THE FARMERS READY REFERENCE BOOK

THE MOST COMPLETE FARM BOOK ON THE MARKET. EVERY DEPARTMENT OF FARM LIFE COVERED IN DETAIL BY EXPERTS

CLASSIFIED AND INDEXED FOR CONVENIENT USE

THE

Farmers Ready Reference Book

FOREWORD

In compiling the Farmer's Ready Reference Book it has been our one aim to place between its covers the greatest possible amount of useful and practical information of real value to the farmer. It is not a haphazard collection, gathered at random and from doubtful sources, but has been made up without sparing time, labor and expense, from the experience and experiments of many who have devoted time and energies to the finding of this information.

A great majority of the articles herein are taken from the bulletins of the Department of Agriculture and are written by men high up in their different departments. Some of the information is taken from the experience of the state experiment stations, and some from individuals who have proven especially successful in their various lines of farm work. We have made no effort at special display or outward attractiveness, but have tried in every way to produce a thoroughly simple, reliable and practical volume. We trust that the book may lessen the perplexities of our readers and assist them when in difficulty.

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CORN AND ITS CULTIVATION

C. P. Hartley, Bureau of Plant Industry.

It is possible within a few years to double the average production of corn per acre in the United States, and to accomplish it without any increase in work or expense.

If sixty bushels are raised on one acre instead of on two acres, the labor of plowing, harrowing, planting, cultivating and harvesting is greatly reduced.

The producers of the United States have, during the ten years previous to 1910, averaged in round numbers 2,500,000,000 bushels of corn yearly. In producing this quantity a little more than 95,000,000 acres have yearly been devoted to corn growing. The average production per acre has been twenty six bushels. Very few farmers would like to acknowledge that their average production for the last ten years has been as low as twenty-six bushels per acre, but the conclusion is unavoidable that half of those who grow corn harvest less than twenty-six bushels per acre.

Since the average crop in the states best adapted to corn growing is but little above the general average of the entire country, it is evident that the average is not lowered to any great extent by the poor crops in sections unsuited to corn growing.

Poor corn crops are usually attributed to unfavorable weather for there are but few years during which this crop does not suffer more or less. But there are other conditions that are responsible for low production, and it is these that make possible the doubling of the average yield per acre within a few years.

IMPROVEMENT IN SEED PLANTED.

The first of the three ways for increasing production is by improving the quality of the seed planted. It is a sure and inexpensive way of increasing the production and usually receives the least attention of corn growers in general. Many farmers who give considerable attention to improving the fertility of their farms and bettering their methods of cultivation take their seed corn from the supply that happens to be in the crib at planting time without considering that their production is largely dependent upon the quality of seed they plant.

In purchasing seed corn it is wise to give more attention to the productiveness of a variety, its uniformity and adaptability to the soil and climate where it is to be grown than to the varietal name.

Careful breeders of productive strains of corn are needed in every locality and growers who do not care to grow a special seed patch and select their seed with care should buy the best seed obtainable.

IMPROVEMENT IN CONDITION OF SOIL.

The opportunity for the improvement of the soil offers a wide and inviting field to the intelligent farmer.

The cultivation of corn will never be found profitable on very poor land. Some growers every spring plant corn on land which they

know is too poor to produce a profitable crop. Corn growing should not be attempted on such land until it is brought into a fertile condi tion by the growing and plowing of leguminous crops and the application of manures.

The corn plant will not produce grain unless the soil is rich enough to afford a considerable growth of stalk, and the richer the land the heavier will be the yield of grain.

When poor soil dwarfs grass to half its natural size the crop of hay is reduced one-half, but when poor soil dwarfs the corn plants to half their natural size it is probable that there will be no grain yield.

Poor land in a few years can be made to produce good corn crops. Fertilize the poor fields or confine corn growing to the bottoms. It is too great a waste of labor to plow, harrow and cultivate unproductive spots. Poor clay spots should be enriched, swampy places filled or drained, and the corn planted further from timber. No field can be well tended if the corn rows extend through a portion too wet when another portion is in best condition for cultivation.

SOIL WASHING AND ITS PREVENTION.

Soil washing must be guarded against if profitable crops are to be harvested for a number of years.

