds of quicklime, or twice this amount of ground limestone, will usually be sufficient. In Section III the soil is generally very deficient in lime, and 2,000 to 4,000 pounds of quicklime, one half as much more of hydrated lime, or twice as much ground limestone, is required. The land in Section IV is very irregular. Many of the valleys are supplied with lime, but most of the hill lands require about the same amount as do sections II and III.

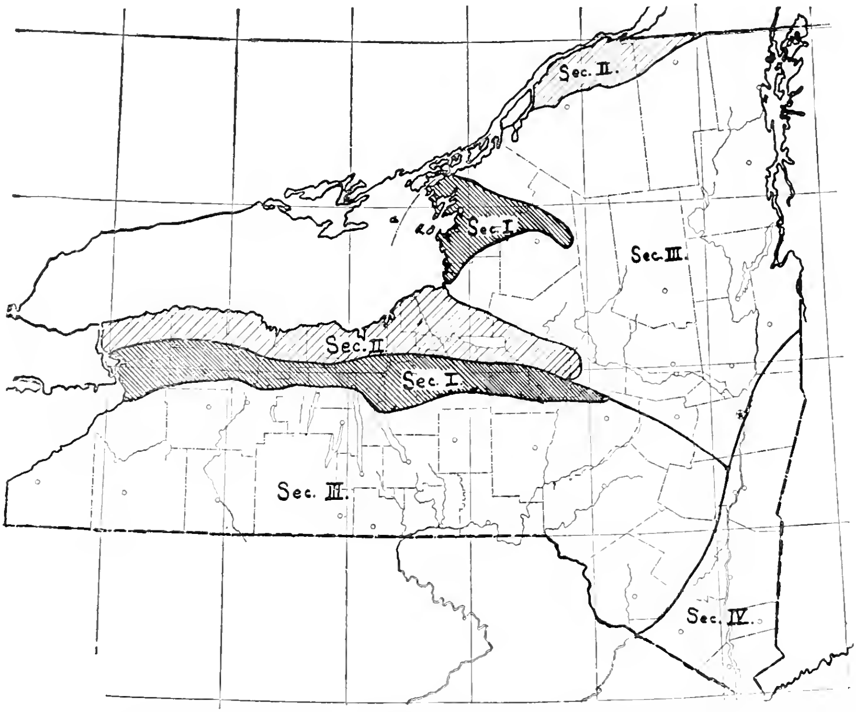


FIG. 237.— *This chart is intended to show in a general way the variation in lime requirement for alfalfa in New York State. It must be borne in mind that the map is very general, as there are considerable areas even in Section III where lime is not required for alfalfa culture.*

In general, the valleys require less lime than do the hills. This is quite true in Section IV, where most of the valleys have sufficient lime and most of the hills are deficient. Keeping the above in mind, the following statements will serve as a general guide in determining the amount of lime to apply:

Section I, generally enough lime, but where required about 500 to 1,000 pounds of quicklime per acre is sufficient.

Section II, 1,000 to 2,000 pounds of quicklime per acre on hills and half as much in valleys.

Section III, 2,000 to 4,000 pounds of quicklime per acre on hills and half as much in valleys.

Section IV is very irregular. Many local areas and most of the valleys have sufficient lime, but hills in general will require about the same lime as do sections II and III

There are certain areas in the State, such as the limestone soils, where most of the productive soils will grow alfalfa. However, for a large section of the State, designated as Section III on the chart, only the best land should be used for alfalfa at first. Its culture should be tried first on well-drained bottom land and extended to upland as experience is gained and as experiment indicates the best method of procedure. On the hardpan soils of southern New York, alfalfa culture should be tried only on the most favorable land at present.

Form of lime

There are three forms of lime. When 100 pounds of raw lime rock is burned it is reduced to 56 pounds, because of certain gases being driven off. When this burnt lime, or "quicklime," is water-slaked it takes up 18 pounds of water, giving a weight of 74 pounds. Therefore, the amount of each form of lime to give equivalent results is expressed as follows:

Burnt lime, or quicklime	56 pounds
Hydrated lime	74 pounds
Ground limestone	100 pounds

U. S. DEPT. AGR., BUR. PLANT INDUS.

FIG. 238.— *Root nodules of alfalfa*

INOCULATION FOR ALFALFA

Alfalfa requires large amounts of nitrogen. If the soil is very rich in easily available nitrogen, the alfalfa plants will acquire a sufficient amount for good growth. In ordinary soils, however, alfalfa is not able to obtain its nitrogen from the soil, but must have the aid of certain bacteria that fix free nitrogen from the air in such form that it can be utilized by the plant.

Root nodules are found abundantly on the roots during most of the growing season. These nodules are the home of the nitrogen-fixing bacteria, which have the power of assimilating free nitrogen from the air and fixing it in the nodule, the latter decaying and leaving it in the soil.

Where alfalfa has never been grown the bacteria are probably not present, unless sweet clover is found growing. In the absence of sweet clover, bacteria must be introduced artificially. The best method of inoculation is to procure soil from an old alfalfa field and apply it at the rate of 200 to 300 pounds per acre to the new field just before sowing. The soil should not be allowed to dry before applying. There are many prepared cultures of bacteria on the market, or they can be obtained without charge from the Department of Agriculture, Washington, D. C. No other is so satisfactory as the soil method of inoculation. Sweet clover has the same form of bacteria, and soil from an old sweet clover patch may be used with success. Wherever sweet clover is found growing wild, natural inoculation will probably be present. In fact, wild sweet clover usually indicates a good alfalfa soil.

Inoculation is not necessary in limestone soils where alfalfa has been cultivated in the neighborhood for several years. Under such conditions natural inoculation seems to be present. Also on very fertile soils, heavily manured, the alfalfa will often live without inoculation for two or more seasons, when natural inoculation often seems to take place.

Manuring the land before plowing for alfalfa is a great help, especially in soils on which liming and inoculation are necessary. The manure not only furnishes a needed stimulus to the young alfalfa, but, what is more important, it helps to make the soil favorable for the rapid development and spread of the alfalfa bacteria.

SOWING THE SEED

Amount of seed

Twenty pounds per acre is the usual rate of seeding. On good alfalfa land a satisfactory stand sometimes results with 12 to 15 pounds, but with 20 pounds the stand obtained is oftener too thin than too thick.

Time of seeding

There are three general times of seeding, known as early spring (April), late spring (June), and midsummer (August) seeding. When the land is suitable, midsummer seeding is probably preferred by the majority of growers, as it not only enables them to secure some other crop from the land the same year, but does away with the necessity of clipping in order to keep down weeds and with general care of the crop for the first year. The commonest cause of failure in spring-sown alfalfa is weeds; but these seldom give trouble in midsummer seeding, as the summer weed crop has practically been destroyed by that time. Midsummer seeding should be from July 25 to August 10, and never later than August 15. The soil should be in good preparation and thoroughly packed, *as alfalfa will not winter well in a loose seed-bed.*

The two principal objections to midsummer seeding are: (1) the season may be too dry to prepare the land and sow the seed by August 10:

(2) on heavy soils or those with hardpan subsoil the young plants are not strong enough to withstand winterkilling. There is a large area of such heavy soil in New York State, especially the type known as Volusia silt loam and the hardpan hill lands in the south-central part of the State.

For the heavy types of soil mentioned above, prepare the land thoroughly and sow about May 1; or, if the land is weedy and not in first-class

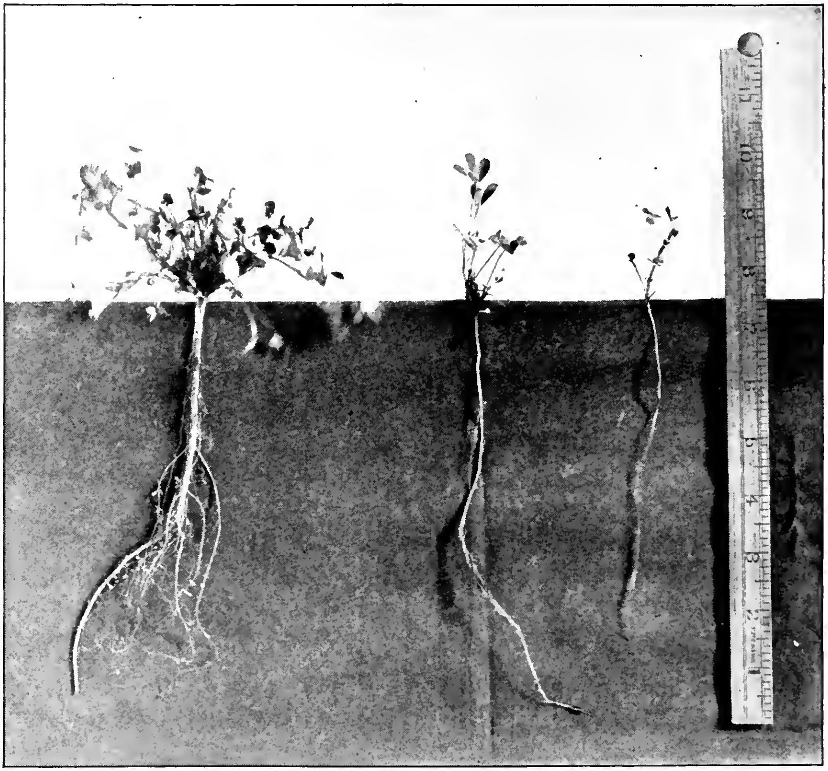


FIG. 239.— *Showing advantage of midsummer sowing, as compared with early fall sowing. Beginning at the left of the picture, the seed was sown August 19, September 15, and October 1, respectively. All were dug up April 13 of the following spring.* (*At Nebraska Agricultural Experiment Station*)

tilth, plow early and fallow for about two months, killing the spring crop of weeds and putting the soil in fine tilth. Sow about June 1 to 10.

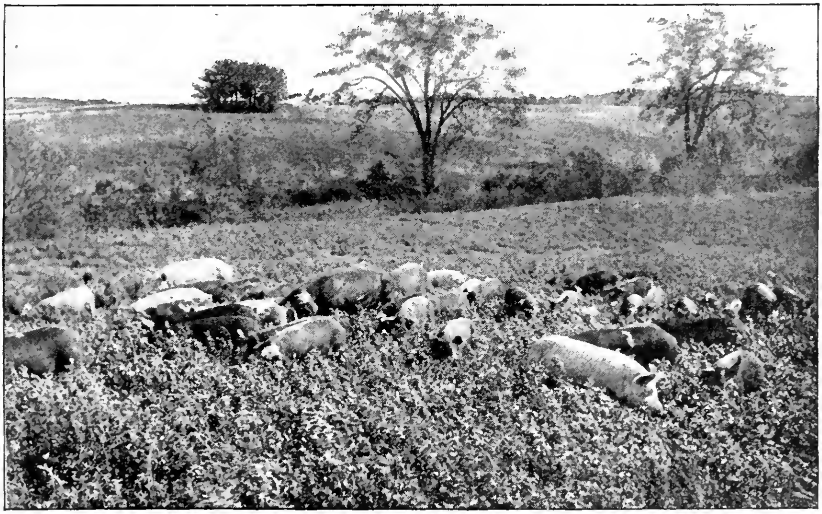
A nurse crop is seldom used except on land especially well adapted to alfalfa. The young plants are delicate and must be favored in early growth. However, in spring sowing it is often good practice to sow a half-seeding (one bushel per acre) of oats or barley to be cut green at heading time for hay.

