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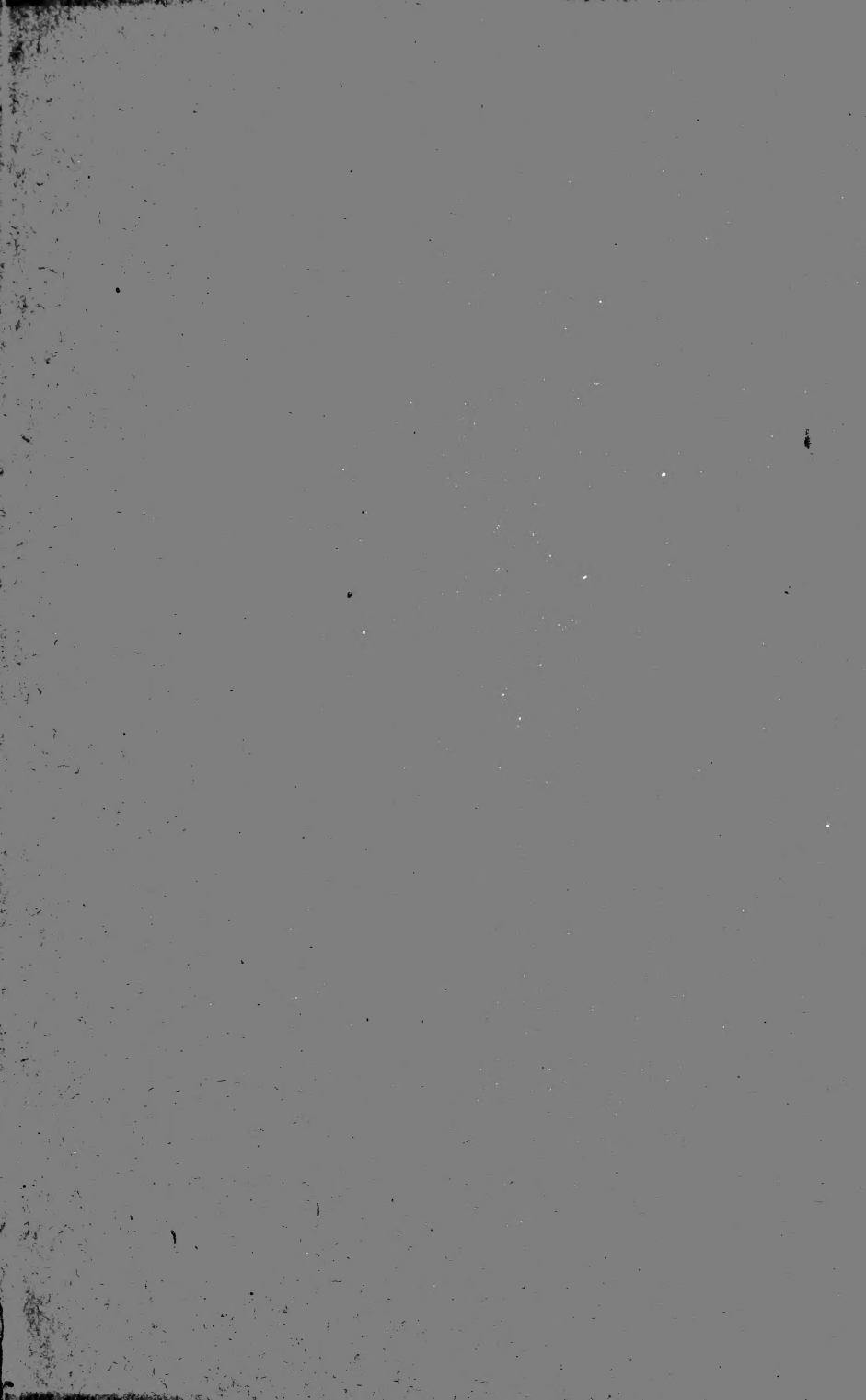


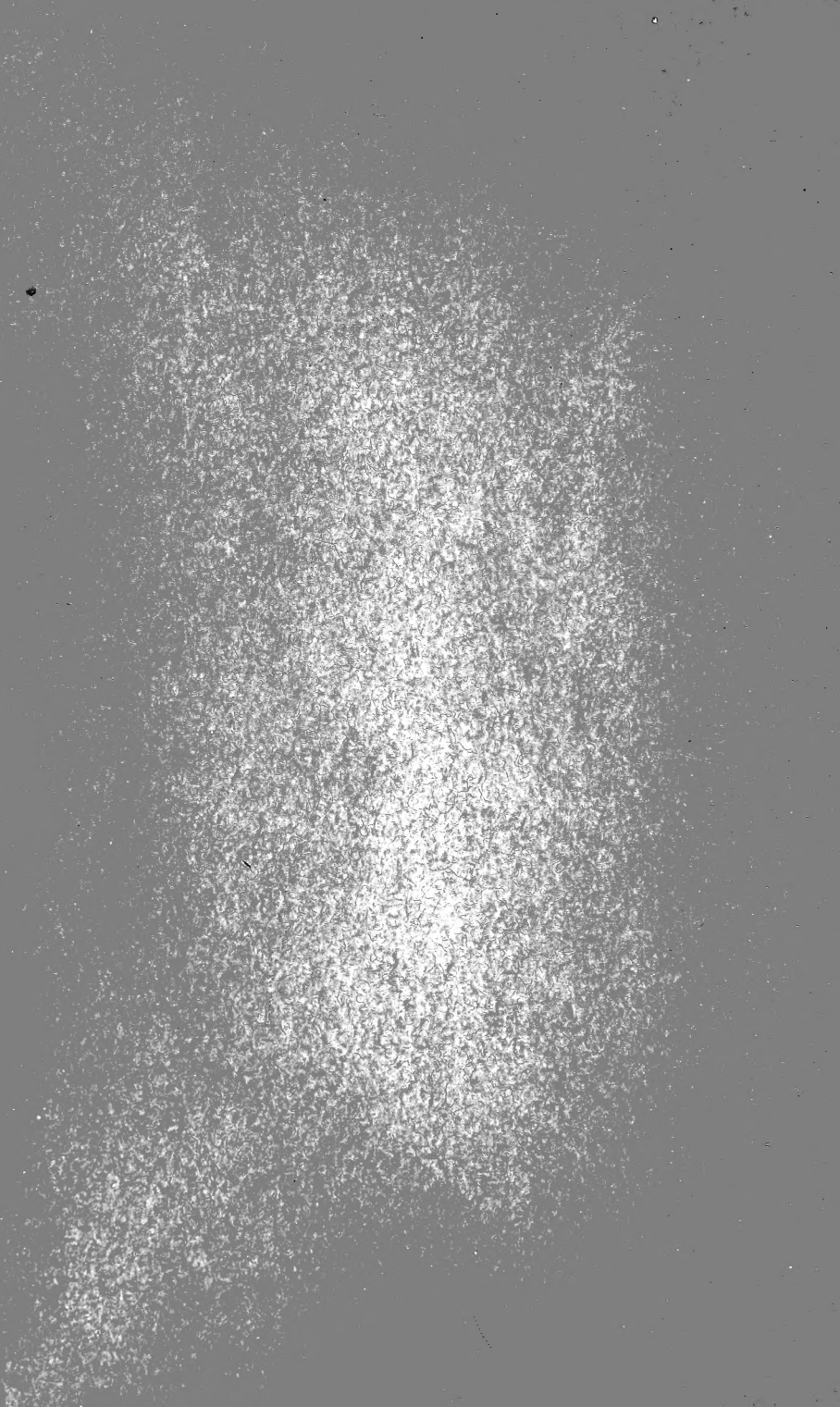
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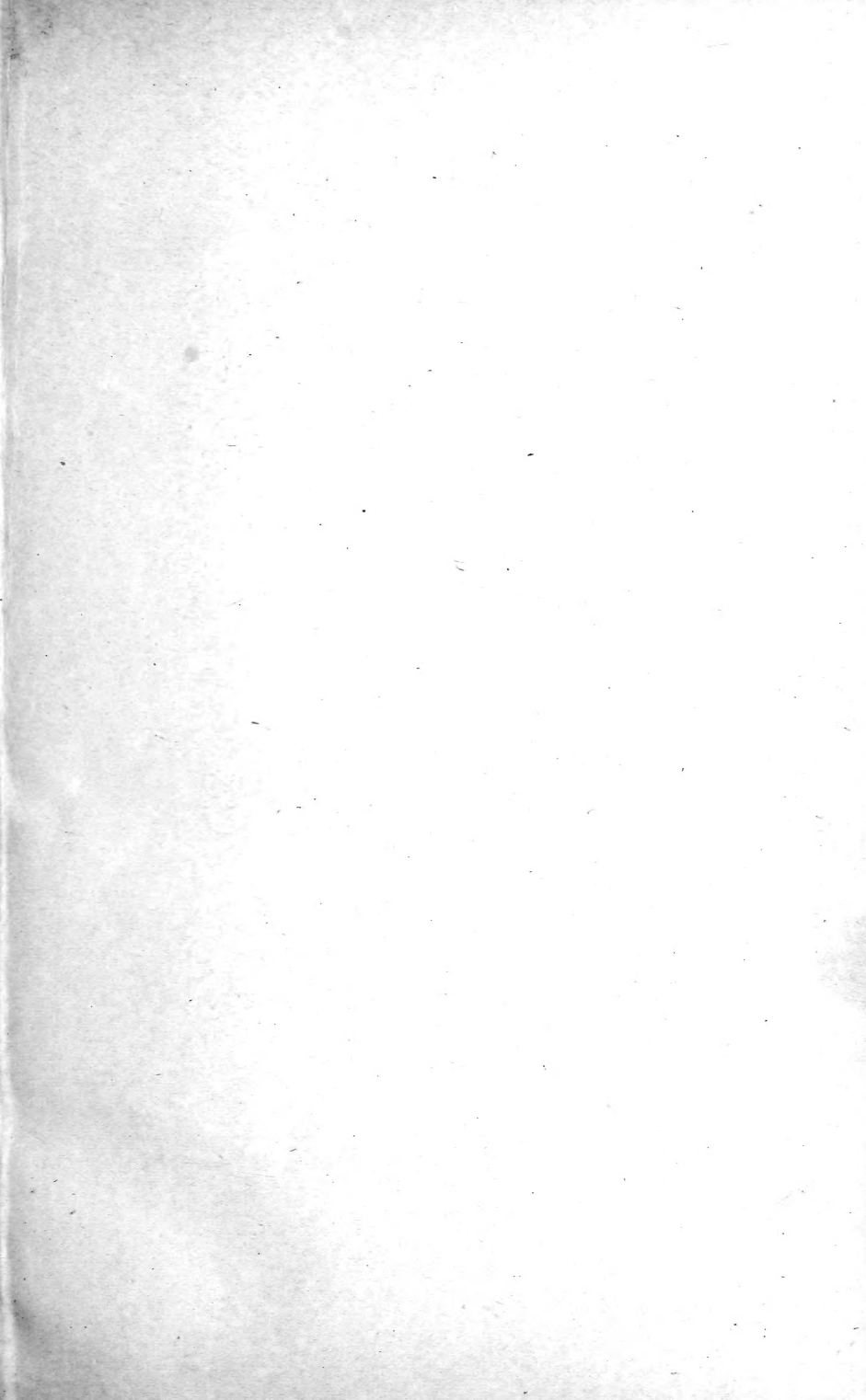




















# THE STUDY OF HORTICULTURE.

BY J. C. BLAIR,

Professor of Pomology and Chief in Horticulture, University of Illinois.

ISSUED MONTHLY.

25 CENTS A YEAR.

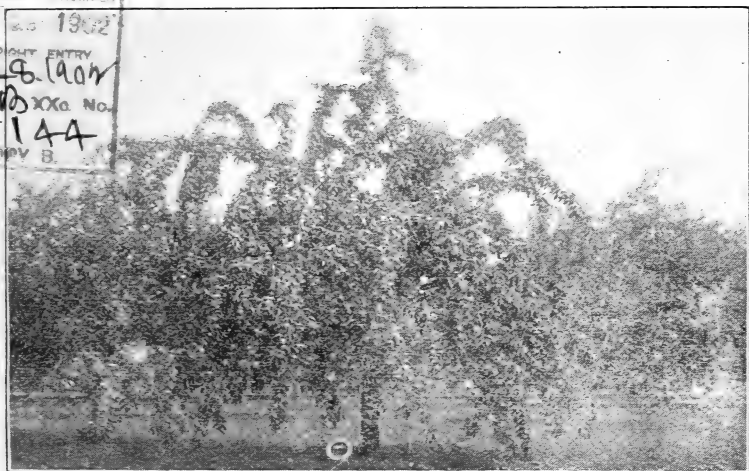
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NEW SERIES, No. 13.

WHOLE No. 25.

TAYLORVILLE, ILLINOIS, SEPTEMBER, 1902.



*Dominie Apple Tree.*

“There was practically only one general horticultural commodity a hundred years ago and that was the apple.”

—*Cyclopedia of American Horticulture.*

## INTRODUCTION.

The city with its noisy streets and many storied buildings has always seemed to the country boy or girl a fascinating place in which to live, while city children flock to the parks and try to picture what it must be to live in such a beautiful place all the time, for to the city child the country is just a great park. Almost all of us have

this unfortunate habit of being dissatisfied with our surroundings, and it is one of the best signs of our times that the children of the farm homes are learning to see the things that make farm life what it should always be—the ideal life, because it is the very nearest to Nature herself. In the country one has but to step out of doors to watch mother Nature rearing her children. Here in the hedge is the thrush's nest, and there a chipmunk slips out from a fallen tree and pops up on his hind feet to watch us. All about are the little vines and plants and bushes which Nature looks after through the entire year—never forgetting to send them the sunshine and rain in summer, or the warm blankets of snow or leaves for their wintry beds. In Nature's garden are all these growing things and none can learn their secrets more easily than the country children. Here in these natural gardens of meadow and forest, roadside and river bank, are learned the mysteries and the beauty of outdoor life. An immense storehouse of unexplored treasures lies in the very farm which we have sometimes wished might be changed into busy city streets with "something going on" aside from the eternal quietness of growing vegetation.

Turning from the wild places where Nature gardens for herself, to the farms all about us, we find that not all those who live on farms engage in the same pursuits for earning a living. They may all be *farmers* in the broad sense of the term—but one is a stockgrower, another raises corn and other grains, while still another devotes his energy to growing fruit or vegetables—or both. Of the latter you will hear it said that he is a horticulturist. Now this series of lessons is to treat of horticulture, and you will probably wonder if anything with so long a name can possibly be made interesting.

## WHAT HORTICULTURE IS.

Let us first learn exactly what is meant by the word “horticulture”, and we can then decide whether or not it is likely to prove an interesting study. Now if you will take your dictionary and look up the word “horticulture”, you will find that it is derived from the two Latin words “*hortus*” and “*cultura*”. The dictionary will also tell you that the meaning of these two Latin words is—“*hortus*”—a garden, and “*cultura*”—culture. Here we have it exactly—and easily—“garden culture”. But just here we must be careful, for in these days we have narrowed down the word garden to mean a little place where we may grow a few vegetables or flowers—and after that—lots of weeds. Now where the old Romans used the word “*hortus*” they meant an enclosed place, and so with the German word “*garten*”, and this enclosure might be of any size up to the limit of the farmer’s possessions. Within this enclosure were grown fruits, flowers, vegetables, and trees for useful or ornamental purposes. So the growing of all these things is what is meant by the term horticulture. If a man undertakes to grow grapes as the means of earning a living he has taken up that branch of horticulture called *viticulture* or vine culture; if he grows apples, pears, quinces, plums, cherries, nut fruits, oranges, or lemons—or the small fruits—such as strawberries—he has followed that branch of horticulture called *pomology*. The culture of vegetables is a division of horticulture known as *olericulture*, and is of increasing importance in the United States. In many sections of Illinois hundreds of acres are yearly planted to rhubarb, melons, asparagus, and tomatoes; these are shipped in many hundreds of carloads to the people of the cities. So you see the tables of city homes far away are provided with vegetables per-

haps grown quite near your home. The most beautiful, if not the most interesting divisions of this great field of horticulture are floriculture and landscape horticulture. By *floriculture* is meant flower growing, either for the home or for the purpose of supplying city markets with potted plants and cut flowers, which are in great demand in all large cities, especially during the winter. *Landscape horticulture* is the growing of ornamental trees, shrubs, and other plants for the purpose of adding beauty to city and country home grounds and to public parks, etc. Landscape gardening, which is often considered a part of horticulture, is really one of those arts which we term *fine arts*, such as painting, sculpturing, etc. It is the arranging of plants and other objects of beauty in any outdoor space in such a way that the result may be a pleasing picture.