The effect of heavy rains is to wash out gullies and ditches and to carry away the soil and plant food as muddy water. If this is allowed to continue unchecked the lightest and most fertile portion of the soil is carried away and the land becomes less productive from year to year.

Because land is rolling or hilly does not signify that washing must take place. Some very hilly sections which have deep porous soils full of humus wash but little, and that only when the ground is frozen to a considerable depth and thaws on the surface.

Hard soils that do not readily take up the water that falls on them wash much more than loose porous soils. The most effective means of preventing washing is to cover the soil with vegetation and loosen the subsoil so that the rainfall can penetrate and be absorbed instead of running off. The rows of corn, moreover, should run at right angles to the direction of the slope. Terraces when properly placed and well constructed are effective barriers to soil washing and their use is to be encouraged.

The carrying away of soluble plant food and lighter portions of soil is not the only objectionable feature of soil washing. The water itself is likely to be needed during some portion of the summer.

By loosening the subsoil and covering the surface with a growth of vegetation the soil can be made so absorbent that the water will penetrate the ground and be held in reserve to sustain the growing plants during drouth.

CLAY SUBSOILS TURN WATER.

Some very fine clay subsoils are so compact that they turn water almost like a slate roof. Such subsoils should be made porous and permeable, and the most effective and cheapest way to accomplish this is by growing deep rooted plants such as clovers, alfalfa, melilotus, etc.

Some subsoils instead of being too compact are too open. A subsoil of coarse gravel may allow the water to pass away too readily, thus washing out and draining away the fertility. Such subsoils are not compact enough to supply the surface with moisture and are benefited by the plowing under of vegetable matter.

RETENTION OF SOIL MOISTURE.

The amount of moisture needed to produce a crop is much greater than would be imagined, and with corn would need to be sufficient to cover the field with water to a depth of 10 to 15 inches.

More corn crops are cut short by an insufficient quantity of available soil moisture than by any other cause.

After the soil and subsoil have become well supplied by the rains of fall and spring and winter, the next important consideration is to retain it in the soil constantly within reach of the growing crop.

The rapidity with which moisture will evaporate from the ground depends upon the condition of the pores that connect the surface with the deeper soil. The most practical protection is a covering of finely pulverized dry soil two or three inches deep.

In this condition the surface soil becomes quite dry and remains so without absorbing moisture from below, thus acting as a mulch and retaining the moisture within reach of the plant roots. A rain however will wet the surface, causing the soil to run together and crust, necessitating another cultivation.

FERTILIZERS AND CROP ROTATION.

For increasing the yield of truck crops or high priced crops the application of commercial fertilizers is often highly profitable because their cost is small in comparison to the prices obtained for the produce.

A soil lacking in fertility can of course be made to produce a crop of corn if the requisite amount of nitrogen, potassium and phosphorus be added and the soil kept in a good physical condition, but the growing of corn on very poor land is usually attended with little profit.

If the soil is such that the application of one or a few elements at a small cost will induce it to produce good corn these should be supplied, but if little more than a foundation to which must be added large quantities of plant food corn growing should not be attempted until the land had been permanently enriched by manure or the growing and plowing under of leguminous crops. The plowing under of such crops is the cheapest way to permanently enrich the large areas existing in almost all states of the Union, and which each year yield poor corn crops for lack of fertility.

Soils that have become so completely exhausted that they will not produce a leguminous crop should be inoculated with the proper nitrogen gathering bacteria, and should receive manure and commercial fertilizer sufficient to produce some crop of legume. Cow peas and soy beans are good crops for very poor land.

In sections where wheat, oats or other crops are harvested in early summer it's almost always desirable to follow them with a soil improving crop that can be turned under in the fall or spring. Clover sod turned under in the autumn and then torn to pieces and well mixed in the soil by cultivation the next spring furnishes one of the best seed beds in which to plant corn.

Whatever may be the system of crop rotation, all fields which are subject to blowing or washing of the soil should be kept covered with some crop during the winter. This is usually advisable even though the field is not subject to blowing or washing, and if the proper crop is grown during fall and early spring it will enrich the soil when plowed under. If oats are to follow a corn crop, clover, cowpeas, soy beans, velvet beans, wheat, rye, or some other crop should be planted in the cornfield at the last cultivation, or as soon as the corn is cut.