Method of sowing

Drilling is a good practice, but the land must be harrowed smooth after the drill. If the drill marks are left, a heavy rain within six or eight weeks after sowing may wash enough soil on the young plants to kill them. Broadcasting ahead of a disk drill or a spring-tooth harrow and rolling afterward is very satisfactory.

CARE OF THE STAND

If the alfalfa is spring- or summer-sown without a nurse crop, the weeds must not be allowed to get ahead of the seeding. They should be clipped



COURTESY OF W. A. WHEELER, MITCHELL, S. DAK.

FIG. 240.— *Hogs in alfalfa pasture. Not troubled about the high cost of living*

back with a mower, the cutter bar being set 5 to 6 inches high. It is *very important not to clip the young alfalfa close to the ground*, below the leaves, during the first four months, as good stands are often killed by so doing.

Care of the established field

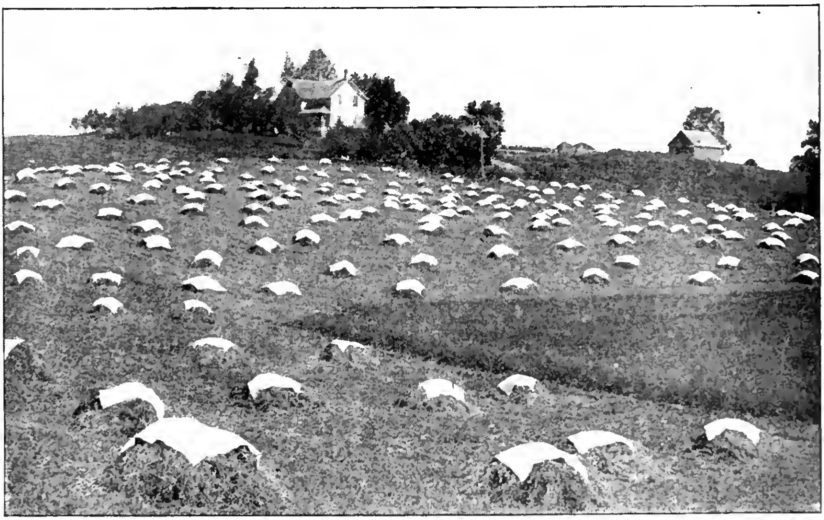
Whenever alfalfa shows signs of blooming it should be cut. It is then at the stage of growth for the best quality of hay, and if cut promptly will often make four cuttings for the season instead of three. The rule is to cut when it is one tenth in bloom. A better method is to watch the new shoots that start from the crown. When they are an inch long, cutting should be done at once.

Disking the alfalfa field early in the spring or after the first cutting is often practiced in dry climates, but in humid climates, such as that of

U. S. DEPT. AGR., BUR. PLANT INDUS.

FIG. 241.— *A western method of stacking alfalfa. The second cutting is stacked on top of the first cutting*

New York, the plants injured by the disk are very likely to develop root rot and thus, on the whole, decrease the stand in time. However, on an



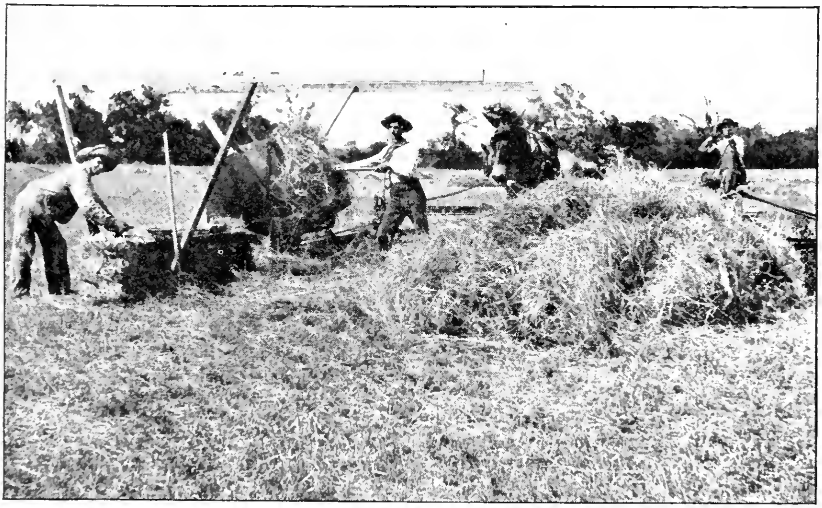
COURTESY OF W. A. WHEELER, MITCHELL, S. DAK.

FIG. 242.— *Curing alfalfa under hay caps. It is wise to have enough hay caps for a part of the crop*

old stand that is thin and must be broken up in another year, disking will stimulate growth for at least one season and destroy many of the weeds and much of the grass that may be coming in. Therefore disking is good practice under such conditions, but it is not good practice on a new stand.

Pasturing

Alfalfa is the ideal pasture for hogs and horses, but if fed to cattle they are likely to bloat. For cattle pasture the alfalfa should be mixed with grass, about half and half. It is very important not to pasture close, as a good stand may be killed in a single season by close cropping. Ordinarily, enough forage should be on the land at any time to cut at least three fourths of a ton of hay. The best practice is to cut for hay about twice a season while pasturing. Treated in this way the stand will last for ten or twenty years.



U. S. DEPT. AGR., BUR. PLANT INDUS.

FIG. 243.— *Baling alfalfa from the windrow in the field. A practical method in good haying weather*

CARE OF THE HAY

Two points are to be remembered: first, that alfalfa hay cut young — when one tenth in bloom — is more digestible and better than when older; second, that the leaves of alfalfa are three to four times as valuable as the stems. Good alfalfa hay should be about one half leaves, but unless handled with care a large proportion of the leaves may be lost.

How to cure

The first crop, which is usually harvested the middle of June, is handled very much as a heavy clover crop. The first crop is generally quite heavy, and the stems are coarse; and this crop is not easy to cure. Coming at a time when haying weather is not of the best, the first crop is usually cured in small cocks. The second and third crops, being lighter, with finer stems, and coming in July and late August when haying weather is good, are easily cured. The second and third crops are often cured in windrows and stacked or put in the mow directly, without cocking.

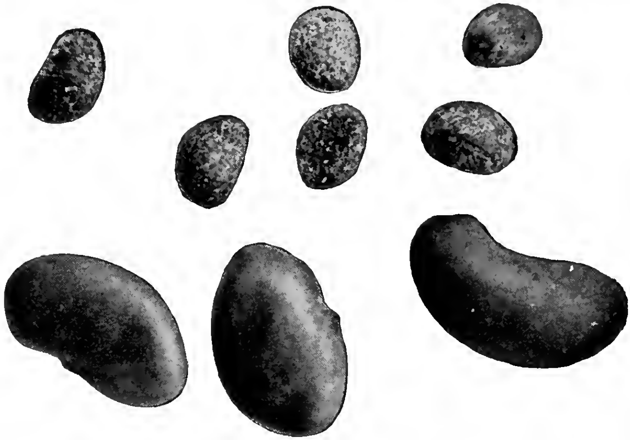


FIG. 244.— *Alfalfa seeds below, compared with dodder seeds above (enlarged)*

FERTILIZER AND MANURE FOR OLD SODS

No crop responds more readily to barnyard manure than does alfalfa. Whenever an established stand is not doing well—yielding less than three tons per acre—it will pay to manure. The manure should be applied during the winter.

Acid phosphate has been found to give good results in certain cases. One to two hundred pounds per acre seems sufficient. Nitrogen need not be applied.

ALFALFA SEED GROWING

Usually the second crop, and sometimes the third crop, is used for the seed crop. Dry weather is required during the blooming period to secure a set of alfalfa seed, and July is the month when the proper weather conditions are most likely to occur. In New York, however, it is seldom that a good seed crop can be secured, and it is not to be expected oftener than once in three or four years. The seed crop is harvested very much as is clover seed, and as soon as cured it is threshed, either from the field or from the stack.

ALFALFA ENEMIES

Dodder

Alfalfa fields occasionally are infested with dodder, from seed. The dodder seed germinates at about the same time as the alfalfa and in the course of a few days it attaches to the alfalfa plant. The dodder plant does not develop a root system of its own, but lives on food extracted from the alfalfa plant. The infested plants die in time.

The dodder plant, being a twining vine, spreads from one alfalfa plant to another. It seldom seeds in New York State, but the original infestation comes from dodder seed in the original alfalfa sowing.

The dodder plants also live over winter, on the crowns of alfalfa plants, and in this way spread rapidly from year to year.

If the field is thoroughly infested, about the only recourse is to break it up and put it to some other kind of crop for at least two years. Where the dodder occurs only in small spots it can be controlled, and sometimes eradicated, by mowing those spots very close as soon as they appear, drying the material, and burning it on the land. The burning will injure the alfalfa plants only slightly and may kill any dodder still adhering to the crowns.

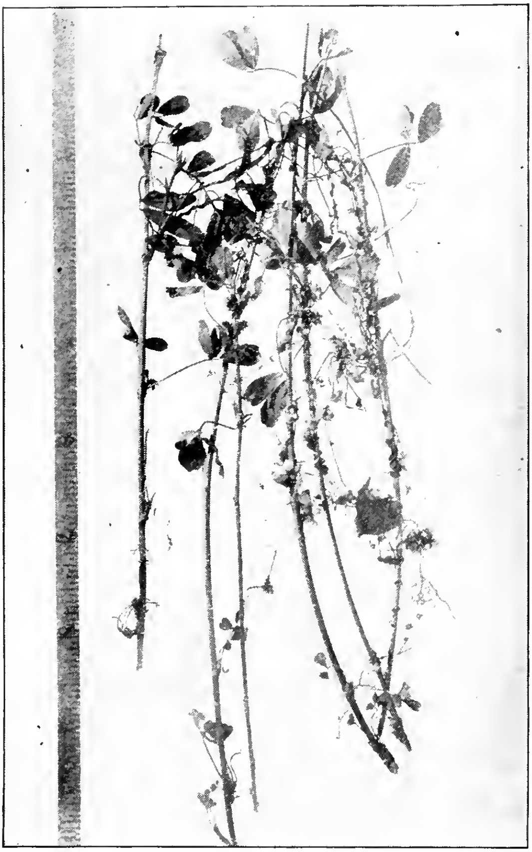


FIG. 245.— *Alfalfa dodder plant, as it grows on alfalfa plants*

Root rot

In old alfalfa fields many of the large roots are likely to begin to rot at the crown. The root decays slowly and dies in one or two seasons. There is no remedy for this. The rot is usually favored on rather wet lands and is increased when the crowns are injured by machinery. Cultivating the fields with a disk harrow stimulates growth, but usually it increases root rot by injuring many of the plants.