Now in all this growing of fruit, flowers, and vegetables, do you not think we can find something to interest and instruct us? There ought to be a great deal. We have studied physiology in order to understand the development of the human body—our physical make-up. We have studied botany and know quite a little about plants and their parts and habits. We need to know something of zoology too, if we are to adjust ourselves properly to the world about us. But between plant life and human life there is a connecting link which we miss if we study only botany and physiology. In studying botany we learn the various parts of the wild flowers and where they may be found and who their relatives are. Why not add to this something still more important, a knowledge of the proper growth and care of those fruits and vegetables upon which we are largely dependent for our healthy development?

We are not taking up this work with the hope that it will make horticulturists of us. You do not expect to be a physician or a nurse because you prepare your physiology lesson daily. Our studies, if wisely selected, teach us how to live. In order to know how to live so that we can do the most good to the greatest number we must be in touch with the animal and plant life about us. So whether or not we ever expect to live on a farm or grow fruits and vegetables, it will be well to know something of that industry which is furnishing a means of livelihood to an increasing number of our fellowmen each year. Then, too, there is something of still greater importance than food-supplying and money-making in horticultural work, and this is too often forgotten. Who can measure the good we receive from an interest in the things of nature, from outdoor exercise, and companionship with trees and flowers? Do you remember that Longfellow said in one of his beautiful poems:—

“Go out under the open sky  
And list to Nature’s teaching!”

We will greatly increase our happiness and our store of health and wisdom if we follow this advice.

If you have read the quotation on the first page of this leaflet, you may rightly guess that horticulture a hundred years ago, had not become the great life work of thousands of busy people. People in those days grew what fruit they wanted or went without it. Apples were practically the only fruit that could be found in the market, and these probably only found their way there because the farmer’s trees had produced more than he cared to make into cider. How interesting it would be to trace the history of the growth of horticulture considered merely

as a business; then how much more so to find what has been written about it during the past hundred years, and how the new varieties of fruit have come into existence, and then pushed their way into market. But to follow all this would take more time than your other studies will allow. For example in 1817 one hundred varieties of apples were grown in this country. In 1892 the number of varieties had swelled to more than two thousand.



*Strawberry Picking in Southern Illinois.*

So you see we cannot hope to do more than go by leaps and bounds over the field which horticulture covers in all its divisions.

Fifty years ago there were no large fields of strawberries to be found in the United States. To-day there are hundreds of acres of this fruit in Illinois alone. The



above photograph was taken in the fields of George W. Endicott at Villa Ridge, Illinois.

Horticulture.....	Pomology.....	{ Orchard fruits. Small fruits. Herb-like fruits. Grapes.
	Olericulture.....	{ Kitchen or home gardening. Market or commercial garden- ing. Gardening under glass or vege- table forcing.
	Floriculture.....	{ Amateur flower growing. Commercial flower growing.
	Landscape Horticulture.....	{ The growing of ornamental trees, shrubs, and other plants for the purpose of adorning public or private grounds.

#### THINGS TO DO.

1. Count the seeds in each grape of a cluster. Does the number vary?

2. Find out how many varieties of grapes are grown in your neighborhood, or shown in your local market.

3. Compare a grape and apple leaf and write a description of each.

4. Make a drawing of each, showing the veining.

5. Tell how many trees a fruit grower can plant in an acre if the trees are set thirty-five feet apart?

"The district school cannot teach agriculture any more than it can teach law or engineering or any other profession or trade, but it can interest the child in nature and in rural problems and thereby fasten its sympathies to the country."—*L. H. Bailey*.

"The soil, cultivated plants, domestic animals, are not simple and elementary things, easy to be apprehended

and comprehended. If we are to know them in any accurate sense, we must see straight and clear and long."—*Dr. A. C. True.*

"Horticulture is the growing of flowers, fruits, and vegetables, and of plants for ornament and fancy.—*Cyclopedia of American Horticulture.*

Some books worth buying for the school or home library. Each month one or more books will be suggested:

- Garden Making, L. H. Bailey, \$1.00, Macmillan Co., N. Y.  
 The Amateur's Practical Garden Book, C. E. Hunn and L. H. Bailey, \$1.00.  
 Lessons With Plants, L. H. Bailey, \$1.10.  
 First Lessons With Plants, L. H. Bailey, \$.40.

## Davenport's Study of Farm Animals.

This series consists of 12 eight-page leaflets which treat of the origin, nature and habits of the common farm animals. They are intensely interesting and of great practical value.

These leaflets were prepared especially for school reading, and may be used in all grades above the third. Their use will bring pupils into close touch and sympathy with our domestic animals, and at the same time give them a high regard for the blessings of mankind.

Price, only one cent a copy in quantities of ten or more, alike or assorted as desired. Sample set of the 12 numbers only 10 cents postpaid.

## Shamel's Study of Farm Crops.

These leaflets were written especially for school reading and study to meet the growing demand for instruction in the essentials of agriculture.

The boy who reads these leaflets will use his mind as well as his body when doing the work on the farm. He will have a keen interest in the germinating seed and the growing plant. The simple experiments and suggestive questions will set him to investigating in a manner that will be both pleasant and profitable.

There are 12 eight-page leaflets in the series. Price, only one cent a copy in quantities of ten or more, alike or assorted as desired. Sample set of the 12 numbers only 10 cents postpaid.

**C. M. PARKER, Publisher,**  
**Taylorville, Illinois.**

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THIRD SERIES, No. 2.

WHOLE No. 26.

TAYLORVILLE, ILLINOIS, OCTOBER, 1902.

## WHERE AND HOW PLANTS FEED.



*The waves at work grinding up the rocks into sand.*

This picture was taken on the shore of Lake Michigan and it shows how the waves are constantly rolling the stones about and grinding them up. This same thing is done by all rivers and bodies of moving water.

### WHERE PLANTS FEED.

In the first lesson we said that the effect of good food is readily seen and the stock farmer never forgets this. When he has stock to fatten he does not turn the animals

into a bare pasture. They must have food containing fattening properties; they must have plenty of water and must suffer neither from cold nor heat.

These same things must be done for the plants of the field and the trees of the orchards if they are to produce good crops for the harvest. Every farmer knows what grains will fatten his stock and day by day he can judge of the quality and measure the quantity at feeding time; but the food that plants like and thrive upon he cannot see and so he often forgets that they need anything more than just a place to send their roots into—that is to say—a place to hold onto. Then no matter what the weather has been he blames it when the crops are poor and forgets that while these same crops were getting ready for the harvest he gave them nothing to eat. Yet plants are just as hungry as growing boys and can eat almost as much. The food that the farmer feeds his cattle is taken from the corn-crib, granary, or haymow, but plant food is hidden away in that wonderful store-house of plant food—the soil. But this food is not always stored away in a form which the plants can use and sometimes there is none at all where it is most needed. This is the reason why thinking farmers are studying the soil to find out all its hiding places for plant food and learning how to get at this food as the plants need it. The study of the soil goes so deep into the mysteries of the formation of this earth that men who have studied it all their lives still feel that they know little about it after all.

#### WHAT THE SOIL IS.

Can you believe that it is really rock dust? Take up a handful of the soil and examine it. It scarcely seems possible that this powdery material was ever a rock. Yet it was, although now it is something more for it is mixed

with decaying plant life—everything from the tiny moss that lives its life and dies, to the giant tree that lies fallen in the forest. This decaying vegetation, together with manures and various fish and animal materials, often applied to the soil, makes up what is called the organic matter of the soil. Then there is the soil moisture and soil atmosphere. This latter differs in several particulars from the air we breathe; soil atmosphere containing more water vapor and less oxygen; and considerably more nitrogen and carbon dioxid.

#### THE CHARACTER OF THE SOIL.

If the soil is made up of large rock fragments, we say it is stony. Stony hillsides in many states make the farmer's life miserable. Let the rocks be several degrees finer and we say the soil is gravelly. If finer still then sandy and so on until we have the sticky clay that in rainy weather will fill the wagon wheels almost to the hubs if the road bed has not been covered with gravel. There are many other ways of classifying the different kinds of soil but these lessons are only meant to serve as little guide posts pointing out a few paths that it is hoped will prove interesting enough to lead you farther.

#### SOMETHING MORE ABOUT SOIL COMPOSITION.

The foods that plants get from the soil are thirteen in number—among which are phosphorus, nitrogen, iron, sulphur, potassium, calcium and several others. There are few soils which do not contain the most of these, but this does not necessarily mean that the plants grown in these soils will therefore have enough to eat. This is dependent on the condition of the soil and the composition of the food elements.

We could not eat dry flour—yet we live largely on articles of food made from flour. We combine it with

milk or water and yeast and make bread. Upon bread our digestive organs can easily act. Now when we say that plants use phosphorus and nitrogen, etc., as food, we do not mean that they absorb these separately, but that when compounded with other food elements and dissolved in the soil moisture, these food elements are taken up by the plant.

For instance, the two gases, nitrogen and hydrogen, combined form ammonia. This is absorbed by the plant and the nitrogen helps it to make a strong stalk. Nitrogen is the most important food of plants, while the next is phosphoric acid which makes hardy and fruitful plants. Decaying vegetation aids the plants in getting phosphoric acid, or it may be added to the soil in manures, bones and phosphoric rocks which have been treated with acid. Potash is another important plant food, making woody tissue and starch. Wood ash contains all the potash which the burned wood had absorbed while it was a growing tree, so it is a very valuable application to the soil.

All of these plant foods, or fertilizers as they are called in commerce, may be bought and put into the soil, but your mother will tell you that it is cheaper to bake than to buy bread. In all probability, mother nature has stored away more food than all the growing crops in his fields could use, if the farmer does his part by thorough cultivation of the soil, or tillage as it is called, and by adding such fertilizers as are produced right on his own farm. Nothing should be allowed to go to waste on the farm.

#### HOW SOIL IS MADE.

Nature has more than one means at her command for fining the hardest of granite. All of the bodies of running water are helping her by grinding the pebbles over



and under and around each other, taking off a corner here and there until they are like little bullets and still each day they lose a little more until they are ground to dust. Then when this powder has been made it is washed hither and thither until some time when there is high water it will be cast up on the fields. Water-carried soil is called alluvial soil. Frost breaks up the rocks and the winds blow particles from place to place and in some countries even earthworms play an important part in helping Nature in her soil factory. The air too wears the rocks away; the surface of them becoming soft and scaling off. This is repeated until after long years perhaps there is nothing left of the original stone. But perhaps the most wonderful way of making rock dust is that by which most of the soil of eastern North America and northern Europe is made. Ages ago these regions were covered with glaciers or sheets of ice, as Greenland is. Prof. Tarr, of Cornell University, tells the story of glacial soils in Nature Study Leaflet No. 15. He says:

“The bottom of the ice is like a huge sand paper being dragged over the bed rock with tremendous force. It carries a load of rock fragments, and as it moves obtains more by grinding or prying them from the rocks beneath. These all travel in towards the edge of the ice, being constantly ground finer and finer as wheat is ground when it goes through the mill. Indeed the resemblance is so close that the clay coming from this grinding action is often called rock flour.”

This soil which we have been considering, and from which plants obtain their food supply is usually very shallow, sometimes not more than a few inches deep, but beneath it is what is known as the sub (or under) soil. Into this sub-soil the roots of most horticultural plants go for moisture and some little food, but mainly for the purpose of support. Plants, such as apple trees must hold

themselves firmly to the soil in order to support their expanse of branches laden with fruit, and to endure the attacks of wind which would blow them over if they had not a sure and solid foothold.

This old monarch of the forest fell many years ago and now has so nearly crumbled to dust that only a portion of its length is visible. This is one way which Na-



*Decaying Vegetation.*

ture has of adding organic matter to the soil. The decaying of leaves and all other vegetation contribute to the same purpose. Already the seeds that dropped on this fallen trunk have sprung up into sturdy young trees.

#### HOW PLANTS FEED.

We have learned a little about the place from which plants derive their chief food supply and of what that food consists, so now a word to explain the manner in which

they take up this food obtained from the soil. It is impossible to go into details in this regard, but it is one of the most difficult of plant operations for us to understand. The roots of plants have more than one duty to perform—they hold the plant steady in the soil; if fleshy roots, they are a kind of storehouse for feeding the growing plant, as little bean plants are fed; but their main duty after all is to absorb moisture—this water being laden with the mineral salts which are the main food of the plant. In order to absorb this moisture the roots send out tiny root hairs which act as mouths to drink it in. There are so many of these root hairs and they are so small that they can take up moisture from every little particle of soil which they are able to get at, until the soil is as dry as dust. These little root hairs never grow into roots themselves, but die off when no longer needed on the old and woody roots.

Now the moisture taken up by the root hairs would do the plant no good if it could get no farther, so the food burdened water is carried up through the woody tissue of the plant to the leaves. It travels up through the youngest woody ring in a tree; in corn it is carried up through the thread-like fibers which can be seen in the pith; in plants having netted veined leaves and herb-like growth, it ascends in the tissue between the pith and the bark. Having reached the leaves that portion of the water no longer of use to the plant is evaporated and the mineral salts are left behind to be used as food. But you must not understand that the soil is the only source from which plants derive food. Some plants (a family of them called Leguminosae) get their nitrogen by means of their roots from the air and not as others do from the soluble salts in the soil. All plants get the carbon which they so

much need from the air and have little breathing pores in their leaves which are called stomata. These stomata are the doors which allow the carbon dioxide of the air to come into contact with the living cells of the plant. Here the sunlight and the green of the leaves work together in a way which is not easily explained and make a starch of the carbon and the hydrogen and oxygen of the water which has been absorbed. Since plants can only use very much diluted food just think how many pounds of water must pass through the leaves as vapor before a pound of actual food has been received by the plant. If you wish to see for yourselves this water vapor which the plant gives off, cut off a leafy stem from a geranium say, and put the stem down through a cork into a bottle of water. (The hole may be bored through the cork so that it will fit closely about the stem.) Then tip a glass jar over the whole thing and before long you will see the water mist all over the inside of the jar.

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#### QUESTIONS.

1. What work does the soil do for plant life?
2. How many different soils can you find in your own locality?
3. In order to see what effect it will have on the seed, put a potful of black soil in a shallow pan and bake it thoroughly. Plant two or three beans in this soil after it is replaced in the pot. Plant two or three beans in black soil unbaked. Watch germination of each.
4. Write 150 words telling how the soil is made.
5. What is sandy soil? Clay? Loam?
6. What is meant by "fertilizers"?
7. What machinery does the farmer use when he tills his field?

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#### SOME BOOKS FOR READING AND REFERENCE.

The Soil—Prof. King, University of Wisconsin.

How Crops Feed, How Crops Grow—Johnson.

The Soil—Nature Study Leaflet 15—Cornell University, Prof. Tarr.

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THIRD SERIES, No. 3.

WHOLE No. 27.

TAYLORVILLE, ILLINOIS, NOVEMBER, 1902.