The growing of beans, peas, clover, etc., is a great help to the soil even though the seed be gathered or the vines cut for hay, but the turning under of the entire crop enriches the soil to a greater extent and on poor soils causes a very noticeable increase in yield for two or more years.

The most valuable information regarding the growing of corn in any particular section can be obtained from unprejudiced observant corn growers of many years' experience.

The methods of cultivation in general use in one section of the country differ greatly from those in another section, and while these

differences are to some extent due to the nature of the farm land or to the class of labor employed, they are to a still greater extent due to the conservatism of the farmers themselves.

If every corn grower could visit all the corn producing states the general result would be the discarding of poor and the adopting of improved methods. Almost every section excels in some particular respect.

In the South Atlantic states terraces are used for preventing the washing away of top soil. Rows and stalks in the rows are spaced at distances suited to the fertility of the soil, and where poor soil forces the planting of rows six feet apart the economy of growing a soil enriching leguminous crops between the corn rows will be observed.

In the West he will learn curtailing expense by the use of plows, planters, cultivators and corn harvesters, designed so that one man can drive many horses and accomplish a maximum of work.

FALL PLOWING.

Fall plowing can not be recommended for all localities and soils, but should be more generally practiced than at present. If a cover crop or sod is turned under in the autumn decomposition will increase the amount of plant food available for the crop next summer.

Fall and winter plowing is one of the best methods for combating grub worms, cut worms and corn root worms. Because the surface of ground plowed in the fall is drier at planting time in the spring than that of ground not so treated, it does not necessarily follow that there is less moisture in fall plowed ground. The fall plowing has enabled the rainfall to better penetrate the subsoil, thus relieving the surface of its excess moisture. In sections where there is much rain during the winter it is better not to harrow the fall plowed land in the autumn. In tests of fall and spring plowing, preceding a dry summer, the fall plowed fields have generally yielded better.

DEPTH OF PLOWING.

There has been much contradictory evidence regarding the best depths to plow for certain crops. For a deep, rich soil deep plowing is best, providing it is done in the fall or does not render the soil too loose and dry. For thin clay soils subsoiling is better than very deep plowing, because it does not turn the compact clay to the surface, yet at the same time loosens the soil to a good depth.

A little subsoil turned to the surface occasionally allows the elements to act upon it, liberating plant food, and as it becomes mingled with surface soil and vegetable growth the soil will be increased. To accomplish these desired results it is well to plow a little deeper each year for several successive seasons, and then for one season give a plowing at about half the depth of the deepest plowing. The plow should be so adjusted that it will turn all the soil and leave the surface smooth. In every instance spring-plowed land should be pulverized the same day it is plowed.

PLANTING.

Corn planted early most oftens gives the best yield. Occasionally later plantings yield best, but they are excèptions. In the Northern states there is little choice as to time of planting. Corn must be planted as soon as the ground is sufficiently warm, in order that it may mature before early fall frosts. In the Southern states the growing season is long enough to allow planting at different dates, thus lessening the liklihood of having the entire crop cut short by drought. Growing conditions are more favorable in the spring, and corn usually produces better if planted at that time. Although the Southern summers are long enough to afford plenty of warm weather, corn planted in the summer will ripen in less time, and usually produces less, than if planted in the spring. Fields planted early frequently escape at-

tacks of the bud worm, while later plantings of the same year suffer.

The best planting season has been found as follows: Middle Georgia, March 15 to 20; Illinois, May 11 to 18; Indiana, May 1 to 11; Kansas, May 2; South Dakota, May 10 to 20. Corn should not be planted in cold or wet ground because the calendar shows that the usual time for planting has arrived, but by good drainage, fall plowing, etc., every farmer should strive to have his land in good condition to plant at the proper time.

Underground drainage will prove most profitable in the end, but as this is rather expensive it is sometimes desirable to use low flat land for corn before it is possible to have it tile drained.

More care can be exercised dropping a precise number of kernels and covering them with mellow soil when the planting is done by hand, but the labor saved by the use of planters is so great that for profitable corn growing their use is indispensable. If the seed bed is in proper condition any good planter can be made to cover corn as satisfactorily as it can be done with a hoe, and if seed ears having kernels of uniform size be selected and the small and misshaped kernels at the extremities of the ears be rejected good corn planting machines can be made to drop with sufficient accuracy.