Alfalfa rust

Occasionally rust occurs in fields to such an extent that most of the plants are affected. When it appears in large amount the crop should be cut at once. Usually the rust will not appear in abundance again during that season.

EXPERIMENT TO DETERMINE WHAT A GIVEN SOIL REQUIRES FOR GROWING ALFALFA

Every farmer who plans to grow alfalfa extensively at some future time may determine for himself the needs of his soil by a very simple experiment. In fact, it would not be advisable to undertake alfalfa culture extensively in a region where it had not been cultivated previously, without first experimenting. The plan of the experiment is as follows:

Lay off a plat of land eight rods long and four rods wide and divide it into eight square plats of one-fortieth acre each, as shown in the plan below, setting stakes at the corner of each plat. Great care should be taken to see that the land is uniform in quality.

1 Inoc. Lime	2 Inoc. Lime Manure	3 Inoc. Manure	4 Inoc.
5 Lime	6 Lime Manure	7 Manure	8

Apply 50 pounds of quicklime or 100 pounds of ground limestone to each of plats 1, 2, 5, and 6; a liberal dressing of barnyard manure to each of plats 2, 3, 6, and 7; twenty pounds of fresh soil from an old alfalfa field or sweet clover patch to each of plats 1, 2, 3, and 4. No treatment is given plat 8.

This experiment furnishes all possible combinations of lime, manure, and inoculation, with a check plat of untreated soil. Particular care should be exercised in choosing a piece of land free from weeds and in putting the land in good tilth before sowing. The land should be plowed four to eight weeks before seeding and the lime applied at that time. The inoculation should be done at sowing time.

The experiment should be allowed to stand at least two years, as the most marked effect of the treatment is to be expected the second year.

FIG. 246.— *Alfalfa in stack. A practical and economical way of preserving the crop*

REFERENCES

The book of alfalfa. F. D. Coburn. Orange Judd Company, New York.

Alfalfa in America. Joseph E. Wing. Sanders Publishing Company, Chicago.

Alfalfa. Farmers' Bulletin 339, United States Department of Agriculture, Washington, D. C.

Inoculation and lime as factors in growing alfalfa. New York Agricultural Experiment Station Bulletin 313, Geneva, N. Y.

THE CORNELL READING-COURSE FOR THE FARM

This course provides information on elementary agricultural subjects and on important farm and general rural problems, and is designed to meet the needs of persons who desire to study but are unable to leave their work. The lessons are published monthly and are placed in series dealing with various agricultural problems. Readers enroll for one or more series and are supplied with the first lesson in each. Other available lessons in the series are sent, one at a time, on the return of the discussion papers described below. When all of the available lessons in any series have been studied, the reader is placed on the mailing list to receive the future Reading-Course lessons added to the series in which he is registered. References for advanced study are supplied on request and correspondence is invited. Requests for specific information on agricultural problems are referred to members of the college staff for personal reply.

A supplement containing questions (for this reason called a discussion paper) is inclosed with each Reading-Course lesson to help the reader obtain the most benefit from the lesson and also to give an opportunity for an expression of his opinion. Questions are asked in order to bring out the more important points and stimulate observation and original thinking, which may result in new plans and improved methods of conducting the usual operations. The answering of these questions is optional, but it is desirable that persons who wish to continue to receive Reading-Course lessons sign and return the discussion paper. Each discussion paper returned will be read over carefully and a personal reply will be made when necessary.

The Cornell Reading-Course for the Farm is an enlargement and revision of the former Reading-Course for Farmers. Following is a list of available back numbers of the former Reading-Course for Farmers (designated as " Old course ") and lessons of the present course (designated as " New course "), arranged by series:

Series		*Lessons*	
Stock feeding....	Old course	7	The computing of balanced rations
		9	Soiling crops, silage, and roots
		10	Pastures and meadows
Dairying.......	Old course	22	The composition of milk and cream, and their by-products
		23	The construction of sanitary dairy stables
	New course	16	Practical dairy problems
Farm crops.....	Old course	9	Soiling crops, silage, and roots
		10	Pastures and meadows
		41	Improving plants by selection or breeding
		42	Improving corn by seed selection
	New course	20	Alfalfa for New York
		24	The rotation of farm crops (In press)
Poultry........	New course	4	Incubation. Part I
		6	Incubation. Part II
		10	Feeding young chickens
The soil........	Old course	37	Drainage and larger crops
	New course	2	The soil: Its use and abuse
Fruit growing...	New course	18	The renewal of the neglected orchard
		22	The culture of the currant and the gooseberry (In press)
Rural engineering	New course	8	Knots, hitches, and splices
Farm forestry...	New course	12	The improvement of the woodlot
The horse......	New course	14	Horse breeding to increase the farm income

Residents of New York State may register for one or more of the series named above by addressing the Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, N. Y.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. I. No. 20 | ITHACA, N. Y. JULY 15, 1912 | FARM CROPS SERIES No. 1

ALFALFA FOR NEW YORK

DISCUSSION PAPER

A discussion paper is inclosed with each Reading-Course lesson in order that the best results may be obtained by the reader. Questions are asked so that the more important points will be given attention. We hope you will answer these questions, either from the lesson or from experience. You will be surprised to see how this will clarify your knowledge and help you to remember what has been read. The answering of these questions is optional with the reader, but IT IS NECESSARY TO SIGN AND RETURN THE DISCUSSION PAPER IN ORDER TO RECEIVE THE NEXT LESSON.

Each discussion paper returned will be read over carefully and will not be quoted. It will require letter postage, which is the only expense connected with the course. We regret that we cannot reply to every discussion paper personally, but we shall write to those persons who need definite information that we can supply.

The discussion paper has other uses. You may indicate on it any new series of Reading-Course lessons that you wish to study. Whenever space allows, the last page of the lesson will show the series available and the lessons in each. If you wish to select the lesson that you desire to study next, you may do so and advise us on the discussion paper. When the lessons in any series have been studied, references for further study will be supplied on request. THE SPACE BELOW ON THIS PAGE IS RESERVED FOR YOU TO WRITE US CONCERNING ANY OF THESE POINTS RELATING TO YOUR COURSE OF STUDY.

1. Does sweet clover grow wild in your vicinity? Would this indicate that alfalfa could be grown?

2. From inquiry do you find that new seedings of late-sown alfalfa winterkill on soil similar to that of your farm? Do old, well-established stands winterkill?

3. In what respect does your soil vary from ideal alfalfa soil? Is it too heavy? too light? hardpan? acid? or does it lack drainage?

4. Name the three most important soil treatments generally required in preparing land for alfalfa.

5. What is the probable lime requirement per acre of land in your vicinity?

6. At present prices would it pay you to grow alfalfa rather than timothy? What yield per acre do you expect from each crop?

7. Capitalizing the net income from alfalfa, on what value per acre would alfalfa meadow pay an income of six per cent?

8. How much per acre would you feel justified in spending in order to secure a good alfalfa stand?

Name..

Address...

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. 1. No. 22 | ITHACA, N. Y. AUGUST 15, 1912 | FRUIT GROWING SERIES No. 2

THE CULTURE OF THE CURRANT AND THE GOOSEBERRY

C. S. WILSON

Believing that more attention should be given to the growing of bush fruits and desiring to stimulate an interest in their development, the

FIG. 247.—*A patch of currants and gooseberries on the grounds of the Geneva Agricultural Experiment Station*

Department of Pomology undertook, some time ago, a survey of the industry in western New York. The work was begun in the summer of

1910 in Chautauqua county. It was later extended into Erie county and into the vicinities of the cities of Rochester and Oswego.

The plan of the survey was to visit personally every grower and obtain as much information about his patch as possible. The surveyor, who was a graduate student at Cornell University, examined the patch in order to determine the type of soil, condition of the plants, and the like. He then obtained from the owner information as to the age, methods of management, yields, and harvesting. In other words, the information gathered may be likened to an accurate history of each patch for four years. In order to convey a more definite idea of the nature of the information, a copy of the blanks used for the work is reproduced:

SMALL FRUIT SURVEY
N. Y. STATE COLLEGE OF AGRICULTURE

Fruit.......... Acres..........
..........county Date..........191...
Owner.......... P. O...........
Location.......... Site..........
Slope.......... Age of plantation..........
Soil, type..........
Drainage: natural or artificial; character..........
Soil management: kind, nature, and frequency..........
....
Preparation of soil..........
Manure: frequency..........quantity..........
Commercial fertilizer, frequency..........quantity..........
Pruning, method..........
Frequency..........character..........
Renewal of plantation..........
Plants used, how obtained..........
Season of planting..........Age when planted..........
Spraying: mixtures..........No. applications..........
Machinery..........Effects..........
Insects..........
Diseases..........
Other troubles..........
Present condition..........

ACRES

	19.....	19.....	19.....	19.....
Yields (total).....				
Price per.....				
Income per acre.....				
Market.....				

Planting plan

Packages used..........Labor..........
Method of picking..........
Variety notes..........
....

Varieties and proportional area { Early.......... Medium.......... Late..........

General observations..........
....

Observer..........

The extent of the work, and of the industry as well, is shown in the following table, which summarizes the surveys:

	Total farms visited	Farms reporting yield	Farms not reporting yield	Acres yield reported	Acres yield not reported	Total acres visited	Acres per grower
Strawberry	125	120	5	285.42	13.00	298.42	2.38
Red raspberry	115	91	24	115.49	27.00	142.49	1.23
Black raspberry	97	71	26	196.67	63.00	259.67	2.67
Purple raspberry	50	35	15	125.00	100.25	225.25	4.50
Blackberry	40	29	11	42.56	19.75	62.31	1.55
Currant	19	19	0	32.33	0.00	32.33	1.70
Gooseberry	6	5	1	2.15	0.25	2.40	0.40
Dewberry	4	4	0	4.75	0.00	4.75	1.19
Black currant	2	2	0	1.62	0.00	1.62	0.81
Total	458	376	82	805.99	223.25	1,029.24	......

Much of the information contained in this bulletin is gathered from the above study of bush fruits. Bulletins relative to the culture of the other bush fruits will be issued.

The field work of this survey was done mostly by A. B. Buchholz, and in part by K. B. Lewis. The writer wishes to express his indebtedness to both these persons, and to Mr. Buchholz in particular.