## THE ORCHARD.



*University of Illinois Orchard in Clean Cultivation.*

If nothing but neatness were the result of such a method of caring for the orchard it would still be worth the trouble and expense. But when the well-being and productiveness of the trees are so much increased by cultivation, then surely the fruit grower cannot afford not to cultivate his fruit land.

### INTRODUCTION.

If your father grows corn or any other field crop, or if you have been out in the country during seed time, you

know that the farmer prepares his fields very carefully before sowing the seed and then continues to cultivate long after the plants are growing bravely. Fruit trees are just as sensitive and respond just as quickly to good care and intelligent treatment as does corn, oats or wheat, but how seldom are they so well treated! It is within the last ten years as an outside limit that any fruit growers in this State thought it worth while to till their orchard lands. They hadn't time and it wouldn't pay anyway. These were some of the reasons given and it has taken a long time to convince even a part of them that it doesn't pay to do any other way. There are still many who refuse to believe the evidence of their neighbors' flourishing orchards and continue to let the weeds almost hide their fruit trees. When these poor trees once in several years make a great effort and give them a fair crop of apples they laugh at the neighbor who goes to the trouble of cultivating—and in the years when the trees are too discouraged and weak to set fruit some flaw in the weather is hunted up to account for it. But one by one the little army of earnest growers who treat their orchards well and expect to be repaid for it by a good harvest is growing larger and the time is not far distant when the man who does not believe in cultivating and caring otherwise for orchards will do it anyway just because his neighbors all do.

It is not possible in this little leaflet to go into all the details connected with the successful growing of fruit trees. We can only try to make it clear why certain things must be done or not done, for there are a few principles in the matter of orcharding that cannot be overlooked if we are to get first-class results. These principles can be best explained if we confine them to the



growing of one kind of fruit—the apple for instance. Not all orchard fruits require the same treatment, but if one has learned just what an apple tree needs from its baby days to old age, it will not be difficult to understand the care of other trees. So for this lesson we will talk only of the apple tree's needs.

#### WHERE TO PUT THE TREES.

In planting an orchard, or even a single tree, it is very necessary that a good place be selected for it. By this we mean one which is higher than the surrounding land if possible, and naturally well drained—or tile-drained. It too often happens that the poorest place on the farm is given to the fruit trees. Select a rich soil or one that can be made reasonably so, and if the orchard slopes to the north or northeast much will be gained. Indeed in many sections such a slope is almost a necessity in apple growing. This is because the trees on such a slope will not bloom as early as they would if on a warm and sunny southern slope. Sometimes a late spring frost catches these early-blooming orchards and nips off an entire crop. So a delay of even a day or two may mean all the difference between no fruit and an abundant harvest.

#### WORKING THE SOIL.

When the farmer sows his corn in the spring time he is careful to prepare a good seed bed—for the seed would not germinate well nor would the young plants thrive unless the soil were lightened up and warmed by thorough stirring. Now the young apple or other fruit tree must have as carefully prepared soil in which to be set out after being received from the nursery, for while there may be plenty of food in the soil the plants may

starve because the food is not in a form which they can use. For some reason many fruit growers do not think of this fact, and so thousands of young trees die each year because they have been made sickly by their effort to find a congenial feeding place in the sod or hard, unbroken soil where they were planted. The life of any orchard tree and its ability to grow paying crops in later years is in proportion quite largely to the care with which the soil was prepared before it was set out. It may help us to better understand this matter if we recall the fact that no plants on the farm require more food and moisture than do the orchard trees. Just what tillage does for the plant has been better stated in "The Principles of Fruit-growing", by L. H. Bailey, than anywhere else and it is quoted here to show you that plowing is not the mean thing that some boys believe it to be, but a wonderful service which may be done for plant life.

"1. Tillage improves the physical condition of the land,—

- (a) By fining the soil, and thereby presenting greater feeding surface to the roots;
- (b) By increasing the depth of the soil, and thereby giving a greater foraging and roothold area to the plant;
- (c) By warming and drying the soil in spring;
- (d) By reducing the extremes of temperature and moisture.

"2. Tillage may save moisture,—

- (e) By increasing the water holding capacity of the soil;
- (f) By checking evaporation.

"3. Tillage may augment chemical activities,—

- (g) By aiding in setting free plant food;
- (h) By promoting nitrification;
- (i) By hastening the decomposition of organic matter;
- (j) By extending these agencies (g, h, i) to greater depths of the soil."

The best preparation for the apple orchard therefore is deep plowing followed by careful cultivation with disc and smoothing harrow. In the case of only a few trees spade up the ground deeply and fine it with fork and rake.

It is usually preferable to set the trees in the spring time, and this being true, the plowing should be done the fall before. It would be much better to plan for the orchard four or five years or even longer before the trees are to be set, but this is seldom done. If this method were followed, crops which require the best of cultivating could then be grown on the soil, thus putting it into good condition for its future use. If the soil is poor, crops which require the addition of manures should be grown. Such soils can often be put into excellent condition for apple trees by growing clover, cow peas, or some other plant belonging to that family which, as we learned in the last lesson, have the ability to gather nitrogen from the air. This crop should not be harvested, but when mature should be plowed under, thus adding considerable vegetable matter which, when decayed in the soil, enables the soil to retain a greater amount of moisture. With the soil in good condition, the next thing to be done is the setting of the trees.

#### THE PLANTING.

Before the trees are actually put into the ground it is important that the best trees obtainable be chosen for the planting. The life of the tree is so great and its ability to pay handsome returns to the owner are so sure that it is not economy for any one to place in the soil a tree not already well started and in good condition. This simply means that in buying the tree one must first be-

come acquainted with a reliable nursery firm—anxious to produce and to furnish to his customers nothing but strong, healthy and well grown nursery stock. It is very important that the plant be carefully dug, and if the nurseryman is a good one, he will see that the plants have been so removed from the nursery as not to destroy too many of the roots and rootlets. These roots must not be allowed to dry out before they are set in their place in the orchard. The trees as they leave the nursery should be carefully packed and boxed so as to keep them from drying in air and sun. In placing the trees in the ground set them about as deep as they were in the nursery—that is to the crown of the plant. The distance which apple trees are set apart in the orchard is governed somewhat by the varieties planted, but it seldom pays to set them closer than thirty feet apart each way and the best commercial orchardists in this State, those who grow winter fruit quite largely, such as the Ben Davis, set the trees forty feet apart. The trees should be set straight in the row—not only because when so set they are more pleasing to look at but because it indicates a degree of carelessness or untidiness if they are not so set. There are various methods by which the rows of trees can be planted straight, but there is not space in this lesson to explain these, nor is it necessary. If you have trees to plant and a sincere desire to have them planted in straight rows, you will hit upon some plan of your own for doing this. In placing the tree it is usually best to dig the hole considerably deeper than is needed for the tree and fill it in again until the right depth is reached. This enables the young tree to get its first food easily and encourages it to send its roots deep down into the soil instead of out laterally. Fill

in the soil around the roots slowly, having some one straighten out the little rootlets, and pack the dirt firmly around them. Be sure that no air spaces are left among the mass of roots—that is, each and every root throughout its whole length should touch the soil at every point. All injured roots should be removed with a sharp knife or saw before the tree is set, for injured roots are often the starting points and causes of decay.

#### LATER CULTIVATION.

After the trees are in their places the soil for a space of five or six feet on either side of the rows should be carefully pulverized the first year. The remaining space between the rows may be used as a place in which to grow annual or yearly crops. For such a crop it is best to select a plant requiring much cultivation, such as corn, potatoes, etc.

Each year, for seven or eight years, the space cultivated on either side of the rows must be widened as the feeding rootlets of the growing trees reach out farther and farther. At this age the trees will probably begin to bear their first crops of fruit and then no other crops must be grown on the soil and the ground must be most carefully cultivated. You see if other crops are taken from the orchard lands the trees have been robbed of all the food and moisture used by this annual crop.

The cultivation giving best results starts as early in the spring as the soil will allow and is kept up until the trees have about matured their growth for the year. The plow is the cheapest and most satisfactory pulverizer and is the tool which should be used for the first breaking of the soil each spring. This compels the roots to go deeper into the soil and they will thus escape injury from the plow.

After plowing, the ground should be thoroughly disced and then finished off with a smoothing harrow. All later cultivation for the season may be with this latter implement. Once each week and after each rain, when the ground has become dry enough for working, the surface should be gone over with the smoothing harrow.

It should be borne in mind that soil so treated is in bad condition for winter for the rains and melting snows will wash the fertility from the soil and the roots of the trees will be more surely injured by exposure to changes of temperature. In July, or early August, a crop of rye, oats or vetch should be sown in the orchard—something that will make a blanket of vegetation. This protection is well named a cover crop, and when plowed under in the spring time adds organic matter to the soil.

The most serious mistake an orchardist can make is to allow a grain or hay crop to be grown in his orchard to steal moisture and plant food from the trees' storehouse. During the entire life of the tree after it has commenced bearing this plan of clean cultivation should never be given up.

Pruning, spraying, and other important matters connected with the orchard, will be treated in some of the lessons next spring.

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#### REFERENCE READINGS.

Bulletin No. 52—Orchard Cultivation, Illinois Agricultural Experiment Station.

Bulletin No. 59—Orchard Management, Illinois Agricultural Experiment Station.

In connection with this lesson it would be well to memorize the "Planting of the Apple Tree", by Bryant, a poem familiar to the most of the older generation.

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# THE STUDY OF HORTICULTURE.

BY J. C. BLAIR,

Professor of Pomology and Chief in Horticulture, University of Illinois.

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THIRD SERIES, No. 4.

WHOLE No. 28.

TAYLORVILLE, ILLINOIS, DECEMBER, 1902.

## WINDOW GARDENING.

"We would have flowers in every home, for their sunny light, for their cheerful teachings, for their insensibly ennobling influence."

In this month of keen winds and biting air let us take up a division of Horticulture that may be carried on indoors and now that autumn frosts have killed all outdoor plants, it will not be amiss to substitute the growing of those plants which have come to be called house plants because they are willing to live indoors with us and brighten our windows with beautiful foliage and flowers.

You know, of course that many plants will sicken and die if an attempt is made to grow them in the house, so it is necessary to make a careful selection of plants for indoor growing, and since we cannot all be experienced florists, it is well to ask some one who has had training in the business to help us in selecting material for our window garden. There is one great charm about window gardening and it is this—every one may have such a garden if he will, for every one has a window, while not all of us have lawns where we may do our bit of gardening. The poor child of the tenement often has a sturdy geranium which is not ashamed to hide its roots in a tomato can. Plants respond eagerly to loving care, no matter whether they are in the tenement or in the beautiful home of some more fortunate child. If you care little for plants and mean to neglect them when you feel like it, don't

bring them into the house at all, for nothing is quite so pathetic or so disagreeable as the sight of long-stemmed, few-leaved, starved and forsaken plants. Better a bare window from fall to spring, than such a window garden. But there is something so interesting as to be almost exciting in watching over and feeling responsible for the beautiful development of some choice specimen of the plant world. If you have never ventured to grow a house plant and feel very helpless, yet anxious to learn, do not start with too many. Take perhaps only one or two, say a vine and some easily grown plant, and study them and you will soon learn to read their wants in the appearance of their leaves and stalk. Then when you think you know how to care for these add another to your collection and you will be fairly well started along a most pleasant path. Window gardening has charms that no other manner of gardening can rival.

#### SELECTING THE WINDOW.

The first thing necessary in starting a window garden is a suitable window. Any window is better than no window at all, but if you have several windows from which to select the best one for a general collection of plants during the winter, select one at the south side of the house. Next in choice after the southern exposure is an east window which will answer very well for all those plants which care little for much direct sunlight. West windows are not likely to suit your plants well as they generally prove too hot a place for ordinary plants. Ferns, pansies, umbrella plants, etc., will thank you for a north window if you see to it that they do not suffer from the cold, while geraniums, the beautiful foliaged coleus and other heat-loving plants will flourish in the south window which you made first choice. Begonias, marguerites and



fuchsias with their gracefully drooping flowers, will do best in the east window.

#### WHAT TO GROW.

As you have probably not had much experience in growing plants indoors, it will be wisest not to attempt too much the first season. Crowded plants do not thrive so well as if they have plenty of room in which to develop and you may become weary of caring for too large a family of plant children, since it will be an unfamiliar task at first.

I would suggest that you start your collection with one or more geraniums. These are old fashioned flowers, it is true, but they are liked by all and bloom freely with ordinary care. Geraniums that are to bloom during the winter should be taken from the garden early in September, if you wish to use old stalks. Shake the earth all away from the roots, prune the plant into good shape and then pot with fresh soil and keep your plant shaded for a week or so. Then let it have sun and water, and in two or three months it will be ready to reward you for your care. If you prefer to start a new plant from the garden geranium stalks, cut a firm young shoot or stem so as to leave one or more buds on the cutting, set it deep in sand and in a few weeks it will be ready to pot.

I think you will enjoy making the acquaintance of the bright faced Chinese primrose. This cheery plant with its spring-like fragrance will probably give you flowers larger than any other one in your window. It requires constant moisture, but not muddiness. If the drainage in your pots is poor so that the water stands in the soil, the primrose will die off. It will probably be best for you to buy the seed if you wish to attempt to grow primroses. For choice plants in next winter's window garden

sow the seed this coming April, according to the general directions under "Seeds."

There are few plants which will give you greater pleasure for your indoor garden than pansies which you may raise from seeds. Secure a package of the very best seeds and plant them according to directions given elsewhere. When the little plants have formed two leaves they may be transplanted into small pots filled with very rich soil, that is, soil containing a great deal of well rotted manure. These plants do not like too much bright sun and will do well in a north window if there is a chance for the afternoon sun to reach them from a west window. If you plant them in a month or two, you will have splendid plants to bed out in the spring and when these are through blossoming if cut back a little and the flower buds nipped off whenever they appear all through the summer they will blossom again next winter. Pansies are very easily grown if you only give them enough to eat; that is, a good rich soil from which they can take up what they need in the way of plant food. The following list offers a pleasing variety: Vaughan's Giant, of the following colors: pink, purple, coal black, violet blue, Aurora, Parisian Striped, Golden Queen and Masterpiece.

If your mother has a fuchsia ask her to allow you to take a cutting; then try your skill in raising one of these plants yourself. They are easily grown and ever since they came from South America, their native home, they have been a favorite for the window garden. Put your cutting in damp sand, according to directions under "Cuttings" in the next lesson. As soon as rooted transplant into rich soil in what is called a three inch pot. As soon as the main branch has started up well, tie it to a small stick and see if you can train your plant to a good shape.

When the branches are two or three inches long nip out the tip of each one and two or three branches will start from each.

Carnations are so beautiful and possess so refreshing a fragrance that you will feel well repaid for what care they require. I remember seeing one in a farm house window a few years ago, the flowers a beautiful dark red. There were so many blossoms on the stalks that I asked permission to count them. Buds and flowers taken together numbered more than one hundred. So you see they are worth while. Perhaps no other plant demands so rich a soil in order to produce fine flowers. There are so many varieties that you might have a fine display with no other plants than carnations.

You must not think your winter garden complete unless you have a few at least of the beautiful flowering bulbs. For more than three hundred years hyacinths have been cherished by plant lovers and they are today the most frequently sought for winter window decorations. But freesias, tulips, crocuses, narcissuses, lillies and best of all the beautiful cyclamen, all deserve a place in our affections even if we haven't room for them all in our windows. Any of these bulbs may easily be grown in pots, although nearly all of them are hardy even in the northern states. The same method of treatment will do for them all and the catalogs from which you select your bulbs will usually tell you all that is necessary about the care of them. However it will not be amiss to say a word about their planting. A pot six inches across and the same in depth will be best for your bulbs. Place only one hyacinth bulb in each pot, while three or four narcissus or tulip bulbs, or even a dozen crocus bulbs may be put into a pot of the same size. There is nothing

spécial to be said about the soil, almost anything will do, even pure sand or moss will be found all right if kept damp enough. After the bulb is placed so that about one fourth of it appears above the soil, press the ground firmly into place, water it well and put the pots down cellar for about two months. Then bring them up to the light to brighten your Christmas holidays.