The kernels of different kinds of corn vary so much in size and shape that it is necessary to adjust the planter to each kind of corn to be planted.

The proper depth to plant must be governed by the quality and moisture of the soil. If it is stiff, heavy clay, containing plenty of moisture at planting time, one inch is sufficiently deep; but if it is a light, open, dry soil, three or four inches is a satisfactory depth. If the corn is planted deeper than four inches much of the food supply stored in the seed will be consumed before the young plant can reach the surface and expand its leaves.

They can better be fortified against dry weather by planting the seed in a furrow, covering it slightly, and then gradually cultivating the furrow full of soil as the plants grow. This requires some care, however, as the furrow should not be filled to any great depth until the plants have attained a height of two feet or more and have established their root systems at the desired depth. This method of planting is especially well adapted to deep soils where dry weather is likely to prevail during the middle or latter part of the growing season. The lister, the implement with which a large part of the corn is planted in the Prairie States, fulfills the requirements of this method of planting.

By planting in a deep furrow, as is done with a lister, weeds in the corn rows are more easily covered by cultivation, and as the furrow becomes filled by cultivation the root system is placed at a greater depth. The corn is thus better enabled to endure drought, and the stalks are not so easily blown down. On soils where corn can be listed without previous preparation of the ground this method is profitable because of the labor saved, but it can be successfully employed only on very deep, loose soils. When the drill is attached to the lister, one man with three strong horses can do in one day all the work connected with the planting of seven acres of corn. The drill is so constructed that it can be detached from the lister and used separately. By this means an additional man and horse are required to drill the corn in furrows made by the lister. If the soil is stiff and heavy it should be well plowed and brought into good condition for planting before the corn is listed. A lister or a planter with lister attachments which lists two rows at once and makes a mark to guide the driver on his return, can then be employed. Disks or double mould boards can be attached to the various makes of planters and check rowers, and thereby the corn can be planted in the bottom of furrows below the general surface of the field.

Perhaps more corn is now planted by means of the check rower than by any other device. The spacing of the rows and the distance between the plants can be regulated to suit the requirements of the

soil. By means of a wire chain stretched across a field one man and team can plant in straight rows in both directions across the field twelve or fifteen acres per day, thus admitting of cross cultivation. Corn planted in this way can be kept free from weeds and well cultivated without costly expense.

Checkrowers are best adapted to large and comparatively level fields free from trees or stumps. Hillsides and sloping ground can not be planted in checks without increasing the liability of soil washing.

Some find it profitable to use a two-row marker set the same as their checkrower, the checkrower follows the deep furrows, thus accomplishing all the advantages of both listing and checking.

DISTANCES BETWEEN ROWS AND HILLS.

The distance between rows and stalks in the rows affect the production per acre. A proper number of stalks evenly distributed, so that none will suffer from crowding, and so that there will be enough to produce the greatest number of well formed ears, constitutes the best stand for the production of ear corn. If planted thicker than this the weight of stover increases and the production of good ears decreases. If planted thinner the weight of stover as well as of ears decreases.

Small growing varieties should be planted thicker than varieties producing tall stalks. For greatest production rich soil requires thicker planting than poor soil. Each farmer must determine the best distance for his particular corn and soil.

On many farms of slight fertility in the leading corn states of the Mississippi Valley the annual yield is considerably reduced because the corn is planted as thickly as would be advisable on fertile prairie or bottom soils. Here the thinner planting practiced in regions generally less fertile could be adopted with advantage. Corn should not be planted on soil so poor as to necessitate the placing of the rows five or six feet apart.

The distance for planting in a particular soil should be decided upon and the planter adjusted to plant accurately and regularly. Spots missed by the planter, as well as those depleted by crows, insects, etc., greatly decrease the yield per acre. The custom of planting many times thicker than the stand of stalks desired is not a good one. It is a waste of seed and also of labor to thin or "chop out." If the seed germinates poorly it should not be planted, for although a stand may be obtained by very thick planting the stalks will not be thrifty, and a reduced yield will result from using the poor seed.