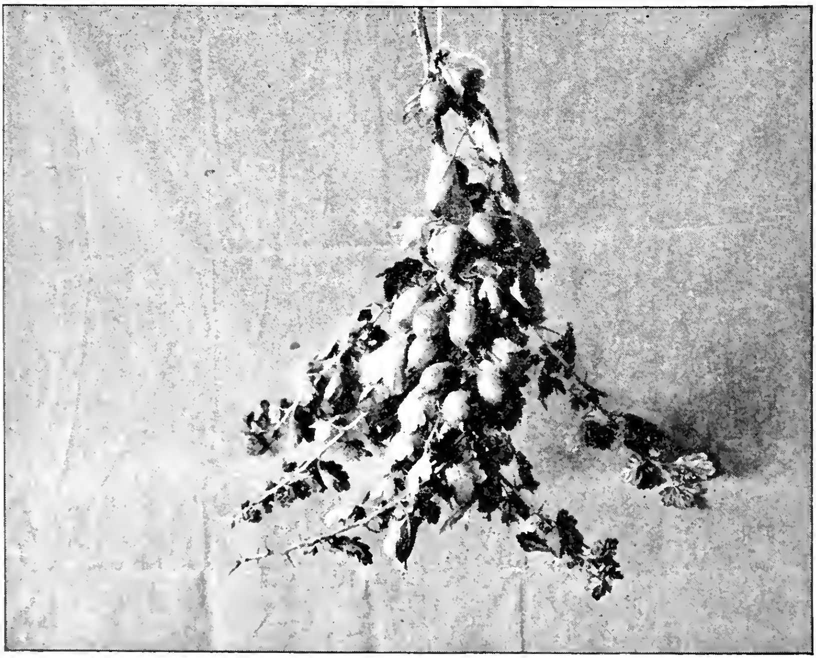


FIG. 248.—*A branch of large fruit*

THE CURRANT

The currant is grown to a less extent commerically than most of the other bush fruits. This may be accounted for in part by the fact that it is seldom eaten fresh. It is used mainly for making jelly, jam, and pies, and for these purposes, especially the first named, it is an excellent fruit. The currant is a staple crop and is usually in good demand at a steady price. The growers who raise it receive good returns and believe that there are even greater opportunities in its commercial culture.

The currant is hardy in its ability to withstand cold and can be grown anywhere in the United States without the least danger of winter injury to wood or bud. It cannot endure the warmer climates, however, and consequently it is not grown to any extent in the Southern States.

A patch should produce six to eight commercial crops, provided it is well cared for; but the growers do not believe that it is economy to keep a patch longer. A new patch is easy to start and the younger plants produce the best crops. As one patch grows old another should be started, which will be in full bearing by the time the older one is removed.

SOIL

In general, any rich soil that is cool and moist will produce good crops of currants. Certain types of soil will probably give better returns than others, although our information on soil preferences is too limited to warrant definite statements. We know, however, that the soil should possess certain characteristics. It should be well drained, but not too heavy; it should be moist and cool, but not wet and cold. In our study of this fruit in western New York the type of soil received some attention. It was thought that the data would give a little indication of the soil preference. The figures are given below. Too great value should not be attached to them, since most of the patches are on the lighter soils and consequently there is no opportunity for comparison between them and the heavier types, and also since the acreage is too small to give an accurate average.

	Farms	Acres	Yields per acre (quarts)	Incomes per acre
Gravel	5	4.22	2,062.3	$137.14
Gravelly loam	6	6.67	2,210.1	125.43
Sandy loam	5	21.91	3,383.9	151.88

The currant does not do its best in intense heat, and therefore a northern and western exposure is preferable. When planting in the garden, the shade of a building or fence may be chosen. The currant does well when planted in the shade of trees, and because of this it may be used to advantage as a filler in the orchard. When so used it should be planted in rows between the rows of trees, and not between the trees in a row.

PROPAGATION

The currant is propagated commercially by means of stem cuttings. The new wood of the previous summer's growth is taken and cut into pieces about eight or ten inches in length. The base should be cut smoothly

FIG. 249.—*A healthy and vigorous currant bush*

just below a bud. The length should be estimated and the top cut obliquely just above a bud. The purpose of cutting with reference to the buds is to avoid stubs, which do not heal readily and which often cause hollow branches. The end of the new growth should be removed, since it contains too many buds that are weak and immature. Better growth results if the top is cut back to a strong bud.

The cuttings are made in the fall, usually during September, and tied into bundles. It is the desire of most nurserymen to hasten the growth of the callus at the base of the cutting. In order to accomplish this, the bundles are buried at once in a warm, well-drained soil, upside down and deep enough so that they are covered two or three inches. This places the base, which is now uppermost, in the most favorable condition for the development of the callus, which at once starts; but the top is too deep in the soil for favorable conditions of growth and does not start. The cuttings may be left where buried until spring, provided they are protected with more dirt or mulch; or, at the approach of cold weather, they may be removed to a cool cellar and kept buried in moist sand over winter.

It is not always necessary to treat the cuttings as mentioned above in order to start the callus. Often the cuttings are made in the fall and placed in moist sand in a cool cellar without being buried previously in the soil; thus treated, the callus is wholly or partially formed by spring. Sometimes the cuttings are not made until spring, in which case they are planted immediately in the nursery row. Good results are obtained even by the latter method, which is, of course, much less trouble. Whether previously callused or not, the cuttings should be planted in the nursery row early in the spring because the currant starts to grow quickly.

When grown from seeds, the currant reproduces itself more nearly true to variety than do most fruits. Because of this fact, and since it does not take a plant long to come into bearing, the currant should be more interesting to the plant breeder than it is. Very little systematic work has been done along this line. The grower who is interested in the development of new varieties will find the currant a promising fruit.

VARIETIES

The preferred varieties are shown in the table below. In the summer of 1910, twenty-one patches were visited in western New York. The figures show on how many farms out of the twenty-one these varieties are grown. The plantings indicate fairly accurately the commercial value of the varieties.

Variety	Number of farms
Fay	15
Wilder	7
Cherry	7
Versaillaise	2
Victoria	2
Red Cross	1
Pomona	1

A similar study was made of the currant in Monroe county during the summer of 1908 and the preference was given to different varieties in the following order:

Variety	Number of farms
Fay	13
Red Cross	3
Cherry	3
Victoria	3
Perfection	2
Wilder	1
Pomona	1

Both of these tables show the preference of the grower. The value of the varieties on the market is also important. Many commission men in the large cities were asked to indicate the most popular varieties from the considerations of the buyer. The Cherry ranked first, with the Fay second. No mention was made of the other varieties. It is probable that the consumer gives very little attention to the particular varieties.

A study of the above figures indicates that reliable varieties for commercial planting are Fay, Wilder, Cherry, Red Cross, Versaillaise, and Perfection. In setting these varieties the grower is taking no risk, as they have stood the test of several years. It is suggested, however, that the grower test also some of the newer varieties that seem particularly adapted to his soil and climate. It is probable that newer varieties, which will prove themselves more valuable for commercial purposes, will in time partially or wholly supplant the older ones.

A brief description of a few reliable varieties may be helpful to the grower in choosing for a particular locality or purpose:

Fay.— Productive. Fruit large; bunches well filled. Quality good. Season medium. Bush spreading. An objectionable character is the drooping habit of the branches.

Wilder.— Productive. Fruit large; bunches long, large, and well filled. Quality above medium. Season medium. Bush vigorous and of upright growth.

Cherry.— Productive in most places. Fruit very large; long, dark red bunches well filled. Quality medium. Season medium. Bush a medium grower.

Red Cross.— Hardy and productive. Fruit medium; light red bunches, short and compact. Season late. Bush spreading, moderately vigorous.

Versaillaise.— Very productive. Fruit medium to large; long, deep scarlet bunches, often not well filled. Bush upright, moderately vigorous.

Perfection.— A comparatively new variety, originated by Charles G. Hooker, Rochester, N. Y. Fruit in large, long clusters.

PLANTING

The currant may be planted in the fall or spring, but fall planting is preferable. The wood of this plant matures quickly, which permits transplanting as early as September. This enables the plant to become well established before the ground freezes. Moreover, the currant starts to grow early in the spring. If the planting is done then, there are usually unavoidable delays that check the growth.

The distance between the rows and the plants in the rows will be influenced somewhat by the method of cultivation. Usually the plants are set in rows six feet apart, with the plants four feet apart in the row. By this method one can cultivate both ways during the first years of the patch. Later, when the plants have grown closer together in the row, the cultivator is run lengthwise only. Some growers prefer to cultivate both ways during the entire life of the patch. If one wishes to do this, it is more convenient to set the rows five feet apart and the plants five feet apart in the row. The practice in western New York is somewhat variable. Most of the growers plant in rows six feet apart, with the plants three to five feet apart in the row. In a few cases only is cultivation both ways continued during the entire life of the patch, in which case the plants are set five feet by five feet.

The ground should be well prepared previous to planting. The rows are marked off, both lengthwise and crosswise. A deep furrow is run one way with the plow. The plants are then set at the intersections and at such a depth that they will be about one inch lower than they were in the nursery row. In planting, care should be taken to spread out the roots and press the dirt firmly about them. It is not necessary to throw back all the dirt by hand. After placing enough to hold the plants the filling can be completed by the plow.

CULTIVATION

The patch should be deeply cultivated and carefully hoed the first year. The growing of cover crops is not generally practiced in New York yet. Without a doubt, however, it would be very beneficial to grow a cover crop of crimson clover, or something else, which gives a good covering in the fall and is easily worked up in the spring. Continue to give the bushes good cultivation each year. Since the root system of this fruit develops near the surface of the soil, it is necessary to cultivate shallowly after a few years.

It is the general practice in New York to plow in the fall or spring, or both. The productive benefit of the plowing, however, unless very shallow, is questionable, since the roots of this plant feed so near the surface that serious injury might result. For this reason, the currant is adapted to mulching, but growers should not practice this system commercially unless an abundance of mulching material is easily obtainable. The system of mulching is recommended when the currant is planted in the garden, where it is often neglected.

FERTILIZATION

Since the currant does best on a rich soil, it naturally follows that this plant responds generously to liberal applications of stable manure, which should be applied in the fall or early spring and thoroughly worked in by the cultivator. In case additional fertilizers seem necessary, an application of potash and phosphoric acid, in the usual form and amounts, may be used. In western New York the patches that were fertilized gave a higher yield and income in 1910 than did those that were not fertilized, as shown by the following table:

	Farms	Acres	Yields per acre (quarts)	Incomes per acre
Manure	9	26.35	2,471.0	$144.23
No fertilizer	7	3.33	2,078.2	134.45

PRUNING

A knowledge of the fruiting habit of the plant is essential to an intelligent understanding of the methods of pruning. Some fruit is borne on the wood of the previous year's growth near the base, and often this fruit is the largest. Wood that is two or three years old gives the most and best fruit. Older branches produce fruit, but the amount is less and the size of the berry smaller. The aim of the pruner, then, should be to remove all branches over three years of age; to thin out the bush in order to admit the sunlight and permit good air circulation; and to head in those branches that make a long and irregular growth.

Beginning when the plants are set, the pruning would be somewhat as described below. The directions are given in detail in a definite form in order to make them most helpful to the reader. Variations will be necessary for different varieties and conditions. The grower must allow for such variations as are needed.

At planting.— (First spring.) The plant should be pruned to a single branch, which is headed back to five or six buds.

Second spring.— Five or six branches are chosen to make the framework of the bush; the others are cut out. If any of these five or six branches have grown too long, they should be headed in so that all are of uniform length.

Third spring.— The plant is thinned out to the desired form and the branches that have grown too long are headed in.