#### SEEDS.

You have planted seeds of corn and beans, and know something of the process of germination, so no more space will be given to the method of growing plants from seed than to give a general principle or two which governs the growing of all plants in this manner. A shallow box not more than two inches deep is best for this purpose, one with cracks or holes in the bottom through which the water will readily drain. Fill within one half inch of the top with leaf mold from the woods if you can get it. If not take equal parts of sandy soil and well rotted stable manure, or if in the city, street sweepings may take the place of the latter. Whatever the soil is made up of it must not be firm and heavy enough to discourage the little plant from seeking the light. Press this soil level then scatter the seed evenly on top and cover with a thin blanket of earth and press smooth again. Then water the earth well and keep the box comfortably warm, about 60 degrees or considerably cooler than the proper temperature of your school room. Water the box only when the ground seems dry—you see there is not so much need of water as long as there are no thirsty tiny roots to drink it. Unless the small plants become sickly or too closely crowded they may be left in this sociable home for several weeks and then transplanted as gently as possible either into pots or the open garden as the case may be.

Growing plants from seed is a more satisfactory way than to purchase plants from some one else. If this latter is done you have missed the first of their life story and will not feel on such friendly terms with the plants. It is a cheaper method too, for you see the florist charges for doing that which you might have done but didn't. However, not all plants will grow from seed and from many it is best to take cuttings.

#### GENERAL SUGGESTIONS.

While some plants need more water than others, do not make the mistake of keeping them all in pots of mud. As long as the soil seems moist to the touch it is a safe rule to give no water. When the water has been absorbed the soil will dry; then it should be watered liberally.

Plants need fresh air. Open the windows on mild days but do not allow the wind to blow across the plants. It is better to open the windows every day, if the plants are somewhat protected on very cold days, than to open them wide once in a while and chill the plants because they are not used to the out door air.

Keep your plants clean. They cannot be healthy if they are covered with dust. If you wish to wash the plants without removing them from the window a sponge is the best for the purpose. If you remove the plants from the window then a sprinkling or shower bath is best. On a mild day when the rain is falling gently set all the pots out of doors.

Too great heat during the day will make your plants look sickly. Most plants prefer a cooler air at night even if it drops as low as 45 or 50 degrees, but there are some, begonias, the coleus, etc., the hot house plants, which prefer an even warmth. There are others, such as the

geraniums which are very easily pleased and accommodate themselves to almost any circumstances. Such of course are easiest to grow in our ordinary living rooms.

Give your plants a little extra food about once a week. This fertilizer is made by putting one or two shovelfuls of manure with one pint of charcoal to kill the odor, in a bucket half full of boiling water. This amount of fertilizer will last for a couple of months if you keep adding water as you remove the fertilizer for your plants. Use it not too strong. The color should be like weak tea, when the proper strength. Simply use it in place of pure water once a week and the plants will grow more vigorously.

Pick off all dead leaves, being careful not to injure the stems.

If green flies come to feast on your plants, water in which tobacco stems have been soaked until it is tea colored, may be sprinkled on the leaves. This method is better in window gardening than to burn damp tobacco stems for the odor is very disagreeable.

Watch the under sides of the leaves for red spiders, and if you discover any, sponge the plant thoroughly with very weak soapsuds.

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#### QUESTIONS.

1. What is Floriculture?
2. Write a history of some plant which you have grown. If you have never grown one, now is a good time to begin and you can keep a diary of its progress.
3. What are some of the difficulties in growing plants in the house?
4. If some one in your neighborhood grows plants successfully in her windows ask permission to observe them now and then and to ask questions as to how it is done.

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**THIRD SERIES, No. 5.**

**WHOLE No. 29.**

**TAYLORVILLE, ILLINOIS, JANUARY, 1903.**

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## **THE MULTIPLICATION OF PLANTS.**

If we had no way of compelling plants to reproduce their kind, that is to multiply, there would be no nurseries from which to buy young plants of any desired varieties. Nature would manage things in her own way and if the wind and the weather and other agencies happened to scatter her seeds, where they could grow, that would be so much the better, but it would be a very uncertain way of getting one's plants. We could never be sure just where the seeds had found a lodging place and started to grow. So you see there may be ways of improving on Nature's methods, that is, there may be methods more suited to our ideas of push and enterprise. Man, therefore, collects the seeds which have been produced and makes his seed bed just where he wants it. He puts the seeds in it, and knows, that if he has obeyed the principles that govern seedage, he can go right to that bed later on and find the young plants in a definite place and not scattered about in Nature's unfenced gardens. If he prefers he may perhaps take a portion of the parent plant and produce a new plant without seed.

These then are the two general methods which we may employ when we wish to increase the number of our plants. One method is called propagation by seeds, the other propagation by division of the plant. The word propagation is taken from the Latin language and in hor-

ticulture is defined as the artificial multiplication or reproduction of plants as contrasted with their natural multiplication which Nature looks after.

You may wonder why it would not be easiest and best to propagate all varieties from the seed. It sometimes happens that after plants have been cultivated for some time, and are much improved in appearance by this culture, their seeds are weakened and cannot be relied upon to germinate; or by growing near each other two varieties may have become mixed so that their seeds would not come true. You know that the pistil of a flower must be fertilized by pollen dust in order to produce seed. If this pollen dust is from the same plant, probably the seed will produce plants like the parent; but suppose another variety be growing beside this one and that the wind or insects or some other agency should carry pollen from one plant to the other, then the seeds of these two plants might be like either one of the parents or be so mixed as not to be like either. So where it is desired to create new varieties this exchanging of pollen is done by hand, instead of trusting to the natural methods of pollination. One cannot be sure of the result unless he attends to the pollination of the flowers himself. With plants which are called annuals, because they live their whole life in one year and die, or with biennials which have a two year life, it is the custom to use seeds instead of any of the other methods of cultivation. This is also the case with field grains, forest trees or seedlings to be used for grafting, and, as we learned before, whenever man wishes to produce new varieties.

If the gardener desires to grow a new plant just like one which he already has he will be more certain to succeed if he takes some portion of the root, stem or leaf and



plants it. Just what part he shall take depends on the plant which he is dealing with, for different families of plants are propagated in different ways although some grow readily no matter what method is employed. Some plants, as mint, are more easily grown by division than by seeds. Some plants, the horseradish, sugar cane, etc., rarely produce seed, consequently new plants must be grown by dividing the parent plants.

#### PROPAGATION BY SEEDS.

Something of the method of growing plants from seed has been suggested in a previous lesson but there is so much to be thought of and so many things to be remembered in this operation that lies at the bottom of much of our plant culture that we cannot go over it too often.

First of all, care must be taken that the seeds selected are the best possible for the purpose. Seed from inferior, sickly parent plants will never produce first class plants. Again seeds may fail to grow because they are too old. Some seeds remain in good growing condition for many years, as for instance cucumber seeds which after perhaps ten years of waiting to be planted will produce plants when put into the soil. Starchy seeds, such as rice or wheat, will continue in germinating condition longer than oily seeds like those of the sun-flower. Other seeds may have been gathered too young or before they had matured. Such seeds do not contain as much of a food supply for the embryo as is in a fully grown seed. However seeds not quite mature usually germinate sooner than ripened ones probably because the seed coat is not so hard. Or the seeds may have been damp when gathered and put away. In this condition they are in danger of moulding in warm, or freezing in cold weather. Insects or disease may have injured them.

You must see by this time that it would hardly be wise to plant a large field with one or many varieties of seeds without knowing first whether the seeds are in prime growing condition and likely to produce high grade plants. A simple little seed tester that you may like to use for testing your own garden seeds is made as follows: Take an old table plate that is not cracked or broken. From thick cloth cut two circular pieces the size of the plate. Dip them in water and wring out most of the water. Spread them on the plate and between them put some of the seeds from the lot you wish to test. Cover the plate with a pane of glass or another plate and place in a living room comfortably warm. The glass cover prevents the moisture from evaporating. Examine the seeds frequently and record the number that fail to sprout. There is of course great difference in the length of time it takes different kinds of seed to germinate.

After the seed has been tested and found satisfactory, the soil which shall have been crumbled thoroughly is to be pressed down firmly over the seeds; only a thin covering of soil is usually better than a heavy layer. The soil should be patted or rolled close about the seeds because they cannot absorb moisture so well if they only touch the soil at a few points. This soil should not be muddy or the oxygen will not be able to penetrate it and reach the seeds, for they need air just as we do. Seeds having very hard coats will germinate sooner if put in warm water and allowed to soak for a day or two. Seeds should be sown at the time stated by the seedsman of whom they are bought.

#### MULTIPLICATION BY SUCKERS, STOLONS AND LAYERS.

After you have become skillful in growing plants from seed you will be interested in trying some of the

other methods of producing new plants. The easiest way of all is what is known as propagation by suckers, for nature does nearly all the work herself. Shoots that grow up into the air from stems or roots that are underground are called suckers. Blackberries and red raspberries are common examples of plants that may be propagated by suckers. Plants produced from suckers have usually less strength than the parent plant and each new generation is likely to be weaker than the last. The only part that man has to do in growing plants by this method is to cut off the stem or root that joins the sucker to the parent plant, and transplant the new plant.

A branch curving downward until it touches the ground and sends out roots is called a stolon. When the roots have developed sufficiently the new plant may be separated from the old one by cutting off the stem that joins them. The black raspberry propagates itself naturally by means of stolons. A layer is really just an artificial stolon. To try your skill at this method of propagating, take a stem of a currant which is near the ground and cover one of the joints or nodes with the soil. A node, as you have probably learned elsewhere, is the place where a leaf joins or has joined the stem. At these joints growth seems most active and from them roots usually start first when cuttings or layers are being made.

#### CUTTINGS.

A cutting is the name for that piece of a plant which if cut off and planted in proper soil will grow and become like the parent plant. This cutting may be a portion of the stem, the root, a leaf or only a part of the leaf. It may be taken from the hard and ripened wood of a tree, or from the green stem of a geranium; it may be only the ragged fragment of a begonia leaf standing in the sand,

or simply a bit of root two or three inches long. So, although it is an easy matter to take a geranium slip and grow from it a sturdy plant, you must realize that this is only one of the many methods of propagation by cuttings, and that you might spend years in experimenting with plant cuttings and then have much still to learn.

Hardwood cuttings, that is, those made from ripened wood, are best made in the fall and stored in sand, moss or sawdust in the cellar until spring. Such cuttings may vary in length, but it is best to make them not less than six nor more than ten inches long unless there is a scanty supply of stock from which to take them. Grape cuttings should have from two to three buds, while cuttings from the bush fruits, as currants and gooseberries, which have shorter joints, will contain anywhere from five to ten buds.

By the making of greenwood cuttings one gets results more quickly, as roots develop speedily. A shoot may, however, be either too old or too young to make a satisfactory cutting, and this can be very easily discovered. Bend the shoot, and if it snaps off clean it is in prime condition to grow, but one that bends or crushes is probably too old, although it may bend because too young to have developed any power of resistance. After these green cuttings have been made (and perhaps you will be wise to select geranium or coleus cuttings for your first experiment), they should be set firmly in sand, and kept moist enough to prevent wilting, and protected from the sun for a week or so.

In making cuttings use a sharp knife. Plant them as soon as made. Keep their heads cool and their feet warm; that is to say, the ground ought to be warmer than the air. The object of this is to coax roots to develop before tops. Covering cuttings with tumblers or mason jars retains moisture and protects the cuttings.

GRAFTING.

The usual method of propagating our fruit trees and even many of those trees which we plant solely for ornament is by grafting. Grafting is the joining of a certain part of one plant to some portion of another plant in such a way that their cambium layers unite. For example, if we are propagating the apple, young plants (seedlings) are grown, the roots of which are used as the stock or base. To this stock we unite a part of a twig (here called cion) which is taken from a tree of that variety which we wish to multiply. The stock may be one year old, and is dug in the fall after the leaves have fallen, and packed away in a very cool cellar and prevented from drying out by a covering of moss or sand. In January and February, the months in which grafting is usually done, these young seedlings are cut off at the crown and the roots divided into pieces three or four inches long. (The crown of these seedlings is the part where the stem issues from the surface of the ground.) These pieces of root should be joined to the cion in the manner described later.

The cion is a portion of a twig four or five inches long and containing two or three buds. These twigs are cut from the trees in the fall or winter months before hard freezing weather sets in, and may be stored in a cool cellar in the same way as the stocks. There are many ways of joining the cion to the stock but most nurserymen prefer the method called whip grafting. A long, slanting cut is made on the stock and a corresponding one on the cion. Each of these cut surfaces is split so that in putting the two together they are a little dovetailed. In making this union care should be taken that the inner bark of the stock and cion unite on one side at least and they should be held in this position by a band-

age. No. 18 knitting cotton soaked in melted beeswax is excellent for tying together these two pieces. It is not necessary that the entire cut surface should be covered with the wrapping material. After the operation of grafting is over, these little grafts may be packed away in sand, kept a trifle moist. When the time comes for planting out in the spring it will be found that the stock and cion have grown together or united slightly. The ground which is to receive these grafts must be moderately rich and well fined. The entire stock and the greater portion of the cion should be covered with soil and this well firmed around the plant. In a short time there will be a little tree of the same variety as the tree from which the twig or cion was taken. If we had planted the seed from this tree instead of grafting its twigs, the young plants would probably have been unlike the parent plant. If we had planted the twigs directly in the ground instead of attaching them to stocks, we would find that they would not readily grow roots. This is why we resort to graftage instead of cuttings when propagating fruit trees.

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#### NOTES TO THE TEACHER.

1. Assist the pupil in discovering as many specimens of the annual, biennial and perennial types of plants as are to be found in the neighborhood.
2. Explain to the pupil what is meant by the cambium layer, using twigs from fruit trees.
3. Take a shoot from the grape vine and show what is meant by a node and an internode.
4. See that the terms stock and cion are clearly understood.
5. Assist the pupils in making some whip grafts. When each pupil has had practice in making a number of these, store away the grafts according to directions and set them out in the spring. Have the pupils make careful notes of the condition of the grafts before storing, at the time of planting and at least once each month after growth commences.

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THIRD SERIES, No. 6.

WHOLE No. 30.

TAYLORVILLE, ILLINOIS, FEBRUARY, 1903.

## THE SCHOOL GARDEN.

"The garden is Nature's best school."

That is a new thing to think about, isn't it? A school garden! One might almost believe that we are going to talk about German schools where school gardens are no novelty. But here in Illinois it will be an unusual sight—this school garden—yet there are going to be many of them in the course of a year or two; such a number that we almost dare to hope there may be "enough to go round" so that every schoolhouse shall have its garden plot just as every homestead does. The best way to bring this about will be to make the garden you undertake in your district a success. Its fame will spread to the next township and next year there will be a garden over there possibly as good as your own, and so the gardening interest will spread wider and grow deeper until Illinois pupils and teachers will wonder why they didn't think of gardens long ago. They may be the means of increasing attendance, studiousness, and many other school virtues which sometimes are in danger of being forgotten when daily tasks become lifeless and uninteresting.

It seems strange to be thinking and writing of gardens when all out doors is covered with a thick blanket of snow. For almost two months yet there will be blustery weather when one's teeth would chatter at the mere thought of working in a garden. But gardens to be a

success must be planned for and laid out on paper or in the mind long before the actual work of seed time begins. One must determine where the garden is to be, what will grow best in that soil, where and in what amounts the seeds are to be bought, what treatment the soil must receive from start to finish. The tools must be selected and put in working order, and not before all of these things are more or less thought out, should the ground be broken for the garden that is to be.