It is not only a waste of land to have missing hills in a cornfield, but also a waste of labor in cultivating them. If a field has been drilled in but one direction, and for any reason a poor stand is obtained, it can be replanted with a checkrower set to drop one kernel at a time and operated without the tripping chain. The checkrower is driven at right angles to the rows of the first planting and is operated so as to plant just as it crosses each row. For this purpose two men will be required, one to drive and one to trip the checkrower as it crosses the corn rows.

THOROUGH EARLY CULTIVATION.

The most successful corn growers realize the importance of thorough early cultivation, thus preventing any check in the growth of the plants because of weeds or crusted soil. The farmer should see that, from the time of germination to the maturing of the corn, the plants are not subjected to any unfavorable conditions, but are given an opportunity to make a steady, vigorous growth.

As a consequence of heavy rainfall the stalks may increase rapidly in height, and at the same time, for lack of cultivation or of soil fertility, or for other reasons, they may be slender or of poor color. Thrifty corn plants are thick, strong, and of dark green color.

Horse weeders and harrows should be used when needed to break a surface crust, check insect depredations, or kill young weeds that

start before the corn is up or large enough to be worked with other implements. During the first cultivation, or while the plants are very small, narrow shovels that throw the soil but very little should be used, and fenders are usually found desirable to prevent the covering of the plants.

Experiments are in favor of shallow cultivation. There are but few occasions when deep cultivation is preferable. If excessive rains have packed the soil and kept it water soaked deep cultivation will help to dry and aerate the soil. Breaking the roots of the plants must be avoided so far as possible.

After plants have reached a height of two or three feet, the soil even in the middle of the rows should not be cultivated deeper than four inches, and usually a shallower cultivation will prove better. For retaining soil moisture a loose soil mulch two or three inches in thickness should be maintained.

Corn should be cultivated often enough to keep down weeds and to maintain constantly a loose soil mulch till the corn has attained its growth.

A greater number of cultivations will be necessary when rain falls at intervals of about a week, causing the surface soil to run together and crust. This crust must be broken and the soil mulch restored or evaporation will rob the soil of its moisture. Too frequent cultivation during long drought is a mistake. After a fine mulch of about three inches has been produced its frequent stirring is not necessary except to keep weeds from starting. The object of cultivation is to restore the soil mulch as soon after rain as the condition of the ground will permit. If this time is allowed to pass and the ground becomes hard and baked dry the crop will suffer greatly. Cultivation of hard dry ground breaks it up into clods allowing the air to penetrate to greater depths and causing more damage than if cultivation had not been given at all.

Many crops are cut short by stopping the cultivation, because the corn is too tall for use of a double cultivator without breaking down the stalks. If the condition of the soil demands it, shallow cultivation should continue, even though the corn is tasseling.

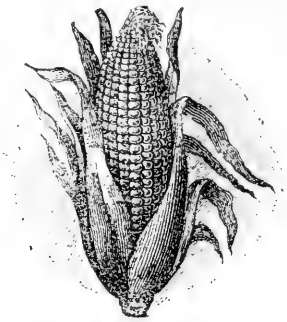
KIND OF CULTIVATORS.

With a good riding or walking double cultivator one man can cultivate as many acres as two men with a one-horse cultivator, and with the improved types he can accomplish the work more easily and as well.

Because of this saving of labor double cultivators should be used whenever practicable. Two-row cultivators equipped with four gangs of shovels and drawn by three horses are meeting with favor in the Prairie States. As one of these completes the cultivation of two rows of corn each time it crosses the field, one man can cultivate fifteen acres per day. In many sections it is often difficult to obtain laborers when they are needed and, with these two-row cultivators one man can cultivate as many acres as two men with double cultivators. Some forms of these two-row cultivators are mounted on two wheels, like two-horse double cultivators, while others made for plowing listed corn are carried on runners or low, broad wheels designed to follow the rows made by the lister Three-row cultivators of this type are used to some extent on large fields free from obstructions. Very stumpy land or tall corn may necessitate the use of one-horse cultivators.