Bearing plants.— All wood over three years old should be removed and the branches thinned out if necessary. Heading-in is not desirable and should not be practiced, except when a branch has made such an abnormally long growth that the balance of the top is destroyed, in which case any branch may be cut back to the length of the others. Low branches that touch the ground should be removed, because they hinder the circulation of air and the berries produced thereon would be dirty. A dead and diseased branch should always be cut out. The pruner should aim to secure an open head, keeping in mind, however, that the weight of the berries will bend the branches somewhat. An open head is helpful in the control of disease, since it insures a freer circulation of air and more sunshine. The pruning is usually done in spring, although it may be done in either autumn or spring.

DISEASES

Only the serious diseases and insect pests of the currant are considered. The description of these diseases and the methods of their control are taken mainly from Bulletin 283 of this station and Bulletin 56 of the Central Experimental Farm, Ottawa, Canada.

Cane blight or wilt

This disease is very destructive in the Hudson Valley. It is caused by a fungus, which kills the bark in places and discolors the wood. The canes die suddenly while loaded with fruit and leaves. No definite line of treatment has been established, but the following is suggested: beginning when the plants are small, the patch should be gone over every summer and all canes showing signs of disease should be cut out and burned.

Leaf spot

This is a fungous disease that is first noticed about midsummer, when small brownish spots appear on the leaves. Sometimes the disease is serious, affecting a large part of the foliage and causing the leaves to fall.

Leaf spot may be controlled by applications of bordeaux 5–5–50, but it is doubtful whether the disease is sufficiently destructive, on the average, to warrant so much expense. If the disease is expected, it is suggested to use bordeaux and arsenate of lead together when spraying for the currant worm. In case it becomes necessary to apply a spray at a time when bordeaux would color the fruit, ammoniacal copper carbonate may be used to advantage.

Currant anthracnose

This disease, which may be mistaken for leaf spot, affects the leaves, leafstalks, young branches, fruit, and fruitstalks. On the leaves it appears during the month of June in the form of small brown spots. Soon the affected leaves turn yellow and fall prematurely to the ground. The fruit may also wither before ripening properly, owing to lack of food or moisture.

Spraying with bordeaux mixture, 5–5–50, is recommended as an aid in controlling this disease. It would be wise, where currant anthracnose is troublesome, to spray the bushes thoroughly before the leaves appear, using lime-sulfur at scale strength. A second spraying should be made with bordeaux when the leaves are unfolding, and successive sprayings at intervals of ten to fourteen days until the fruit is nearly full-grown; there is danger of its being discolored by the spray when ripe. Arsenate of lead should be added to the mixture when the first brood of the currant worm appears. A thorough spraying after the fruit is harvested is desirable.

INSECT PESTS

Currant worm

The currant worm is the most serious of the insect pests. The adult is a four-winged, wasp-like insect, which may be seen flying about the bushes in the early spring. The eggs are deposited along the midribs and on the undersides of the leaves. In a few days the eggs hatch into small, green, black-spotted larvæ, which feed on the leaves, often defoliating the entire bush. A second brood hatches in the early summer.

The application of poisons, such as arsenate of lead or paris green in the usual proportions, is recommended when the worms first appear. In case it is necessary to spray after the fruit is half grown, hellebore should be used.

San José scale

This pest is very prevalent on currant bushes. A dormant spraying of lime-sulfur at winter strength should be used.

HARVESTING

The fruit should be picked when the berries are well colored but still hard and firm. The cautions to observe in harvesting are: (a) to gather the fruit when it is dry; (b) to pick the cluster carefully by means of the stem; and (c) not to bruise the fruit.

The currant is marketed mostly as a fresh fruit. The packages commonly used are the quart or the eight-pound baskets. The former are shipped in crates holding thirty-two quarts. The fruit is sent to a special market or handled by commission men.

YIELDS AND INCOMES

The currant has not been studied sufficiently to obtain accurate figures of the yields and incomes per acre. The estimates given below, however, are the averages of several patches and are indicative of what the grower may expect. Card * states that with good care currants should yield one hundred to one hundred and fifty bushels per acre, with exceptional yields of two hundred and fifty bushels. At the Central Experimental Farm, Ottawa, Canada,† the highest yields averaged at the rate of one hundred and eighty to two hundred bushels per acre. The survey in western New York comprised nineteen patches for 1910 and five for 1909. The following table shows the average yield and income on this area; it also gives the average price that the growers received per quart:

	Farms	Acres	Yields per acre (quarts)	Incomes per acre	Price per quart
1910	19	32	2,330	$145.94	$.0626
1909	5	4	6,000	274.92	.0458

The growers were united in saying that the crop of 1910 was only about one half as large as usual, because of a severe frost when the plants were in bloom.

THE BLACK CURRANT

There are a few patches of black currants in New York State. The fruit does not seem to be very popular, probably because of its peculiar flavor. Professor Budd ‡ states that in the case of the variety Black Naples this peculiar flavor, which is confined to the skin, can be partially or wholly removed by scalding the berries in boiling water. At present the black currant is used mostly for making jam and jelly.

* "Bush Fruits," by F. W. Card, p. 353.
† "Bush Fruits," by W. T. Macoun, Bulletin 56, Central Experimental Farm, Ottawa, Canada, p. 9.
‡ Bulletin 16, Iowa Agricultural Experiment Station, p. 364.

The directions for growing the red currant apply equally well to the black, except that in the case of the red currant the major part of the fruit is borne on two- or three-year wood, while in the case of the black currant it is mostly borne on wood of the previous season's growth. Therefore, for the red currant, prune to retain the two- and three-year wood and for the black currant prune with the object of obtaining one-year wood. The main difference in culture is that the bush of the black currant grows a little higher, and hence the rows and the plants should be farther apart.

There are many varieties of black currants grown on the experiment station grounds and by nurserymen. The more common of these varieties are Black Champion, Crandall, and Lee.

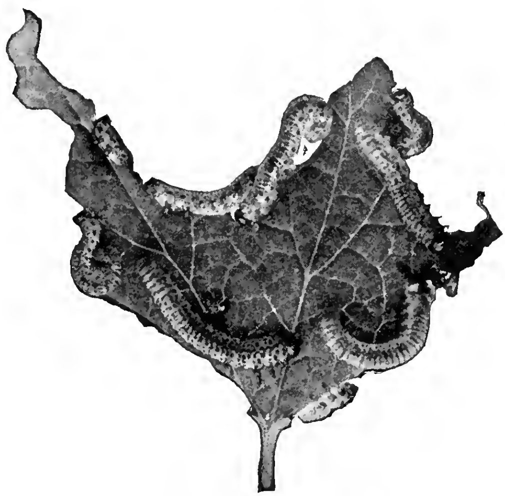


FIG. 250.—*Currant worms*

THE GOOSEBERRY

The gooseberry is a neglected fruit and deserves more of the attention of growers. It has been a favored fruit in England for a long time, probably as early as the sixteenth century; but according to Bailey * the first mention in literature of cultivated varieties in America was in 1849, when Goodrich, writing in the Northern Fruit Culturist, says: "We have it from good authority that native sorts have been discovered both in New Hampshire and Vermont, well adapted to garden culture." The Houghton seedling, which was the first improved variety, was exhibited

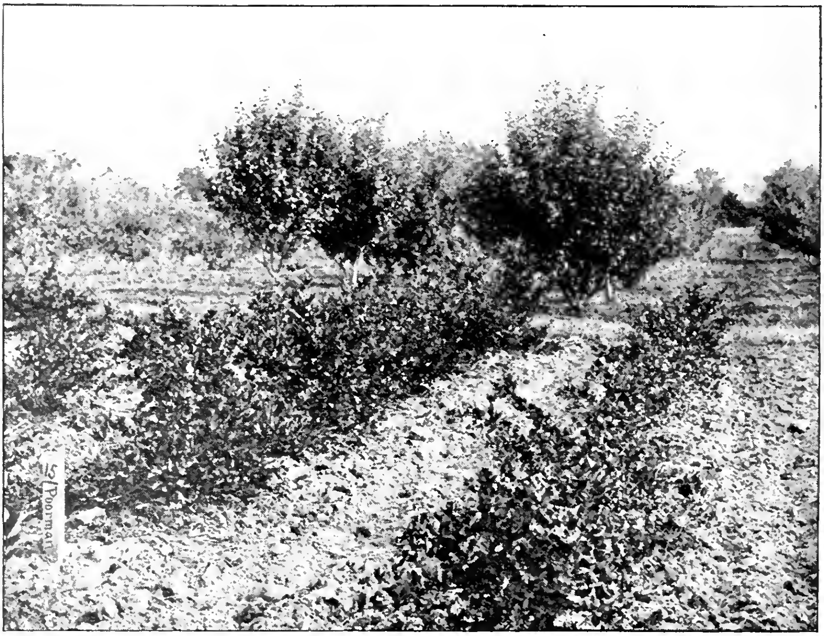


FIG. 251.—*A row of gooseberries; variety, Poorman*

before the Massachusetts Horticultural Society in 1847. Soon after, in 1853, the Downing, a seedling of the Houghton, was introduced. Later our other commercial varieties developed.

The lack of favor that the gooseberry has received may be partially explained, perhaps, by the fact that we use it when green and sour. In this condition it is not at all tempting. If it could be left on the vines until fully ripened, the flavor would be greatly improved. On the other hand, the fact that we do use it hard and green has an advantage. In this condition it is more cheaply handled and will hold up better when shipped.

* "The Evolution of Our Native Fruits," by L. H. Bailey, p. 390.

The gooseberry can endure the coldest climate of our State without the slightest injury. It does not seem to be able to endure extreme heat, however, and consequently the yield is often decreased by severe droughts or scorching summer suns.

The gooseberry produces some fruit the second year after planting, but does not come into full bearing until about the fourth year. After this one can expect about eight commercial crops. The growers believe that it is better economy to dig up the patch after twelve years and set a new one than to continue cropping after this time. In an old patch the cost of production is greater.

SOIL

The heavier soils give the better results, provided they are drained. The rich clay loam, cool and moist, with porous subsoil, is ideal. The gooseberry will do well on the lighter soils, even the sandy loams, although on these types there is more liability to drought. Many of the patches in western New York which are giving good yields are on gravelly loams.

The gooseberry requires an abundance of moisture. As it cannot endure drought, a dry soil should be avoided. It is also a heavy feeder and gives the best results on rich land. Care should be exercised in the choice of soils.

The cool northern exposure is preferable. Since the gooseberry requires an abundance of moisture, it may be planted in the shade of trees or buildings, although it is not so well adapted to these conditions as is the currant.

Preparation

The gooseberry appreciates thorough preparation of the soil. As it is a gross feeder, a heavy application of stable manure should be applied and plowed under before planting. In order to bring the soil into good physical condition, it is advisable to grow a cultivated crop the previous summer. The ground will be in good condition then for fall or spring planting.

PROPAGATION

The common method of propagation for both English and American varieties of gooseberries is mound layering, although the American varieties may be propagated by stem cuttings.