#### THE GARDEN SPOT.

Many people really believe that almost any place will do for a garden, and it is a pleasant fact that with care plants can be coaxed to grow in the most unpromising spots. Still when preparing to test, for the first time, one's skill as a gardener, it is safest to argue that the best place on the farm is none too good for the garden. Nor is it an indication of the wise farmer when we find the home garden in some out of the way corner where perhaps nothing else could be planted with success. So when there are several places from which to select the ideal garden site, it is well to remember that an eastern or southern exposure is best; that is with a slope facing either of these points of the compass. This land should be well drained; and a rich and somewhat sandy soil should be selected if the best results are to be expected. With the school garden, however, one's choice is necessarily somewhat limited, as the lot surrounding the school-house is small and no choice of location is left to the young gardeners. They must take whatever space they can find unoccupied or shaded by buildings and trees and make the best of it. Let us suppose then that the teacher and pupils know just what part of the school premises is at their disposal for gardening purposes, and in order

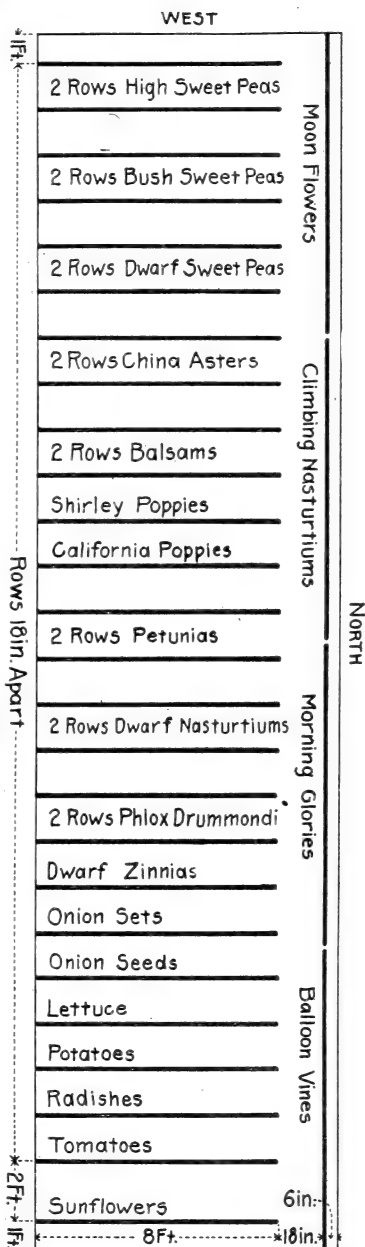


to have some definite peg on which to hang our lesson suggestions, we will limit the garden space to ten by forty feet. A long, narrow strip is best suited to most school grounds and may be placed near the fence or on the border of the play ground. The accompanying garden plan may help in laying out your school garden. The location being selected, the next thing in order is to decide just what to plant.

#### WHAT TO PLANT.

Since these little gardening hints will find their way to school in both Northern and Southern Illinois, probably into each of the many counties of the State, it is not to be expected that the varieties which are mentioned in this lesson are in every case the very best that could be selected for each particular garden. You must use your eyes and your questioning powers

### A SUGGESTION FOR A SCHOOL GARDEN. 10 FT. X 40 FT.



and find out for yourselves just what varieties are best suited to your own locality. The list given here is only intended to suggest some plants which are the commonest and earliest of culture among our annuals. You have learned in an earlier lesson what an annual is, but it will make an interesting chapter in your garden note books if you will devote a few pages to these friends who come and stay through the whole summer season with us and then die. Make up a list of all the annuals you meet during this coming spring and summer and record something of the manner of their growth, the appearance of their foliage, and all you can learn about the way in which their seed is borne. You will feel on much friendlier terms with these garden people if you know something about their home life. Try it and see. When a seed catalogue is picked up there is such a wealth of pretty things from which to select that one is a little dazed and not quite sure whether or not he wants anything at all if he cannot have all. So for a first garden it is best to cling to the old friends and to hunt them up in the best catalogues you can secure. A list of several reliable seedsmen is given on the last page. There are so many first-class catalogues issued that the list was restricted to only five names. Send a postal card to each of these five at least and ask them to send you their 1903 catalogue. This they will gladly do without expense of postage.

Sweet peas, petunias, phlox, nasturtiums, asters and balsams are all old friends of your mother and she will gladly tell you about these annuals and how to grow them. New varieties of these are put out each year and each year finds them more beautiful than ever before, so a word as to some of the new varieties of these old favor-

ites. Of the sweet peas you will want to include the tall, bush and dwarf varieties. Not so much because of a difference in the flower itself, but as an illustration of the different form in which these grow.

#### LIST OF SWEET PEAS.

NAME.	COLOR.
Blanche Ferry, extra early.....	Pink and white.
Blanche Burpee.....	Pure white.
Dorothy Tennant.....	Rosy heliotrope.
America.....	White with scarlet stripes.
Navy Blue.....	Deep indigo blue.
Firefly Cupid.....	Scarlet (dwarf).

Blanche Ferry and Blanche Burpee may be secured in tall, bush or dwarf variety as desired. Sweet pea seeds should be put to bed in the garden at the earliest possible moment after the frost is out of the ground.

Nasturtiums, like sweet peas, delight to climb high or keep close to the ground, according as the tall or dwarf varieties are chosen for planting. For the border fence climbers the tall varieties of the desired colors should be selected. For bedding in rows the dwarf varieties should be chosen. Almost any of the varieties will prove satisfactory if selected from a reliable catalogue. They do well on even a poor soil. If too much plant food is provided, you will find plenty of nasturtium foliage but your plants will be too fat and lazy to produce flowers.

Of the other flowering plants for your garden you will be safe in selecting varieties according to the colors you desire, with what help the catalogues give you, for the seedsman usually gives warning whenever certain varieties are less satisfactory than others.

The vegetables also may be selected from the catalogues with the aid of suggestions from some one in your own locality who has had experience in gardening.

#### PREPARING THE SOIL AND PLANTING THE SEED.

As early in the spring as the soil can be worked without sticking to the spade, dig up the area laid out for the garden, taking care to remove all grass roots and weeds. Around the border of the garden run the spade down deeply so as to cut off all grass and other roots. Repeat this operation at intervals of one or two weeks during the season so as to prevent the grass roots from running in under the bed and robbing the flowers of moisture. When the spading can be done in the fall, so as to allow the freezing and thawing to mellow the soil, very much will be gained. The amount of moisture which the soil can hold for the crops will depend largely on this first preparation of it. The finer and more mellow the soil, the greater the amount of water it can hold. It is important therefore, before the seeds are planted, that the ground be deeply worked with a spading fork. If the ground to be planted is of a sandy nature or of a heavy clay character, some decayed organic matter such as leaf mold or well-rotted manure should be worked into the soil. Rake down the surface until all the lumps are pulverized and a smooth seed bed secured.

A fence board eight feet long may be used for marking off the rows, which must be straight. On one edge of this board you may cut notches eighteen inches apart for convenience in laying off rows the right distance apart, as indicated in the garden plan.

Follow the directions given by the seedsman on each package both as to time and manner of planting the flower seeds. These directions are usually correct and are complete enough to meet your needs, since space is lacking here for complete suggestions. In planting sweet peas, hollow out the row two or three inches so that plenty

of moisture will be kept at close hand. Cover up the little seeds with an inch thick blanket of earth, after pressing them down firmly, and let them alone, merely raking over the surface now and then. The ground should be shaded if possible. A light sprinkling of straw or leaves over the rows may serve this purpose. This beautiful vine likes a very cool bed and often disappoints the gardener by shriveling up when hot weather comes if the ground is not protected from extreme heat in some way. Where the tall sweet pea refuses to grow because of the heat, the bush sweet pea may take its place, for it has so many fibrous roots that it can find nourishment long after the tall sweet pea will die of thirst. The dainty bright little faces of the Cupid sweet peas first peeped out in the light of California sunshine. These dwarfs are never more than five or six inches high and have flower stems a trifle too short for the ordinary vase, but they are very beautiful for borders or window boxes, with a mat of foliage that keeps the ground moist. In a very damp climate this very mat of foliage that is such a protection in a dry soil, may hold too much moisture and mildew.

As with most annual plants, care must be taken not to let seeds develop too early or the blooming of your sweet peas will soon be at an end. When a plant begins its work of maturing seed for another generation of plants, it gives up the labor of producing new flower buds.

Long before the flower seeds are planted—say about the middle of March—tomato seeds should be sown in fine soil in a wooden box which is three or four inches deep, to be kept on the window sill in the schoolroom. The small plants should be thinned out soon after they germinate, otherwise they will crowd each other and spindling plants will result. After they have made their second leaves you must again thin them or transplant some into another box. In May they may be set in their own place in the garden. Care must be taken in transplanting. As large a ball of earth as is possible should be taken up with the plant. They should be set out late

in the day, say after school, and should be shaded for a day or two from bright sun, so that they will not wilt.

You probably know that potato vines are multiplied by planting—not seed (excepting where new varieties are wanted)—but pieces of the potato tuber itself, cut so that an eye or bud is left on a piece of the potato. The planting of the potato should not be made before the first of June if you wish to study them during the fall term of school. Late varieties should be selected for this June planting. It would be well, however, to include a few hills of early varieties, such as the “early rose”, which should be planted as soon as the ground could be worked and which would give additional material for study in the early spring. At about four inches deep they will do best as they may creep out on top of the ground if planted too shallow, and if too deep you will find it discouraging work to dig up your crop. In actual garden practice potato rows should be three feet apart, but in your small garden crowding a little was necessary. It was an old garden custom to “hill up” potatoes—that is make a mound around each plant—but this is not economy of time and labor nor is it necessary if the planting was made deep enough.

Keep down the weeds and keep in the moisture by using your hoe and rake lightly all through the growing season. Do not water your garden. It will not thank you for this mistaken kindness. You can give it a more constant supply of moisture by cultivating it well.

The next lesson will contain additional suggestions regarding the school garden.

Insist on having Bailey's “Garden Making” or “Vegetable Gardening”, by Samuel B. Green. These will give you much help in arranging the home garden which you will want to have next year.

#### LIST OF CATALOGUES.

- J. M. Thorburn & Co., New York, N. Y.
- Peter Henderson & Co., 36 Cortlandt street, New York, N. Y.
- J. C. Vaughan, 84 Randolph street, Chicago, Ill.
- Henry A. Dreer, 714 Chestnut street, Philadelphia, Pa.
- W. W. Barnard & Co., 161 E. Kinzie street, Chicago, Ill.

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THIRD SERIES, No. 7.

WHOLE No. 31.

TAYLORVILLE, ILLINOIS, MARCH, 1903.

## THE PLANTING OF SCHOOL GROUNDS.

"There are two objects to be attained in the planting of school grounds—the making of a picture and the raising of plants for study.—*Country Life*.

I have dared to hope that you have been sufficiently interested in the work suggested in the past lessons to make your preparation for this year's Arbor Day a little better than ever before. I know, of course, that you have not neglected planting something or other each year by way of celebrating this only holiday in which horticulture has a full showing, but it is as necessary to make definite plans for the planting of trees and other ornamental plants as it was to plan the school garden. That is why this lesson follows the one on "The School Garden". You will remember that another lesson on the garden was to follow the last one, but in that way our Arbor Day plans were going to be too late for use this year, so it was deemed best to postpone the second garden lesson a month.

### MAKING THE PLAN.

I do not know just what plans you have carried out on other Arbor Days. Perhaps in some schools they were like that one of which I heard the other day. The teacher told me about it in order to show me just what could be accomplished in an emergency. It was fourteen years ago that she began a spring term of school, just two days before the first celebration of Arbor Day was to take place in that district. A letter received from the super-

intendent during the first day, informed her that Arbor Day had been proclaimed and that a planting of something or other must be made. There were fourteen pupils and to them the letter was read. By way of response eleven infant trees, ranging from six inches to two feet in height, were brought the next day and planted in the small school ground where a woodpile was the only evidence that such things as trees existed. The teacher knew nothing about tree planting, but some holes were dug in a row along the fence, and as if to encourage the further observance of Arbor Day, eight of the trees actually grew. In about such a haphazard fashion as that many of our school grounds have been planted; neither teacher nor pupils knowing the laws governing such plantings.

This is why a plan carefully drawn beforehand seems to be the surest way of getting just the result one desires. Now I am not going to give you any sample plan for you to copy or work from. What I wish you to do after carefully going over this lesson with your teacher is this: Take a sheet of paper and make a map of your school yard. Then by little dots show just where you think a tree, shrub or vine would look its best and make the grounds most attractive. On the lower margin of your paper write a list of those plants which you think you can furnish toward carrying out this plan. Your teacher might then examine all the plans and have several of the best put upon the blackboard for general discussion. The plan fully decided upon will probably not be the work of any one pupil, but will be made up of the good features of several plans. Then the list of plants needed should be carefully gone over and assigned to different pupils to bring in. This assignment of course should be



made from the list which the pupils have offered and in this way the material can be secured with almost no expense to any one.

#### WHERE TO PLANT.

After the plan of the school yard has been drawn upon the blackboard—the next step is to decide just how far the plans already made on paper can be carried out in order that all the best views both in the yard and at a distance may be kept in sight and all the ugly things hidden by a mass of foliage.

Your school house itself is or should be the best feature in the yard, so do not plant anything directly in front of it or scattered about the lawn, for in the school yard of all places, one law of landscape gardening should be kept. This is the law: Keep the center of the lawn free from planting, even of flowers, and place trees and shrubs along the border of the grounds. You must remember that just as a room would look cluttered if too much filled with furniture, so a lawn will be made untidy or spotty looking if too much lawn furniture such as bushes and trees are used.

In a school yard there is still another reason for not doing too much planting of a scattered sort and it is a reason I am sure you will appreciate. Who likes to play ball or blind-man's buff among a network of tree trunks?

Place some smaller shrubs along the foundation of the school house, if the soil is of a fair quality, and the water from the eaves will not drown out the plants.

At the rear of the school house and at that side from which the severest winds come, place along the fence the largest growing trees—elms, maples, etc. Remember not to crowd. Thirty-five feet apart is none too much for elms when mature and you hope that the ones you

plant will live to grow up, so give them plenty of room. In a small school yard, you will not find it possible to group the trees; better plant them in a row along the rear and side fence and along the street at the front. The beautiful effect obtained by irregular grouping, you must make with the larger shrubs, and not too many of them for you will constantly bear in mind that the playground is none too large at best. The lilacs, sumachs, snowballs, syringas, etc., may be planted about five feet apart in the group, putting the higher growing ones such as the lilacs and sumachs at the rear and lower ones in front.

#### WHAT WILL YOU PLANT?

First of all, do not ask the nurseryman for anything this year. See what you can do with familiar material at hand and later on when your success is apparent send for a few choice trees or shrubs.

I do not know in what section of the state your school house may stand, and so I cannot tell you to take this or that particular tree, shrub or vine, but I can say this: On your father's farm or in the woodlands you may perhaps find as much material and fully as beautiful as that often secured from the nursery. Perhaps you haven't had your eyes opened to the beauty of the simple things about you. If so begin at once to hunt for them. There are wild vines whose flowers would be counted beautiful if they grew in your mother's garden, and not in your father's corn field. The wild morning glory is a good example of this. There are trees and shrubs in the woodlot and along the creek that would grace the most beautiful lawn if rightly placed. This then is the idea, to use what lies next your hand, and by skillful arrangement bring out its particularly beautiful features. You may

not succeed at this with the first trial. Few do, but you will be growing familiar with the plants in your neighborhood, learning their best points and how to make the most of them. There is another thing in favor of using your native plants and that is that they are accustomed to your locality and will usually do better than strangers brought in from other and different soils and climate. But it must be remembered that there is often one serious obstacle to the use of native grown trees and shrubs. They usually grow in the forest or thicket and consequently are long and spindling, unused to sun and wind and difficult to transplant since they have few fibrous roots. Nursery grown trees usually have an abundance of fibrous roots, have stems used to sun and exposure and have clean straight bodies and so are more likely to give satisfaction.