Mound layering

An abundance of new branches should first be secured. This is best done by cutting back the plants severely, that is, heading in the main branches to short stubs, which should be four or six inches in length. It should be done in either fall or spring. A large number of new shoots will grow from these stubs. When these shoots have nearly reached maturity, which is in July, the bush is mound layered. Dirt is thrown up over the plant until it covers the base of the new branches for about one half their length. This dirt should be carefully worked in between the branches and then lightly pressed down. Roots will then grow at the base of the new branches. Later each branch is removed and becomes a separate plant. In the case of the American varieties, roots will have formed so that the stool may be separated by the following spring. The English varieties root less rapidly, and therefore should be left another year before separating. In both cases the plants are usually grown one year in the nursery after separation. They are then ready for sale.

Stem cuttings

Cuttings give satisfactory results for most of the American varieties. This method for the gooseberry is practically the same as is described for the currant. The new growth is taken and made into cuttings about eight to ten inches in length. Preferably these cuttings should be allowed to callus before planting in the spring. In order to secure this callus the cuttings should be taken in the fall and either buried in the ground or kept in a cool, moist cellar in sand over winter. The cuttings are then planted in the spring. It is not always necessary to secure the development of the callus before planting, as good growth has resulted without this treatment. In such case the cuttings can be taken in the spring and planted immediately.

VARIETIES

Our study of the gooseberry in western New York shows that the commercial patches consist mainly of four varieties, the Downing, Pearl, Red Jacket, and Chautauqua. The first three of these are American varieties and the last, the Chautauqua, is an English variety.

The Geneva Agricultural Experiment Station* recommends the following varieties for New York State:

American varieties: Downing, Houghton, Pale Red, Crystal, Champion, and Red Jacket.

English varieties: Industry, Crown Bob, Lancashire Lad, Wellington Glory, Dominion, and Triumph.

The varieties that Professor W. T. Macoun † recommends for Canada are interesting to growers in New York State because these varieties will probably do well here. He suggests:

* "Gooseberries; Best Varieties and How to Grow Them," by S. A. Beach. Geneva Agricultural Experiment Station Bulletin 114.

† "Bush Fruits," by W. T. Macoun. Bulletin 56, Central Experimental Farm, Ottawa, Canada, p. 27.

American varieties: Pearl, Downing, and Red Jacket.

English varieties: Companion, Eagle, Glenton Green, Queen of Trumps, Snowball, Whitesmith, and Industry.

Other varieties are mentioned and described in the various publications on the gooseberry, and offered for sale by nurserymen. It is the purpose of this bulletin, however, to discuss only the more important and commoner varieties and not to confuse the reader by citing a long list. Brief descriptions of a few common commercial varieties follow:

Downing.—Most widely grown variety, very productive; fruit medium in size, soft, juicy; good quality; season medium; strong grower; rarely attacked by mildew.

Pearl.—Closely resembles the Downing; productive; fruit medium, juicy, sweet; quality good; season medium; bush upright grower; rarely attacked by mildew.

Red Jacket.—Productive; fruit larger than the Pearl and Downing; good quality; season medium; bush strong grower; not subject to mildew; a good variety.

Chautauqua.—An English variety, somewhat lacking in productiveness; fruit large, smooth, pale green; of best quality; bush a vigorous grower; generally healthy.

PLANTING AND MANAGEMENT

Since the gooseberry and currant are similar plants in many respects, particularly as to manner of growth, the directions for planting, cultivation, fertilization, and pruning as given for one apply equally well to the other. For directions as to these operations, therefore, the reader is referred to the corresponding subject under the currant.

DISEASES

Gooseberry mildew

A study of the patches in New York State indicates that the mildew is practically the only serious disease with which the growers have to contend. As this disease and the methods of its control are well described by Professor W. T. Macoun,* the writer quotes directly from his description:

" The gooseberry mildew has prevented the general culture of the English gooseberry in America. This disease attacks the leaves, twigs, and fruit. When the attack is bad it destroys the foliage, covers the fruit, and causes most of it to drop. It saps the growing shoots to such an extent that they do not ripen properly, and dry up without setting fruit buds. It thus practically destroys the crop. The disease is ap-

* " Bush Fruits," by W. T. Macoun. Bulletin 56, Central Experimental Farm, Ottawa, Canada, p. 28.

parent early in the season in the web-like covering which coats the leaves, shoots, and fruit. This is the mycelium from which is given off the spores which propagate this disease. It is usually noticed first in the lower and most shaded parts of the bush. When the spores are being given off, the mildew has a powdery appearance. Winter spores are formed later, which germinate in the spring. As the mycelium and spores are both on the surface, it might be thought this disease could be easily controlled, but the weather conditions in this country seem so favorable to the development of spores that the gooseberry mildew spreads with great rapidity, and constant and thorough spraying are necessary to prevent it from doing so. American varieties are seldom affected by gooseberry mildew, although occasionally they are slightly attacked.

* * * * * * * * *

" Potassium sulphide (1 ounce to 2 gallons water) has, on the whole, given the best results at the Experimental Farm, although in some instances the foliage was injured by it. This remedy is recommended by the New York Experiment Station, to whom belongs the credit of discovering it in 1887. Early applications are very important, beginning when the leaf buds are breaking and continuing at intervals of a week to ten days. About five or six sprayings will be necessary, but if the weather is unfavorable more may have to be given. The bushes should be sprayed from beneath as well as from above. The centre of the bush should receive the spray also. In fact, the whole bush should be thoroughly sprayed."

INSECT PESTS

Currant worm

The currant worm is the most serious of the insect pests. The life history of this insect and the methods of controlling it are described for the currant (page 207).

YIELDS AND INCOMES

It is more difficult to calculate accurately the average yield for the gooseberry than for most fruits, since the gooseberry is grown commercially to a limited extent only. The figures vary somewhat and therefore are suggestive rather than conclusive. Bailey* gives the average yield for New York State at one hundred bushels per acre. Probably this is too low. Card† says that the grower can expect three to five hundred bushels per acre. At the Central Experimental Farm, Ottawa,

* "Horticulturist's Rule-Book," by L. H. Bailey, p. 125.
† "Bush Fruits," by F. W. Card, p. 371.

Canada,* the Pearl averaged for five years at the rate of three hundred and ten bushels per acre.

The survey in western New York comprised six small plantations including 2.16 acres in all. The following table shows the average income and price per quart on this small area:

Acres	Yields per acre (quarts)	Income per acre	Price per quart
2.16	2563.72	$117.62	$.0458

These growers, who have tried the gooseberry on a small scale, believe it would be profitable if grown on a larger scale.

The fruit is sold to the canning factories or sent to the local market. The former is a satisfactory method of disposing of the crop, which is usually contracted for before ripening, or even, as is sometimes the case, before the plantation is set. In case the fruit is sent to the open market, it is usually packed in eight-pound grape baskets and handled by commission men.

THE CORNELL READING-COURSE FOR THE FARM

This course provides information on elementary agricultural subjects and on important farm and general rural problems, and is designed to meet the needs of persons who desire to study but are unable to leave their work. The lessons are published monthly and are placed in series dealing with various agricultural problems. Readers enroll for one or more series and are supplied with the first lesson in each. Other available lessons in the series are sent, one at a time, on the return of the discussion papers described below. When all of the available lessons in any series have been studied, the reader is placed on the mailing list to receive the future Reading-Course lessons added to the series in which he is registered. References for advanced study are supplied on request and correspondence is invited. Requests for specific information on agricultural problems are referred to members of the college staff for personal reply.

A supplement containing questions (for this reason called a discussion paper) is inclosed with each Reading-Course lesson to help the reader obtain the most benefit from the lesson and also to give an opportunity for an expression of his opinion. Questions are asked in order to bring

* "Bush Fruits," by W. T. Macoun. Bulletin 56, Central Experimental Farm, Ottawa, Canada, p. 22.

out the more important points and stimulate observation and original thinking, which may result in new plans and improved methods of conducting the usual operations. The answering of these questions is optional, but it is desirable that persons who wish to continue to receive Reading-Course lessons sign and return the discussion paper. Each discussion paper returned will be read over carefully and a personal reply will be made when necessary.

The Cornell Reading-Course for the Farm is an enlargement and revision of the former Reading-Course for Farmers. Following is a list of available back numbers of the former Reading-Course for Farmers (designated as " Old course ") and lessons of the present course (designated as " New course "), arranged by series:

Series		*Lessons*	
Stock feeding....	Old course	7	The computing of balanced rations
		9	Soiling crops, silage, and roots
		10	Pastures and meadows
Dairying.......	Old course	22	The composition of milk and cream, and their by-products
		23	The construction of sanitary dairy stables
	New course	16	Practical dairy problems
Farm crops.....	Old course	9	Soiling crops, silage, and roots
		10	Pastures and meadows
		41	Improving plants by selection or breeding
		42	Improving corn by seed selection
	New course	20	Alfalfa for New York
		24	The rotation of farm crops (In press)
Poultry........	New course	4	Incubation. Part I
		6	Incubation. Part II
		10	Feeding young chickens
The soil........	Old course	37	Drainage and larger crops
	New course	2	The soil: Its use and abuse
Fruit growing...	New course	18	The renewal of the neglected orchard
		22	The culture of the currant and the gooseberry
Rural engineering	New course	8	Knots, hitches, and splices
Farm forestry...	New course	12	The improvement of the woodlot
The horse......	New course	14	Horse breeding to increase the farm income

Residents of New York State may register for one or more of the series named above by addressing the Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, N. Y.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. 1. No. 22 | ITHACA, N. Y. AUGUST 15, 1912 | FRUIT GROWING SERIES No. 2

THE CULTURE OF THE CURRANT AND THE GOOSEBERRY

DISCUSSION PAPER

A discussion paper is inclosed with each Reading-Course lesson in order to help the reader to obtain the greatest benefit from the lesson and to give an opportunity for an expression of his opinion. Questions are asked with a view of bringing out the more important points and of stimulating observation and original thought. The answering of these questions is optional, but *it is desirable that persons who wish to continue to receive Reading-Course lessons sign and return the discussion paper.* This will require two-cent postage, which is the only expense connected with the Reading-Course. Each discussion paper returned will be read over carefully and will not be quoted. Requests for information on agricultural subjects will be given a personal reply.

The discussion paper serves other purposes. New readers should indicate on it the series of Reading-Course lessons in which they are particularly interested, so that lessons already published may be sent them. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. The following series have been projected: THE SOIL, FARM CROPS, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT GROWING, STOCK FEEDING. References for advanced study will be given on request. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested.*

1. How would you start a new currant bush from a plant that you already have growing in the garden?

2. What varieties of currants and gooseberries are grown in your locality?

3. How would you prune the currant and gooseberry bushes in the garden?

4. What insect pests and fungous diseases have you found by experience to be injurious to the currant and gooseberry?

5. When and with what mixtures would you spray currant bushes in order to control the currant worm?

6. When and with what mixture would you spray gooseberry bushes in order to control mildew?

7. How are the currant and gooseberry bushes in your locality cared for as regards cultivation, fertilization, pruning, and spraying?

8. Do you consider the care that the plants now receive in your section sufficient to give the best returns? If not, what modifications would you suggest?

9. Name the small fruits, and varieties of each, which are generally grown in the gardens in your locality.

Name..

Address..