Perhaps the first thing you should decide upon when making up your list of things to plant is this—Are you planting for your own pleasure only, or as well for that of the classes who will come after you? If you are planting for the present only, you would better confine all your work to the school garden, or at the most, put in a border of annuals or some quick-growing shrubs here and there. However, if you wish the school grounds to be pleasing year after year you will do best to plant no annuals except in the garden proper, and elsewhere put trees and shrubs that will be a delight as long as they continue in their places (provided they are well treated and remain in a healthy condition). At this point it is well to remember that only the sturdiest and best formed trees and shrubs should be selected for transplanting into your school yard. A weakly, bent young tree will never make a desirable, mature specimen. It is well, too, to

select young trees as large as you have means to move, for these seem to suffer less from the change and will reward you sooner for your labor. One tree from ten to fifteen feet high with good root system, will be more satisfactory than two or three not more than five or six feet high. As to the varieties of trees you should plant, you must be governed, as was noted before, by what available material the neighboring fields or home nursery affords. It is safe to assume that you can find some splendid young plants that will make most desirable members of your tree groups. There are many varieties to select from, but you will be governed by what appears sturdiest in your locality.

Your neighboring woods will probably offer walnut, hickory, elm, oaks, maples and locust—any or all of which are worthy of a place on the school grounds, if there is room for so many large growing varieties.

Next for us to consider after the trees, are the shrubs, without which our lawns would seem very barren. They fill up empty places along the foundation wall, the fence and before unsightly outbuildings. It may at first thought occur to you that they are too small for a school yard, and this may be true of some of the smaller growing or dwarf shrubs, but there are many which will prove most useful and beautiful additions to your list of plant friends.

I feel sure that you will be surprised when I tell you that the *elderberry bushes*, as many people call them, really the American elder, will be among the finest of shrubs for your school yard, while purple and white lilacs, sumachs, snowballs, black currants, and even the smaller growing currant bushes are not to be scorned. You will see that I have not mentioned one unfamiliar

name in the little company of shrubs, and yet I doubt whether some of them would have been remembered by you as desirable for the school yard lawn.

If you really wish something a little less familiar—although old friends are the best—then get that one of the spireas known as Bridal Wreath. It is able to endure the cold, it will cover itself with bloom and be always graceful and beautiful whether in flower or leaf only. The Japan Quince is another pleasant acquaintance to make, whose branches in early spring are brilliant with scarlet flowers. Along the fence what could be more beautiful than several wild rose bushes? There are some hardy roses, such as the old-fashioned yellow rose and the June roses of our grandmothers' days, all of which would make the border planting a delight to the eye in early springtime.

If there is a dead tree on the school premises—don't grumble at it or have it taken away before Arbor Day unless it is far enough gone to decay to be in danger of falling. If sound enough to stand high winds, plant at its base a wild honeysuckle, bittersweet or trumpet-creeper or even the five-leaved ivy, if the others are not to be secured in time for this year's planting. These vines are all hardy and once planted will soon cover the old trunk with a foliage more beautiful than its own was.

#### HOW TO PLANT.

In transplanting a tree or shrub as much of the root system as possible should be left with the plant. It is just as important to spare the fibrous roots as the larger ones. These gather plant food for the tree while the chief purpose of the other roots is to hold the plant firmly in place. It has been proven by examination of many young trees that there is a sort of balance between root

and branch growth; that is that the size of the root system is about equal to that of the tree top. Now it would be impossible in most cases to take up as large a growth of roots as the top, so the right thing to do is to prune the young tree carefully until it is of a size easily manageable and then dig far enough away from the base of the trunk to insure saving an equal amount of root growth. In this way the roots will not be overworked in an attempt to nourish too large an upper growth. The same is true of shrubs and vines. Be careful while taking up the plants that the roots are not allowed to dry out or be much exposed to sun and wind.

Dig a hole deep enough to allow the plant to stand as deep as it formerly grew and broad enough so that the roots may be spread out naturally just as they were when taken up. If any roots have been badly broken during the process of digging they should be cut back to a smooth surface with a sharp knife. Once in its place, each root should be carefully surrounded by earth so that no hollow spaces are left. Scatter the fine soil over the roots and press it down little by little until you are perfectly sure that every root has its own covering of earth and is firmly in place. After the roots are covered, tramp the soil down firmly with the feet and continue this until the hole is filled up. In nature you will notice that even very young trees are held with such firmness by the soil that it is almost impossible to pull them up. Do not allow weeds to spring up about the newly set trees. These trees should have no rivals to deprive them of any portion of their food and water supply. It is well, too, to rake the soil frequently in order to keep in the moisture with a dust mulch. This principle was explained in an early lesson.

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THIRD SERIES, No. 8.

WHOLE No. 32.

TAYLORVILLE, ILLINOIS, APRIL, 1903.

## THE SCHOOL GARDEN.

(Continuation of Lesson 6.)

After the seeds have been planted and school gardeners are waiting for the young plants to push their way up to the light, teacher and pupils will still find much to interest them in the soil. The suggestions given in the November lesson were only to point out the paths which might be followed if you cared to find out some of the secrets of the soil. Once started soil experiments and investigations prove so fascinating that you will be constantly on the alert for something to add to your notebook story of the soil. Take soil in hand instead of a text-book and discuss its uses, texture, treatment; get at the meaning of such terms as soil atmosphere, soil moisture, etc. Study one by one Bailey's reasons for tillage as quoted in the December lesson. Ask yourselves how tillage can increase the ability of the soil to retain moisture, how it can check evaporation. Read carefully Professor E. G. Howe's article in the May SCHOOL NEWS entitled "Watering the Garden With a Rake". This surface working of the soil for the purpose of keeping the moisture from escaping is one of the most important lessons to be learned in connection with our garden. However do not take any writer's say so but try for yourself and see how your plants will behave if the ground is left hard and unworked, as compared with others growing in well worked soil.

Since Professor Howe's article on cultivating the garden is to be found elsewhere in this issue of THE SCHOOL NEWS, you will refer to that when in doubt as to the treatment your school garden soil requires. Remember that the great part of plant substance is water which carries all other plant food in solution up through the plant system. Think how helpless the plants would be in obtaining food if the soil should be thoroughly dried out. In order to avoid this drying out do not use a watering can but take a rake and follow the new plan for watering gardens.

If you wish to test the value of sunlight to your garden, take a cigar box and cover a small portion of your lettuce row after the seeds have germinated. Examine the young plants underneath from day to day and compare them with the ones having the benefit of the sunshine.

#### LIFE STRUGGLE OF PLANTS.

If you have sown your lettuce seed very close you will have a crowded colony of lettuce plants each one struggling for its share of sunlight, food, moisture and room. Look elsewhere than in your garden rows for evidences of this same struggle for a chance to live. Examine a spruce or pine tree and find out what happens to the small inner branches. When walking through dense woods stop for a little while and examine some of the seedlings which are crowded very close together. Notice their shape. Are the branches wide spreading? Explain their direction of growth and notice where their leaves are borne. Do not cease to think about this life struggle which plants carry on until you have found for yourselves illustrations of this and have recorded them in your note book, nor until you have come to realize that this strug-



gle for a chance to live among the things of nature is only a type of the same struggle which goes on among animal life and mankind as well. Professor Bailey says of this condition of life that "Those variations or kinds live which are best fitted to live under the particular conditions". Herbert Spencer, the great scientist called this struggle for existence "survival of the fittest". You will hear this phrase quoted very often and if it has heretofore not meant much to you, it will be very clear after you have watched your little garden plants in their efforts to get room enough and sufficient food, or after you have seen how the branches and even the leaves of the same tree have the same hard fight for a good foothold and plenty of breathing space. The strong will survive and the weak will be pushed aside and will finally give up the struggle.

#### RECORDING CHANGES.

When the young plants send up their first leaves, make a drawing in your garden note book of one plant of each variety. Record the number of seed leaves. You will have a drawing as a record of the leaf form of these first leaves and later on when other leaves develop make a second drawing and compare the shape of these later leaves with the first ones that appeared. Also compare frequently the first or seed leaves of the various varieties you have planted so that you can recognize at first glance a lettuce, radish, or other tiny plant.

It will be interesting to keep a record of various changes which your growing plants make, as for example, the increase in foliage, height of the plant taken at weekly intervals; texture of leaves as compared with the first leaves. Keep a careful watch for any insects that seem to be taking too much interest in your garden. The plants selected for this year's work, with the exception of

the potato, are not particularly troubled by insects. With the gay little stripes of the potato bug you are probably already familiar and since you have so few plants for the bug to attack, it will be the simplest way out of the battle with them if you catch and kill them as fast as they appear. Were you gardening on a larger scale, the quickest cure for potato bugs is to apply Paris green solution about one-half pound to 50 gallons of water.

#### SWEET PEAS.

When your high sweet peas stretch up six inches more it will be time to put in fine, but strong, brush behind each row so that the vines may have some support as they lengthen. The best way is to plant in a double row, say eight or ten inches apart, and put the brush between. If you prefer, drive in a five-foot stake at each end of the row and another in the middle, as the row is rather long. Nail a slat on the upper end of these stakes and another down near the surface of the ground. Then put shingle nails in each slat and weave strong twine up and down for the vines to cling to. The bush peas will need no support. Be sure to keep all flowers picked before they begin to ripen seed, for, as was told you in the first garden lesson, when a plant begins to mature seed it soon ceases to bloom. I wonder if you care to know in what country the sweet pea was first found? Italy is its own native country, but some seeds were brought to England about two hundred years ago, and ever since that time it has been a favorite in the home flower garden.

#### THE STUDY OF CLIMBERS.

A most interesting series of observations are suggested by that row of climbing sweet peas. Suppose we watch these vines as they mount higher and higher

and see how they do it. Compare their way of getting where they want to go with that of climbing nasturtiums, the moon vines, morning glories and balloon vines, or whatever vines you can find in your neighborhood. Do you suppose they all have the same way of climbing? There are, as you know, several ways by which plants climb. Some vines throw out roots which hold on firmly to walls or the bark of trees. Poison ivy, English ivy and the trumpet creeper send out such clinging roots. Others, as the grape vine, are held up to their support by tendrils. What other vines have tendrils? Are the tendrils of different vines alike in the manner of growth? Does the tendril coil in one way through its whole length? Do leaflets ever serve as tendrils? Examine some of your vines and see. One or two of your vines will wind round and round whatever they climb upon. Such vines are known as twiners. A plant or vine which simply spreads upon another plant without having any means of clinging fast is known commonly as a scrambler. You will probably not have any such vines near your school house unless you chance to have a bittersweet in the wood near by. A few blackberries climb in this way.

#### BLOSSOM AND SEED.

As your plants bloom study the shape and parts of the flower and make drawings of them. Try to find other flowers of the same or similar shape. When your China asters bloom compare the flowers with dandelion blossoms. See if there is any similarity. Examine what is commonly called a dandelion flower and see if it is really a single flower or a bunch of them.

In the fall when you allow some of the flowers to ripen seed, in order that you may collect them for the

winter study of seeds, the different forms of seed receptacles will be an interesting study. Perhaps the one that will seem the most curious to you is the balsam or "touch-me-not." When the balsam seed pods ripen, gather some and see if you can find out why they have been given the name "touch-me-not." The action of the balsam seed pods may start many a talk on the manner in which different seeds are expelled from their covering. The seeds of some kinds of plants are thrown two or three feet from the plant. The word dehiscence is used to describe the opening of the pod for the escape of the seed. Examine the fully ripened pods of many different plants to see the manner in which their seed is freed from its receptacle.

Some plants are said to sleep. Have you ever seen one asleep? Does it mean what it does when we say an animal sleeps? Ask your teacher to accompany the pupils to the school garden some night. You will then see that some of your flowers doze at night, while others take that time to open. California poppies always doze at night, while moon flowers never open until the sunshine has gone. What do you know about the plant which is called the four o'clock? Just what it is that causes this strange action of some of the plants has never been settled by botanists.

While making records of the leaf shapes, textures, etc., do not fail to handle the leaves of the different plants in your garden. Some will be velvety smooth, others rough and disagreeable. One of the old-fashioned flowering plants in your garden has clammy, sticky-feeling leaves. Which is it? You will probably have to keep this question in mind until later in the season. But do not forget to find out which plant it is.

The peculiar shape of the calyx of the nasturtium will

lead you to examine other flowers to see if there is great variation in calyx forms.

#### OTHER STUDIES.

What can you find out about the evolution of the tomato? In our grandmothers' days they were grown as garden curiosities and commonly considered poisonous. Bailey's "Lessons With Plants" will give you an account of the changes cultivation has made in tomatoes.

As onions, potatoes, and radishes develop why not think of them in some other connection than as merely furnishing food material for us? Take up a study of the character of their growth first. Would potatoes, radishes and onions all be called tubers? If an onion isn't a tuber, what is it? Radishes are called crown tubers, as are all tubers which produce leaves and stems at the upper end and roots below. What crown tubers can you find in the home garden or in the market? Is there any difference in the tubers of Irish and sweet potatoes?

After you are familiar with the different kinds of thickened stems and roots, ask yourselves if they serve the plant in any way. An old potato left in the cellar will sprout and the potato itself wither away. What did the sprout feed upon to give it such a start? What do tiny bean and other plants feed upon before they get firmly fixed in the soil? May not tubers, bulbs, seeds, etc., be storehouses for plant food? Talk this over. Also their use in propagating new plants of the same kind. How many things that garden has given us to see and think about, and yet the work suggested is only a beginning of it all. One pair of eager eyes will see more things to wonder about than many a busy brain could answer. Go out in the garden and learn to see, learn to

—8—

question nature about what you have seen, and try to solve some of the problems she sets you.

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#### QUESTIONS

1. What is meant by the expression "struggle for existence"?

2. Write a two hundred word story of some such struggle which you have seen.

3. Who was Herbert Spencer? Study something of his life and writings and of Charles Darwin.

4. Select some plant and mark it by placing a small stick or toothpick near it. Make a drawing of this plant, beginning with the first leaves of the plant. Make a drawing of the same plant once each week until mature. Let each pupil select the plant whose picture history he wishes to keep.

5. Write a brief description of the way in which a morning glory climbs. Describe the manner in which a grape vine climbs.

6. How many kinds of tendrils have you seen?

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### AGRICULTURE IN SUPPLEMENTARY READING.

Prof. Frank H. Hall, one of the most prominent educators and text-book writers of Illinois, in an address before the State Farmers' Institute at Bloomington, Ill., Feb. 25, 1903, made the following statement:

"The teachers and pupils of the public schools should be provided at public expense with 'supplementary reading' and library volumes that have a distinctively agricultural bearing.

"For supplementary reading of this kind I most heartily commend the little leaflets published by C. M. Parker, of Taylorville. These are—

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# THE STUDY OF HORTICULTURE.

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THIRD SERIES, No. 9.

WHOLE No. 33.

TAYLORVILLE, ILLINOIS, MAY, 1903.

## PLANT ENEMIES.

It not infrequently happens that with the best possible care and attention children get mumps, whooping cough and other contagious diseases which are waiting around to catch little folks. So with plants which the fruit grower thinks he has given the best of care. Rust comes along and covers his blackberries and strawberries; bitter rot or scab ruins his apple crop; blight destroys his pear trees, and bugs of all sorts attack every plant he possesses.

In the first of this lesson we will talk about a few plant diseases, how to know them by the injury done, when we see a plant affected in a certain manner. In the second part we will become acquainted with a few of the insects which attack certain portions of the plant, and in the next lesson we take up plant medicines with manner and time of giving the doses.

### SOME PLANT DISEASES.

Have you ever read anything about the diseases of fruit trees and other plants? If not, I am sure you would be surprised could you see a book large enough to hold a description of them all. When one reads about the many things which may happen to prevent the fruit grower from having a crop of fruit it almost seems strange that he ever has any. Nearly every variety of vine, bush and tree has its diseases and insect enemies and it takes a

careful gardener to keep his fruit plantation free from them.

With suitable location, good soil and the right food, plants are much better able to withstand disease than those which are starved and poorly placed. But when there comes an attack of some fungous disease even the best of trees are likely to suffer somewhat. I wonder if you are sure of the meaning of the term "fungus". A fungus is a plant having neither leaves nor flowers and feeding upon some other organic substance either living or dead. Many people a great deal older and wiser than you in horticultural affairs know very little about the various fungi attacking their plants. You will notice that in speaking of more than one such plant we say "fungi". I wish you would find out for yourselves the difference in these three words: fungus, fungous and fungi. A fungus is made up of a mass of little cells and thread-like tissues. These threads as they develop and reach out to absorb nourishment from the substance upon which they feed, are called mycelia. A mycelium does the same kind of work as the root of a flowering plant. These thread-like tissues drink up the sap and in time if sufficiently numerous will kill the plant upon which they live.

Let us suppose that in the fruit garden are strawberry plants, currant, raspberry and gooseberry bushes, grape vines, cherry, plum, apple, peach and pear trees. You see we are confining this part of the lesson to some of the diseases of fruit plants only. It would be impossible to describe in so short a lesson all of the diseases and insect pests of even one of the plants mentioned; but this may help you to recognize some of their more common enemies.

You would think the specialists in plant diseases had selected some very unpronounceable names should we use



the terms by which they describe the various plant diseases. For the greater number there is a common name which will answer our purpose just as well. There are two or three different names for almost every one of the different plant diseases. For instance, leaf blight, rust or sunburn are names for a strawberry complaint that is very common. Small red or purple spots appear here and there on the leaves and soon grow larger and browner until the whole leaf may be discolored. This disease is worse after the fruit has been picked, and you may wonder what harm it can do at such a time. Just as every sickness makes a person weaker, so every time a plant is affected it becomes less able to produce good fruit the next year.

Sometimes the fruit and leaves of the strawberry plant are covered with a whitish cobwebby mildew which curls up the leaves as though they had wilted. This affection is known as mildew. These two diseases are the ones which usually do serious injury to the strawberry plantation, and you will have little trouble in recognizing either one. Right here let me urge you to examine all the orchards and small fruit plantations within reach to see if you can find any of the diseases or insects which are described in this lesson. If you happen on anything which you are not able to name, either ask the fruit grower or send a little piece of the sick plant to the Botanist or Horticulturist of the Illinois Experiment Station, Urbana.

Currant and raspberry bushes and grape vines are attacked by diseases very different in character and appearance, but frequently spoken of by the one term—anthracnose. The anthracnose of currants shows itself in small blackish brown spots between the tissues on the upper sides of the leaves, which turn yellow and drop in mid-summer. On raspberries, blackberries and dewberries

anthracnose first attacks the canes just above the ground, the affected parts becoming sunken, with the center gray and the rims purple. The disease creeps up rapidly and the fruit on diseased canes dries up before ripening. The anthracnose or scab of grape vines causes brown spots on the leaves and scabby spots on the new growth and the fruit. This word—anthracnose—is made up of two Greek words meaning “coal” and “disease,” the dark color of the diseased spot suggesting the name.

Plum and cherry trees seem to have their share of enemies among fungous diseases and the insect world. Probably the most common diseases are black knot and leaf blight, or shot hole fungus, so called because the diseased spots on the leaves fall out after a time and leave small round holes. The black knot of plums and cherries is a strange looking disease. Early in the spring a yellowish swelling appears here and there along the branches and trunk of the tree. This lump continues to darken throughout the season until it becomes jet black. It often extends four or five inches along the stem the first year and each year increases in extent until the branch dies. This disease makes the tree very disgusting in appearance and is perhaps the most easily recognized of any of the plant diseases.

A most serious fungous disease which attacks cherries, plums and peaches is known as brown rot. The fruit and very young twigs are attacked by this fungus, and if you have never seen a peach so diseased, I am sure you will remember having seen the disease on cherries. Just when the fruit is ripening it turns brown and looks as though rotted; the next stage is a whitish gray coating of spores. A spore, you will remember, answers the same purpose as does the seed of a flowering plant, that is, it reproduces

its kind. Consequently, a cherry, peach or plum covered with thousands of these little brown rot spores is able to spread this disease broadcast among the fruit. Peach trees have a disease known as leaf curl and its name describes it so well that little more need be said except that the leaves turn yellow and fall so early in the season that a new set appears.

The most serious disease of pear trees, and one which also attacks quinces, and some varieties of apples, is known as pear blight. This is a bacterial disease entering the tree through the blossoms and growing tips and causing the leaves to turn brown. They do not, however, fall from the tree.

An entire lesson might well be spent in studying apple diseases and insect enemies, but if we are to take time to learn anything of the appearance of some of the insect pests of the other fruits, we can only describe briefly two of the most prevalent diseases of the apple. The most destructive disease of this fruit is the apple scab, attacking both leaves and fruit, and causing dark gray or blackish scab-like spots, distorting the leaves and cracking the young fruit. Usually both leaves and fruit drop off early. It appears when the trees are in bloom and unless checked will continue its destructive work throughout the early part of the summer.

Bitter rot is a disease which is most common in the southern states, although it does terrible damage in southern Illinois during some seasons. It confines itself to the fruit and branches of the tree and does not appear on the leaves. It may not be noticed on the fruit until just before harvest time, and then the entire crop may be lost in a day or two. The disease causes light brown patches on the surface of the fruit, the center of which is specked

with black dots in ring-like patches. In Illinois it usually makes its appearance about the first of July, but sometimes not until late in August.

#### INSECTS.

There are two or three kinds of insects usually spoken of as leaf rollers which prey upon the leaves of strawberry plants and cause them to roll up. They are very destructive some seasons, especially in the commercial strawberry fields of our state. The strawberry crown borer and white grub, the latter being the larva of the May beetle, are also quite destructive in strawberry fields which have been planted more than a year or two. The crown borer works its way into the crown of the plant in midsummer and the white grub eats the roots. The wilting and dying of the plant is an evidence of the work of these insects, and they may be found by digging up the plant.

While your currant and gooseberry bushes are in flower you may be surprised some day to see that scarcely a leaf is left on the bushes. Go out and examine them. You will probably find hundreds of small green worms. These are the larvæ of the currant saw fly, a fly not very unlike a common housefly, but rather more yellow. The fly usually appears when the first leaves open and their tiny white eggs are laid on the under side of the leaves. In about ten days they hatch and the worms, at first a whitish color, change to green and later are ornamented with black spots. Many people allow these worms to eat up their currant foliage year after year, until the bushes are too much weakened to produce fruit in any quantity. Among raspberry insects the cane borer probably causes the most mischief. It is a small black beetle, very slim, and about one half inch long. It makes two girdles around the tip of the cane in June and lays an egg between the two, just above the lower girdle. The larva, when fully developed, is about an inch long, bores down

through the cane. The insect attacks blackberry canes as well. The presence of this insect may readily be guessed at if the tip of the cane wilts.

Probably none of our plants are freer from insect enemies than is the grape. The most common one is doubtless the grape slug, or saw fly, as it is sometimes called. This is a small, shining black fly, which lays her eggs upon the under side of the grape leaves early in the spring. These eggs soon hatch and the worms, when fully grown, are about  $\frac{5}{8}$  of an inch long, and of a pale yellow color, with greenish backs and many spots all over the body. They feed in company and are so regular in their movements as they devour a leaf that they look very much like soldiers moving together across a field.

The worst insect enemy of plum and cherry growers is the curculio or "little Turk", as it is occasionally called. It is a grayish brown beetle about one fourth inch long having a snout curved under the body, by means of which a hole is bored in the fruit. In this hole the egg is laid and then a crescent-shaped incision is made in the skin about it. In a few days the egg hatches and the worm begins at once to eat its way into the fruit.

The plum curculio is also very often destructive in peach orchards, stinging the fruit and causing it to be wormy and perhaps to drop prematurely. Borers too of various kinds may destroy peach trees by boring into and girdling them. The yellowing of the foliage may suggest the possibility of these little fellows being present.

The commonest of all fruit insects is the "apple worm" or codlin moth as it is properly called. Every boy or girl has experienced keen disappointment sometime during their life by being obliged to throw away a big rosy apple after biting into it and finding it to contain a pinkish worm three fourths of an inch long. The adult insect which lays the egg from which this worm hatches is a very innocent looking moth of a grayish brown color and about half an inch long. This moth, which passes the long winter months in a cocoon, makes its first appearance in the spring just about the time the

apple blossoms are falling from the trees. The eggs are laid on the young apple usually at the blossom end. These hatch in a very short time and the young worm at once begins to eat its way into the fruit. As the apple grows the worm develops and seems thoroughly to enjoy its home. The presence of the worm in the fruit is easily determined by the casting from the burrows and by the early ripening of the fruit. This premature ripening may cause the fruit to drop before it fully develops. In any case the apples which are so affected may safely be considered worthless. It would be an interesting little lesson in nature study if you should pick some young apples so infested and study the character and markings of the insect and the nature of its work. Tie a muslin bag over an infested apple hanging on a limb and watch for the appearance of the moth which will soon develop from the worm in the apple. As you examine the pretty wings of this gay little creature try to estimate the amount of damage which an old mother moth can do by laying her eggs upon the young apples and thus giving life to many destructive worms. Our next lesson will tell you of a very effective way of protecting the fruit from this pest.

One of the most destructive of leaf-eating insects is the canker worm, which is very common in neglected apple orchards at this season of the year. It is a dark brown measuring worm and when mature is about an inch long. Jar the limbs of an apple tree and you will soon discover several worms for study. Whenever they are disturbed they lower themselves from the limb by a silken thread and dangle at some distance from it until they consider the danger past.

I hope that the acquaintances you form in the insect world this summer may arouse your interest sufficiently to insure your starting a school collection of insects injurious to fruits. Your teacher will gladly help you with this collection and if you are at a loss for the name of some of your friends send them to the State Entomologist, Urbana, for identification.

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THIRD SERIES, No. 10.

WHOLE No. 34.

TAYLORVILLE, ILLINOIS, JUNE, 1903.

## PLANT MEDICINES.

If a farmer's cow or his horse becomes ill, someone who has made a study of the diseases of animals and the cures for the same is called in to prescribe or the farmer himself gives to it some tried mixture of drugs which he knows from experience will fit the case. Now if farmers and fruit growers would be as careful to study the diseases of their horticultural plants, there would be fewer complaints of "bad luck and no crop" when fruit gathering time comes. To many people, who think it perfectly natural to doctor diseased animals, the idea of buying medicine for sick plants never seems to occur. Yet just as certain medicines have been discovered which cure or render less severe our own diseases and those of domestic animals, so earnest horticultural investigators have found combinations of chemicals which applied to plants rid them of both disease and insects. Unfortunately there are too many skeptical people, who cannot be made to believe that it is worth while to do more than feel discouraged and blame providence for a lost fruit harvest. It is more often to the lack of a spray pump and plant medicines than to the unkindness of providence that such failures must be laid. It is true that with the increase in the number of cultivated plants there has seemed also to be a like increase in the number of bugs and diseases to attack them, so that horticulturists of to-day really have a harder fight with these pests than did their ancestors.

However, so much has been learned by careful experimenting, about the cure and prevention of these ills that almost anyone may make a success of his garden or fruit plantation if he will give the matter of plant medicines or spraying a little attention and trial.

#### THE FIRST STEP.

In attempting to prescribe a remedy for a sick plant, it is necessary to follow the method of any physician and first be sure just what the disease or insect is that has made its appearance or which it is expected will come along to feed upon its fruit or leaves. Now the descriptions in Lesson 9 of a few plant ailments were not intended to be complete but were probably clear enough to enable you to recognize a large number of them if you were to make the attempt. I am sure that you will find a study of plant diseases and remedies very interesting if you go out into the orchard and garden and try to make friends with the plants there. I hope it may be possible for you to add to your library Mr. E. G. Lodeman's book, "The Spraying of Plants". This book should be in the home of every grower of horticultural plants if he wishes to successfully rout the enemies which will surely attack them some season or other.

#### SELECTING THE REMEDY.

After carefully examining his patient, the physician goes over mentally those drugs which his medical training leads him to select as best suited to check the progress of the disease or make its effect less severe. The fruit grower needs to follow this same plan, but he will find few difficulties in the path if he keeps in touch with the work of the various experiment stations which are constantly testing materials to determine the most effective check upon certain diseases. Again, experience



teaches us that the wise horticulturist should apply various solutions to his plants at definite times each year. This is because the development of insects and fungi is governed as is also plant life by climatic conditions and other circumstances of a definite or a periodical nature. After a few years of careful observation it is an easy matter to make the applications at just the right time.

A list of the spray solutions which have been tried by different experimenters would not prove very interesting or even instructive material for this lesson even if the mere list could be crowded into this little leaflet, but fortunately long experience has proven that for the troubles which beset our western plants, there are a few tried and trusty remedies and these alone can be considered at this time. However, if you secure the book above referred to, I hope you will not fail to read the chapter on the "Early History of Liquid Applications". You will find it very interesting to trace the work of those people who spent many years in testing the value of different chemicals for spraying. If each fruit grower had to be his own experimenter, it would not seem strange to see neglected fruit plantations eaten up by disease and bugs, but the business of experimenting has become the work of the experiment stations of our states and every year many pages are printed giving accurate suggestions for the treatment of plants affected with different diseases. These bulletins or circulars are not sent out haphazard but go to each person who is sufficiently interested in them to see that his name is put on the mailing list of his own state experiment station.

#### CHECKING SOME PLANT DISEASES.

Suppose we go out now into the garden and see if we can find a bush or vine affected with that disease of

which we learned in the last lesson, called *anthracnose* because of its black color. Copper sulphate, one pound, dissolved in fifteen gallons of water and sprayed on the canes before the leaves come out would probably be effective, but even this will not always check the disease, and then the only thing left to be done is to root up the bushes and plant varieties not so easily affected by this disease on some other part of the fruit plantation. For the anthracnose of grape vines a sulphate of iron solution is used. It can be put on with a white-wash or other brush.

For the black knot of plums, there is no satisfactory remedy. The best way is to cut out and burn the diseased branches. In late winter or early spring heavy applications of bluestone (copper sulphate) solution may be used, followed later in the season by Bordeaux mixture. For the leaf blight apply Bordeaux mixture just after the blossoms fall and once again in about two weeks.

Brown rot of plums and cherries is a difficult thing to fight as there is little use to spray after the disease has made its appearance. When the disease is known to exist, the trees should be sprayed with the copper sulphate solution before the buds open. After the blossoms fall the Bordeaux mixture should be applied every two weeks until the fruit is nearly mature.

For the pear blight, which may also attack apples and quinces, there is no remedy but to cut out and burn the diseased limbs. This may do something to check the disease. Some people also recommend spraying with Bordeaux mixture.

For apple scab fungus, make three applications of Bordeaux mixture at intervals of a week or ten days, the first application to be made just before the blossoms open.

For bitter rot of apples make three applications of Bordeaux mixture at intervals of six or seven days, commencing about the middle of June.

#### DESTROYING SOME INSECTS.

You will remember that in an earlier lesson we talked about "the survival of the fittest". In dealing with the insect world this struggle is repeated, for when it becomes a question as to whether insects or fruit grower shall profit by the fruit harvest, the fittest always wins. If the fruit grower is an energetic worker, he attacks the enemies of his orchards so thoroughly that the crop is his, but if on the other hand he would rather lose the battle than fight, then the insects show their enterprise and carry off the fruit. Don't you think that under the circumstances they have a right to it? If the fruit grower finds that his strawberry plants are attacked by the leaf-roller insect, he cuts off and burns the foliage as soon as the fruit is picked. The worms, as soon as through feeding, pupate in a rolled up leaf and if these are cut and destroyed there will be but few insects left over. If undisturbed, another generation of worms will appear later in the season, probably during August, in which case the second brood may be destroyed by using paris green.