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. 1. No. 24 | ITHACA, N. Y. SEPTEMBER 15, 1912 | FARM CROPS SERIES No. 2

THE ROTATION OF FARM CROPS

EDWARD R. MINNS

The practice of rotating farm crops is many centuries old. The necessity for rotation is not so apparent on new lands as it is where the soil has

FIG. 252.—*Good plowing is important for the successful rotation of farm crops*

been farmed for a generation or longer. In the older civilized countries of the world the benefits derived from a succession of crops have been recognized since the days of Vergil; in our country there are sections where the exploitation of the soil by continuous cropping is yet going on. There are instances of profitable continuous cropping with corn, potatoes, or grass where barnyard manure is available and green manure crops are grown in order to maintain the soil fertility; but the largest part of our farm lands must have a succession, or rotation, of crops, covering a period of two years or more, if their cultivation is to be maintained at a profit.

TEN REASONS FOR ROTATING FARM CROPS

1. Farm crops differ in their requirements of available plant food. If a crop be grown continuously on the same land, the nitrogen or phosphorus or other plant-food elements mainly required by that crop may be used faster than other kinds and the balance between the available plant foods be thus disturbed. Crops produce less in yield and we say the soil is getting poor. A succession of crops that require different quantities of nitrogen, potash, phosphorus, lime, and sulfur will maintain a better balance between the quantities of these plant-food elements in the soil. If we wish to apply manures and fertilizers to help in maintaining this balance, the rotation of crops affords better opportunities for doing it profitably.

2. Farm crops vary in their habits of root growth. Grasses and small grains are rather shallow-rooted plants and feed comparatively near the surface of the soil. Corn, potatoes, and root crops send their roots somewhat deeper and therefore have a larger feeding ground in the soil. Red clover and alfalfa are deep-rooted plants and are able to utilize stores of mineral plant food, such as potash, phosphorus, and lime, which are below the reach of the shallower-rooted crops. When a clover or alfalfa sod is plowed under for the next crop, the roots and crowns decay and give up some of the plant food that they obtained from below to the new and perhaps shallower-rooted crop that succeeds in the rotation.

3. Humus is a very important constituent of soils. The continuous tillage incident to growing successive crops of corn, potatoes, or beans, without returning liberal applications of barnyard manure to the soil, tends to hasten the decay of humus and reduce the amount of it present in the soil. Continuous grass culture on a field may increase the amount of humus-forming material on the surface, but gives little opportunity for mixing into the soil the accumulating leaves, stems, rootstocks, or top dressings of manure. *The rotation of crops where sods, stubble, and barnyard manure are plowed under, tends to keep up the supply of humus in the soil* and thus to conserve the moisture supply and liberate plant food when crops need it.

4. If nitrogen-gathering crops are grown in rotation with others and the entire plants or their residues of root and stem are plowed under to

form humus, *the supply of nitrogen available for other crops in the rotation may be increased.* The clovers, alfalfa, vetches, peas, and beans are able to use free nitrogen from the air through the aid of bacteria living in nodules, or tubercles, on their roots, when their special requirements are fulfilled in the soil. Rotation gives a better opportunity to alternate nitrogen-gathering plants with those that depend on the soil for the nitrogen that they consume.

5. Good physical condition is a valuable asset in soils. Freedom from clods and ability to work well under tillage implements constitute what is called "good tilth" in soils. *A properly managed rotation of crops will keep soils in this desirable condition.*

6. Soils left bare during part of the year tend to grow weeds or to wash away on the slopes. Either a productive crop or one intended as a manure should always occupy the land. By seeding new meadows in ripening grainfields or by sowing winter wheat and rye after the removal of an intertilled summer crop, *the land is kept occupied by the successive crops of the rotation.*

7. Most of our farm crops have enemies in the form of insect pests or plant diseases, or both. These enemies are parasites. Their perpetuation usually depends on the presence of their particular host plants. Many of them are not readily transferred from field to field except on fragments of their hosts. If farm crops follow one another in rotation and sufficient care is taken to plant seeds free from disease, *the crop enemies are starved out for lack of their own host plants and are thus kept in control.* Potato scab and the leaf spot of mangels are plant diseases that crop rotation helps to control.

8. It is thought that some crops during their growth leave in the soil organic substances that are injurious to successive crops of the same kind or to certain other crops that might follow them. By rotating the proper crops, or by making the rotation sufficiently long and properly relating the members in it to one another, *the soil may be freed of such harmful substances and no injury noticed.* This may be the best explanation for the failure of red clover when grown in a continuous cropping scheme, or for the indifferent growth of corn when planted after buckwheat in a rotation.

9. Weeds are a serious pest on many farms. Some kinds of weeds are most troublesome in meadows and pastures but are easily destroyed in plowed fields. Some weeds spread entirely through seed formation; others have rootstocks that multiply and prosper when undisturbed by the plow and cultivator. The alternation of hoed crops with those that form sods or harbor weeds is the only practical remedy for many weed problems. *A good rotation of crops, thoroughly tilled, should keep harmful weeds under control if not exterminate them.*

10. A regular rotation of farm crops makes the farm work systematic. Irregular rotations are better than none at all; but when a definite rotation is established and the cultivated fields on a farm are managed in conformity to this definite plan, labor can be employed more economically than otherwise. "Plan your work and work your plan" is a saying which applies best to farms on which a *systematic definite* rotation of crops is practiced. Of course, a *fixed* rotation will not always be advisable. Where market conditions fluctuate and climate is somewhat variable, there should be some choice in one or more courses of a rotation. It may be better, for example, to refrain from plowing up a good meadow

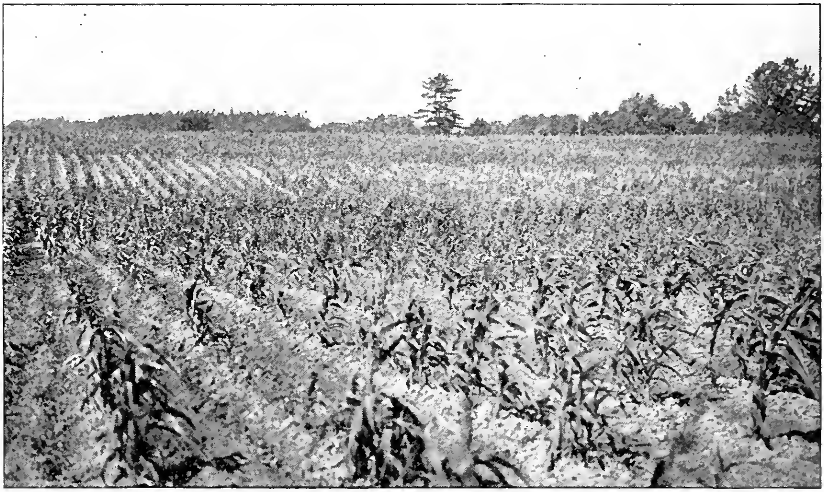


FIG. 253.—*The third consecutive corn crop grown on this field. The first and second corn crops were fairly good, but the soil is poorly adapted to continuous corn culture*

for a late-planted corn crop in a season when hay is selling for a high price and corn planting has been deferred by cold wet weather.

ROTATION AXIOMS

1. Every rotation should be adapted to the soil on which it is grown, to the prevailing climate, and to the purpose for which crops are grown. Some soil types are more easily managed than others and the planning of a suitable rotation may be a simple or a difficult task. Climatic conditions cannot be controlled, but weather emergencies can be anticipated and deprived of their worst discouragement by a flexible, though definite, rotation of crops. The needs of farm live stock for feed and bedding, the market price of purchased feeds, and the opportunity for profitable

sales of farm products, are to be reckoned with in deciding what may be a suitable rotation of crops for each farm.

2. Every rotation of crops should be profitable. Not all the courses in a rotation need necessarily return net profits. One course in a rotation may be grown at a loss when considered by itself, and yet contribute to the success of the other courses. If possible, every course in a crop rotation should pay its own way or make a profit without lessening the chances for success with succeeding courses; but the *success of a rotation* should be measured by the *amount of net profit derived from it and by its effects on the maintenance of soil fertility.*

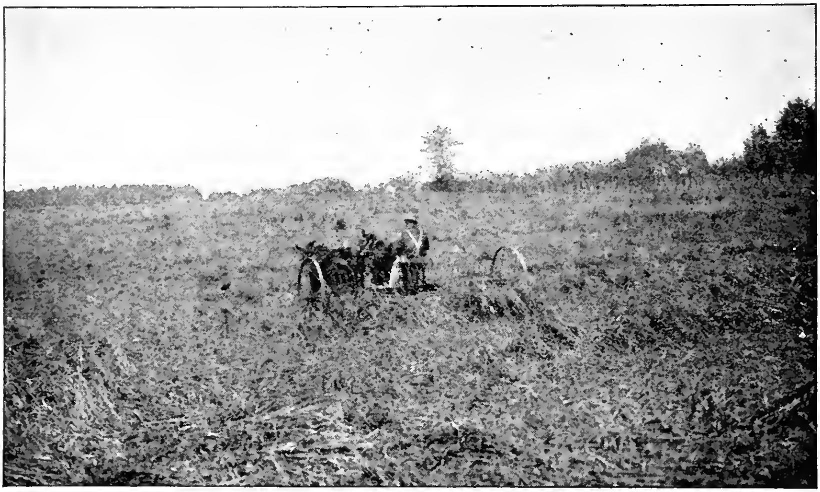


FIG. 254.—*The oat crop that followed the poor crop of corn (Fig. 253) was so heavy that it lodged badly and was cut for hay. The yield was four tons of hay per acre. The rotation of crops is necessary on this field*

3. The use of barnyard manure and the application of commercial fertilizers to farm crops in rotations should be such as to give the largest net results. The crops to which it is most profitable to apply manures or fertilizers should be determined by fair trials and the practice of manuring or fertilizing should be based on this knowledge, rather than on mere convenience.

SOME EXAMPLES OF CROP ROTATION

It would not be consistent, in a short lesson such as this, to try to enumerate all the well-known or possible rotations of crops for this State. A few examples of crop rotations of various lengths and suitable to various conditions will serve to show how rotations are carried out in good practice. The merits and faults of each will be pointed out.

A two-years rotation for a potato farm

1. Potatoes, harvested in time to sow winter rye
2. Rye, seeded with red clover to be plowed under for potatoes

This rotation is practical on land that is in condition to grow red clover. Should the clover fail, a coat of barnyard manure might be substituted. A crop is harvested every year and the field must be plowed every two years. There is some danger that a crop of potatoes every other year may promote the growth of potato diseases in the soil and decrease the profits from the potatoes. A safer rotation would cover three years and be more flexible.