If another insect, the crown borer, appears, burning off the patch may do good. The most satisfactory way to deal with this insect, and also the white grub or May beetle, is to plow up and destroy the patch, starting a new plantation in land which has not been in sod for some time.

The larvae of the saw-fly attacking currant, gooseberry, blackberry and grape vines is a very easy enemy to conquer. As soon as it appears, a spray of Paris green

solution routs the entire tribe and leaves the vines free from this pest.

The little beetle which stings the fruit of the plum, peach, cherry and apple, and which is known by the name *curculio*, is destroyed in large numbers by spraying the plants and their fruit with paris green solution; but the most satisfactory way of getting rid of them on small trees, such as plums, is to jar the tree in the early morning. The beetles evidently regard this shaking up as very unpleasant for they at once curl up and fall off the tree. A sheet spread under the tree catches them and they may then be put to death speedily.

For the codling moth of apples, an application of Paris green just after the blossoms fall and again in a week or ten days may be made. A second brood may appear in July, and if so another dose of Paris green should be given them. You will notice that in the case of the apple scab fungus referred to earlier in the lesson, applications of Bordeaux mixture were advised for the same time as this Paris green solution for codling moth; and experience has proven that in this case we may kill two birds with one stone, and to do this the paris green is mixed with the Bordeaux, thus saving the time and expense of making all of the applications.

Canker worms are easily gotten rid of by spraying the plants on which they feed with Paris green as soon as the insects arrive.

#### MAKING THE SOLUTION.

The chemicals and solutions to which we have so often referred in this lesson are not difficult to put together, although this is the excuse often made for neglect which looks considerably like laziness.

The Paris green powder, if pure, will not dissolve in

water. The water simply holds the tiny particles suspended and carries these to the tree, where they are left by the evaporation of the water. It is very necessary therefore that every bit of the dry powder comes in contact with the water and does not float in lumps on its surface. This may be done most easily by putting the dry powder in a bottle or jug and partly filling it with water, then corking and shaking the vessel vigorously for a few minutes. This solution may then be mixed with a larger quantity of water with no difficulty. The principle is the same as that which your mother follows when she mixes the flour for gravies with a very little water or milk before putting it in the pan. One pound of Paris green and two hundred gallons of water is the usual strength for the insects mentioned in this lesson.

Hellebore and London Purple are two other insecticides which may be mixed with water and used in place of paris green, but they are usually not so effective.

When copper sulphate is to be applied to plants, one pound of the crystals is dissolved in fifteen gallons of water. This solution can only be used on plants before the leaves come in the early spring because it would burn the foliage.

The Bordeaux mixture is simply the copper sulphate solution mixed with a lime solution, and this is neither a complicated nor difficult mixture to prepare. Four pounds copper sulphate are dissolved in a small quantity of water and when this is done add enough water to make a total of twenty-five gallons. Do the same with the lime. Of course the lime solution is not satisfactory unless the rock lime is properly slaked. This means that a small quantity of water must be used until the slaking is completed and then the balance of the twenty-five

gallons of water added. By "slaking of lime" is meant the changing of the rock lime to a lime and water solution. As soon as a little water is added to the lime, it commences to heat and break up. Add just enough water to keep the mixture boiling; enough so that the lime will not burn. It is an easy thing to add too little water but it is just as important to avoid adding too much, until after the whole mass has become thoroughly heated and dissolved. The two mixtures of lime and copper sulphate, twenty-five gallons each, are now ready to be put together. This should be done gradually if possible by allowing the two to flow in a slow stream into a third receptacle, where it can be well shaken, giving a bluish solution called the "Bordeaux Mixture".

#### APPLYING THE SOLUTIONS.

Proper chemicals and solutions are of little account unless they are properly applied to the plant. A good hand pump mounted on a barrel usually answers the purpose, but the commercial orchardist usually likes to have a more powerful machine, and for this reason several power spraying outfits have been devised. All of the working parts of the pump as well as all the parts which come in contact with the liquid should be of brass, since most spray solutions will in a short time destroy iron or other metals of that kind. The barrel or other receptacle to which the pump is attached may be carried in an ordinary farm wagon. For spraying apple trees and other orchard fruits the pump should be provided with two leads of one-half inch hose, each twenty-five feet long, and to the end of which is attached a bamboo extension rod. The end of this rod should be provided with a double Vermorel nozzle from which is discharged a fine misty spray if the required pressure is given by the operator of the pump. Allow the fine spray to fall on the leaves and fruit in the form of a mist or dew. Heavy spraying would cause the solution to run off, carrying with it the chemicals.

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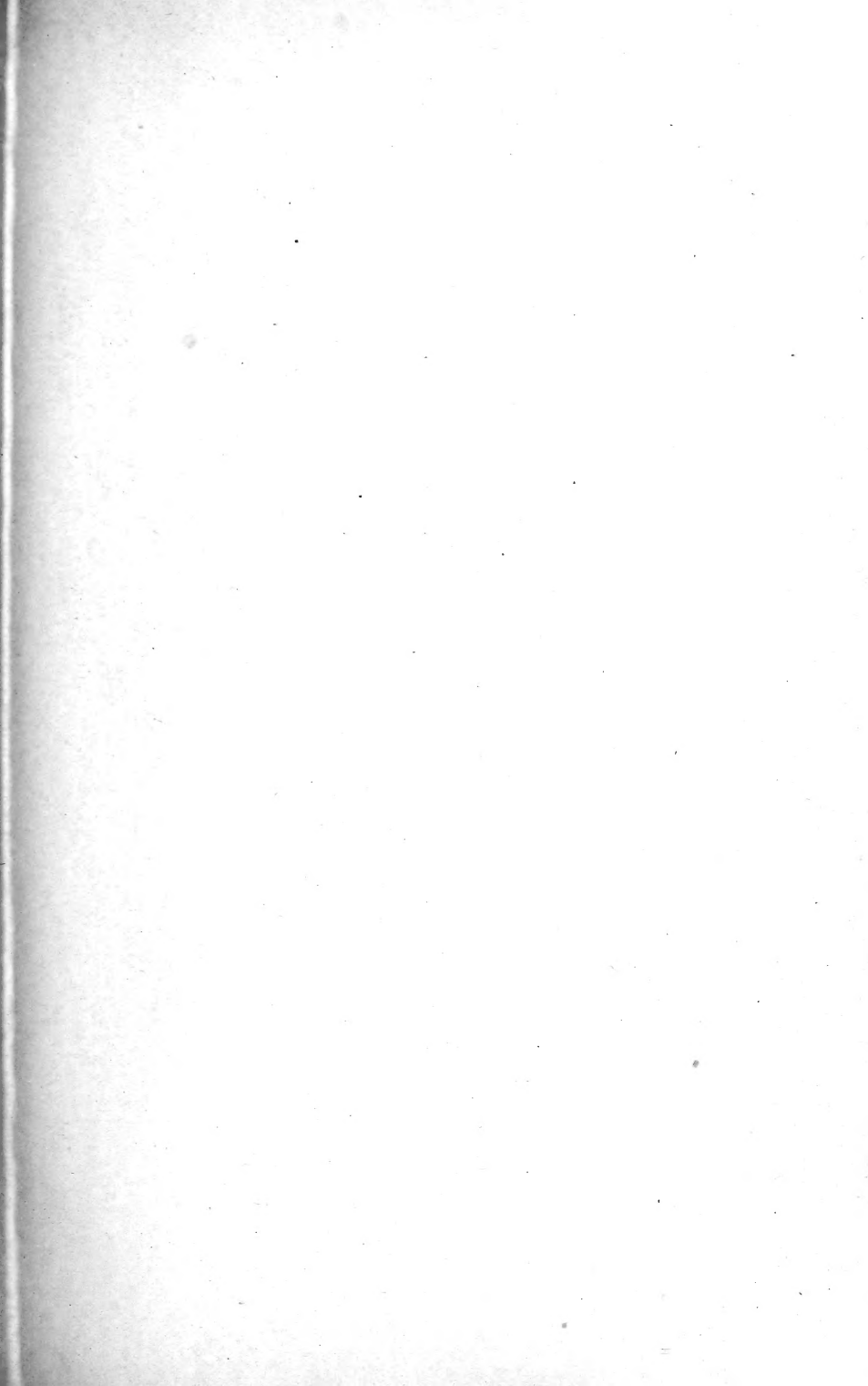
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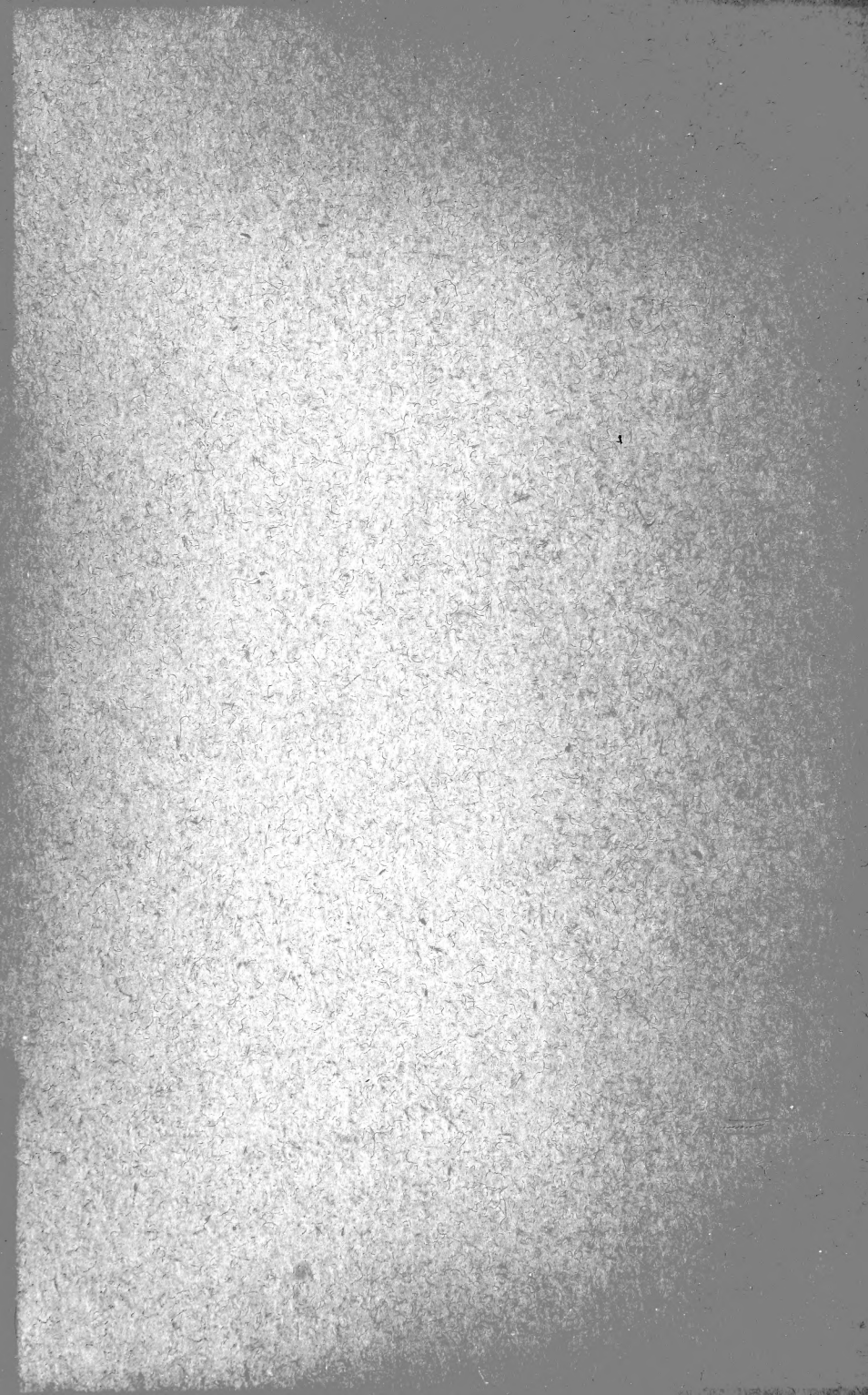
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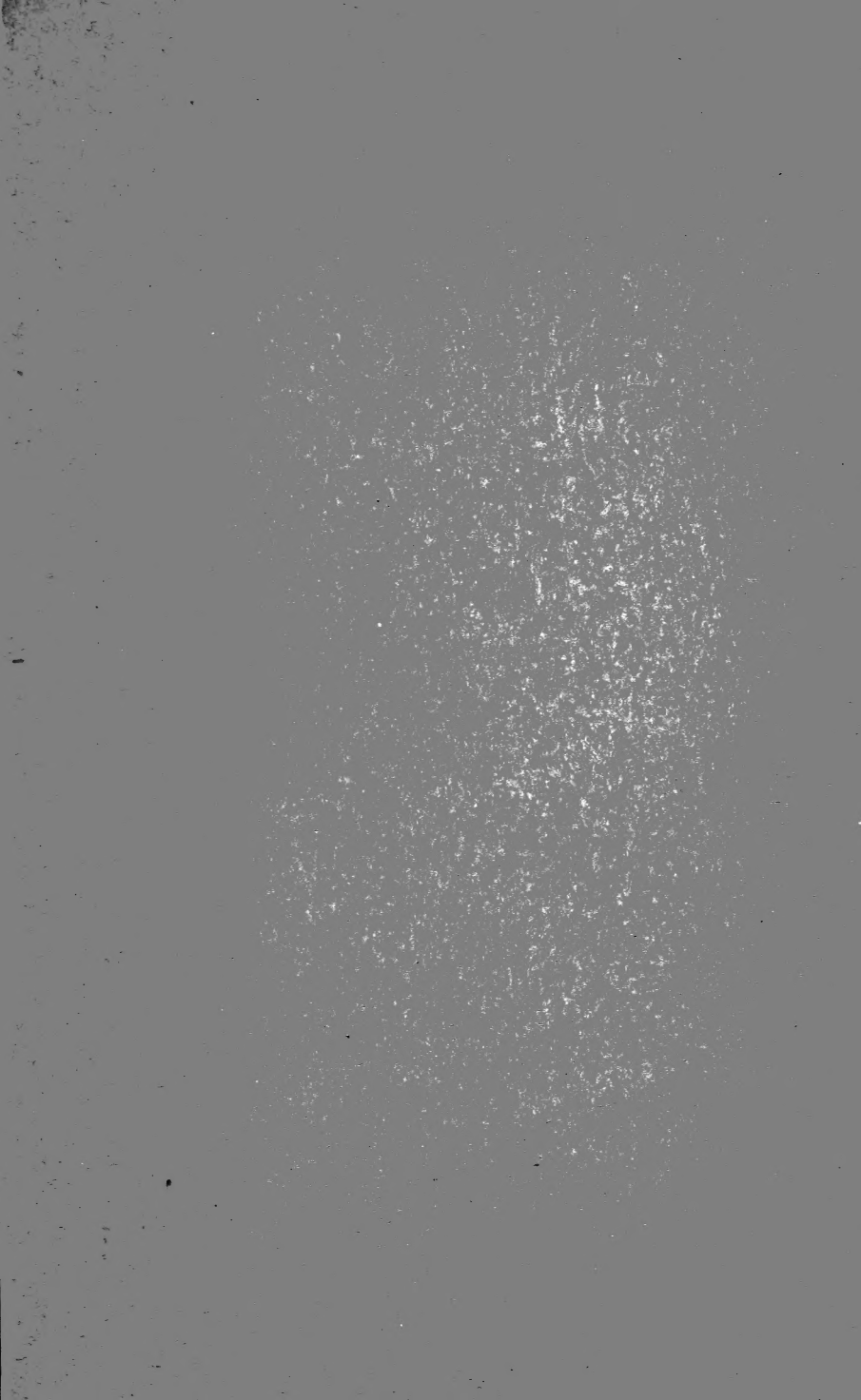












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