FIG. 255.—*This corn crop was grown on the same kind of soil and in the same year as the crop shown in Fig. 253. The previous crop was clover hay. This makes an ideal preparation for corn-growing*

A three-years rotation for a potato and dairy farm

1. Potatoes
2. Winter rye or oats, seeded with clovers
3. Clover hay, followed by manure and a rye cover crop to be plowed under green for potatoes

This rotation furnishes a cash crop, and feed and bedding for dairy cattle. If the potato harvest is too late for rye to start afterward, oats may be sown early the following spring. A mixture of alsike and red clovers may be used if red clover alone is uncertain. After the first cutting of hay is made the clover sod should be manured and plowed in time for seeding with rye in August, so that the rye will make a good start before winter and the manure and sod will be partly decayed before plowing for potatoes the following spring. This is ideal preparation for the potato crop. With the aid of some commercial fertilizers, maximum crops should be grown. This rotation is well adapted where wheat is an uncertain crop and potatoes are depended on for a cash income.

A four-years rotation for a potato and bean farm

1. Potatoes, followed by rye cover crop and manure
2. Beans, removed in time to sow winter wheat without plowing
3. Wheat, seeded with clovers

FIG. 256.—*A very heavy crop of oats and peas followed the corn crop shown in Fig. 255. The rotation used on this field has been very successful*

4. Clover hay, sod to be plowed for potatoes the following spring

This rotation produces three cash crops in four years and requires plowing twice. Although rye, manure, and clover sod are plowed under, the drain on soil fertility from removing wheat, beans, and potatoes will make the judicious use of commercial fertilizers profitable. The bean crop gets the first benefit of the application of manure. If the potato crop needs it more than the beans do, it may be applied on the clover sod soon after the hay is cut. The latter will involve some waste, as the manure will usually have to accumulate during a season of the year when losses in the manure pile are heaviest. The clean cultivation of a potato and a bean crop should free the land of many weeds.

A five-years rotation for a stock farm

1. Corn, on freshly plowed sod, and rye sown between the rows in August
2. Corn, well manured on rye plowed under. Plow the stubble in autumn
3. Oats, or oats and Canada field peas. Plow stubble for winter wheat
4. Wheat, seeded with timothy in autumn and with clovers the following spring. Top-dressed with manure after harvesting the wheat
5. Mixed hay

This rotation is now in use on the Cornell University farms. It is designed to produce enough silage corn to feed a large herd of cattle, from soil better adapted to growing oats and timothy. It is a flexible rotation, in that the first year of corn can be omitted and the meadow allowed to produce a second crop of hay. This is an advantage whenever hay is more desirable than corn fodder.

On soils in which sods decay rather slowly, the second corn crop may be better than the first one. Two coats of manure are applied, two green crops are plowed under, and the land is plowed four times in five years, if no change is made in the succession of crops. When fresh manure is applied as a light top-dressing to new meadows, the maximum benefit from its use is most likely to follow. This rotation is best adapted to an intensive type of farming.

A five-years rotation involving less labor and seeding is as follows:

A five-years rotation for a hay farm

1. Corn or potatoes, on manured sod
2. Oats or barley, seeded with clover and timothy
3. Mixed hay
4. Timothy hay, top-dressed with manure
5. Timothy hay, manured or fertilized

This rotation is best adapted to the heavier types of loam soil. It has one intertilled crop, requires two plowings, and will profit by light top-dressings of manure on the meadows. If oats are used to seed down for the meadow, there is more risk of losing the new seeding in dry weather than with barley. Either using a thin seeding of oats, or else cutting them for hay before ripe, should be the rule. A fair crop of potatoes can be grown, and the proportion of potatoes to corn can be varied to suit the convenience of the farmer. In this rotation the hay crops are the most important because of the cash income derived from them. The aim should be, so to feed the meadows that the maximum usefulness will be reached in the third year. On many farms a rotation similar to this one is practiced. It is lengthened by taking four or five successive hay crops from the same fields.

In the alfalfa-growing regions a suitable rotation must be as long as six or seven years. Alfalfa being a perennial plant and requiring two or three years to become well established, it is not desirable to plow this crop under very frequently. If plowed down at the end of five years a fine crop of corn can usually be produced. In many fields there will be some parts where the alfalfa plants have died out because of unfavorable conditions. Rotation with other crops furnishes the right opportunity for reseeding successfully.

A seven-years rotation for an alfalfa and stock farm

1. Corn, well manured
2. Oats or barley, with alfalfa seeding

3 to 7. Alfalfa hay, with manure top-dressings after the second year

Objection will be made to the difficulty of plowing under alfalfa sod five years of age. It is a real difficulty, but it is outweighed by the better stand of alfalfa obtained on reseeding and the fine corn crops on alfalfa sod. Thin seedings of oats and barley are best in this rotation.

A rotation without intertilled crops

Where buckwheat is grown it may follow an early crop of peas the same year, or a crop of clover hay. On soils that are not dry enough for early tillage, buckwheat may be planted on sod to which manure has been applied. The propensity of buckwheat to smother weeds and render soil mellow makes it a fair substitute for an intertilled crop such as corn or potatoes. For sections in the hilly counties where corn does not thrive, the following rotation can be practiced:

1. Buckwheat, manured
2. Oats or barley, seeded with timothy and clover
3. Mixed hay
4. Mixed hay
5. Hay or pasture

DIVISION OF FIELDS FOR ROTATION

In a systematic rotation of crops the most nearly uniform results will always be obtained by dividing the land into as many nearly equal parts as there are courses in the rotation. If there are more fields or less fields to be used than there are courses in the rotation, then large ones may be divided and small ones combined for rotation purposes. About the same number of acres should be provided each year for each course. It should be remembered that seasonal conditions may make more difference than small variations in the acreage, in the production of a given crop in the rotation. The land under rotation should be mapped, and records kept to show the production from each tract under rotation, so that changes in the rotation may be made intelligently when necessary.

FIG. 257.—*A short rotation helps to control daisies and other weeds*

THE CORNELL READING-COURSE FOR THE FARM

ADVANCED READING

To the Reader:

The reading-course lessons are designed merely to introduce the subject; they are elementary and brief, and are intended to arouse a desire for fuller knowledge along particular lines. The study of reading-course lessons should be introductory to the study of standard agricultural books and of the bulletins of the United States Department of Agriculture and the state experiment stations. The Supervisor of the Reading-Course will suggest, as far as possible, agricultural literature to meet the needs of any reader. We do not wish to recommend particular books or bulletins as superior to others on the same subject, but will suggest those we believe will be of special interest to the reader in his particular study.

Below is a list of books and bulletins dealing with the culture of crops mentioned in this lesson. Rotations are frequently mentioned in discussing the culture of single farm crops. Some of these books and bulletins contain pages or chapters on crop rotations.

Agriculture, Vol. II. William P. Brooks. King-Richardson Company, Springfield, Mass. $1.25.

First Principles of Soil Fertility. Alfred Vivian. Orange Judd Company, New York City. $1.

The Cereals in America. Thomas Hunt. Orange Judd Company. $1.75.

Farm Grasses in the United States. W. J. Spillman. Orange Judd Company. $1.

Clovers and How to Grow Them. Thomas Shaw. Orange Judd Company. $1.

The Book of Wheat. P. T. Donlinger. Orange Judd Company. $2.

The Book of Alfalfa. F. D. Colburn. Orange Judd Company. $2.

Corn. Bowman and Crossley. Published by the Authors, Ames, Iowa. $2.

The Potato. Samuel Fraser. Orange Judd Company. 75 cents.

Bean Culture. Glenn C. Sevey. Orange Judd Company. 50 cents.

Forage Crops. Edward B. Voorhees. The Macmillan Company, New York City. $1.66.

Farmers' Bulletins:

101. Millets.
224. Canadian Field Peas.
289. Beans.
339. Alfalfa.
361. Meadow Fescue: Its Culture and Uses.
372. Soy Beans.
402. Canada Blue Grass: Its Culture and Uses.
414. Corn Culture.
424. Oats: Growing the Crop.
433. Cabbage.
443. Barley: Growing the Crop.
455. Red Clover.

Farmers' Bulletins are distributed free on application to the Secretary of Agriculture, Washington, D. C., or to local Senators and Representatives in Congress.

READING-COURSE CLUBS

The study of the reading-course lessons may be pursued to advantage by groups of farmers and their families by means of informal organizations known as reading-course clubs. Where these clubs have been tried an interest in improved agriculture has been aroused and social intercourse increased. These organizations have also brought to light valuable local experience and have stimulated individual thought and self-expression. The Cornell Reading-Course Lessons are used in these clubs for the preparation of programs. One person is generally asked to be responsible for the success of each meeting, which is made possible by a careful study of the lesson. Lessons are distributed to the various members of the club so that they may be prepared to take part in the general discussion, which occupies a part of each program. Music and social features add to the enjoyment of the meetings.

The meetings of reading-course clubs have usually been most successful during the fall and winter, but the interest manifested in reading-course lessons this year suggests that they may well be continued through the summer. Meetings generally take place every two weeks during the fall and winter; if it is not advisable to meet so often in the spring and summer, monthly meetings are suggested. These will keep the organization in good condition for meetings every two weeks later in the year. The College will cooperate with interested persons, in any locality, in the formation of a reading-course club.

In some communities organizations exist with which the College of Agriculture will cooperate in conducting educational work by means of the reading-courses. Granges, churches, schools, and agricultural organizations are invited to make use of reading-course lessons and Cornell University agricultural experiment station bulletins. The following three ways are suggested in which these may prove valuable to a reading-course club or other organization:

1. For study by the entire membership previous to a general discussion at a regular meeting.

2. By speakers in preparing for a program at a regular meeting.

3. For reference. A set of available lessons and bulletins may be obtained for the library of any grange or recognized agricultural organization.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. 1. No. 24 | ITHACA, N. Y. SEPTEMBER 15, 1912 | FARM CROPS SERIES No. 2

THE ROTATION OF FARM CROPS

DISCUSSION PAPER

A discussion paper is enclosed with each Reading-Course lesson in order to help the reader to obtain the greatest benefit from the lesson and to give an opportunity for an expression of his opinion. Questions are asked with a view of bringing out the more important points and of stimulating observation and original thought. The answering of these questions is optional, but *it is desirable that persons who wish to continue to receive Reading-Course lessons sign and return the discussion paper.* This will require two-cent postage, which is the only expense connected with the Reading-Course. Each discussion paper returned will be read over carefully and will not be quoted. Requests for information on agricultural subjects will be given a personal reply.

The discussion paper serves other purposes. New readers should indicate on it the series of Reading-Course lessons in which they are particularly interested, so that lessons already published may be sent them. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. The following series have been projected: THE SOIL, FARM CROPS, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT GROWING, STOCK FEEDING. References for advanced study will be given on request. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested.*

1. Do you practice a definite rotation of crops?

2. Give the rotation of crops, if any, which is the best adapted to your farm.

3. In your opinion, what is the best reason for rotating farm crops?

4. What weeds does your rotation help you to control?

5. For which crop in your rotation does it pay best to apply commercial fertilizers?

6. To what crops grown in rotation do you prefer to apply barnyard manure? Why?

7. What objections, if any, do you have against rotations two or three years in length?

8. Have you found clovers profitable or unprofitable in a rotation? Why?

9. Have you ever rotated alfalfa with other farm crops? What is your opinion of it?

10. What are your special problems in connection with the rotation of crops, concerning which you would like some help?

Name...

Address.......................................

INDEX

G

H

L

M

N

O

P

T