GOOD SEED CORN

C. P. Hartley, Bureau of Plant Industry.



A good corn for any section is a corn that matures in time to escape frost or drought and that produces grain or shelled corn of good quality abundantly. An error is very frequently made in northern sections in attempting to grow a corn that is not sufficiently early in maturing. On the other hand, a corn should be sufficiently late in maturing to utilize the entire period of good growing weather, as longer growth is favorable to greater production.

DESIRABLE STALKS.

A desirable stalk is one without suckers, or offshoots, thick at the base, with well developed roots, gradually tapering toward the top, and bearing a good ear or ears slightly below its middle point. It is not advisable to obtain a taller growth of stalk than ten feet, and in the extreme North the short growing season does not permit of more than half this growth. The stalk should be free from smut or other disease, possess well-formed blades, preferable twelve to sixteen, and have its ear attached by an ear stalk, or shank, not more than four or five inches in length. The stalk is the individual and corresponds to the individual animal, which, with good breeders, is so carefully chosen.

DESIRABLE EARS.

An ear of cylindrical shape, well rounded at each end, affords the largest percentage of grain per cob as well as kernels of the most uniform shape. The cob should be neither too large or too small, and should possess the property of drying well and quickly, causing it to be of light weight and of a bright healthy color. The kernels should fit compactly together throughout their full length on both sides and edges, and should be uniform in shape and length on all portions of the ear. In poorly selected strains of corn undesirable ears of almost every possible size and form appear. Length is a very desirable character for the kernels of a corn to possess, as it is by increased length in proportion to the diameter of cob that the percentage of grain is increased. Soft, chaffy kernels, though long, or kernels with prolonged chaffy caps are not desired. It is much better to select for increased length of kernel than to select for small cob, reducing the size of the ear. It is also an easy matter to reduce the size of the cob to such an extent that the pressure of the kernels causes the ear to break. The shape is that of a wedge having straight sides and edges. This shape admits of the kernels fitting together so compactly that little or no space is wasted. The germ, the most nutritious portion and the portion in which is located the embryo plant, should be large, smooth and firm.

Breeding a productive strain should be begun with the best corn available. The experience of the farmers of a given locality, and experimental tests made at the State Experimental Station may help to decide with what corn it is advisable to begin the work. If the

soil or climatic conditions are peculiar, it is advisable to begin with a native strain adapted to these peculiarities. If a uniform strain bred in some other locality proves as productive it should be given the preference because of its better character.

The strain having been decided upon, the next step is to fix in mind the ideal stalk, ear, and kernel, and preserve for reference from time to time a sample ear that approaches most nearly to the ideal. A field of several acres in extent of the kind of corn chosen should be carefully gone through, and a hundred or more desirable ears selected from the most desirable stalks that can be found.

WHEN TO SELECT SEED.

If one feature desired be the production of an earlier corn the best time to perform the selection work is at the time the earliest stalks ripen and the ears begin to dry. Seed ears can then be taken from the earliest stalks, thus causing the strain to grow earlier from year to year. In the central and southern sections the corn can be allowed to become quite dry before gathering seed ears, but the work should not be delayed long after the corn ripens.

CLOSE EXAMINATION.

The hundred or more desirable ears which have been selected should be placed on boards or tables, with the tips of the ears pointing in the same direction. One by one each ear of the lot should be compared with the sample ear, and any which do not conform to type should be discarded. Two or more kernels, one a third of the distance from the butt and another the same distance from the tip, should be taken from each ear and examined and measured. If these kernels are too short, or are found defective in any character the ear should be discarded.

The ears that have proved suitable should be thoroughly dried and well preserved till nearly planting time, when they should be shelled by hand, the poorly shaped kernels at the extremities being discarded and the good kernels placed in small paper bags, the kernels from each ear in a separate bag.

SELECTING A BREEDING PLAT.

In the breeding plat the best seed ears are planted in separate parallel rows, one ear to each row. This is necessary in order to determine which ears possess the invisible character of great productiveness to the highest degree. One who has never tried this method of planting would suppose that there would be little or no difference among the rows, but the characters of the ancestors appear with surprising plainness.

It is essential that the soil of the plat be uniform and that the various rows be given the same opportunity in all respects. Dead furrows and back furrows should be avoided. In case they are present, the rows should be planted at right angles to them; otherwise a row close to a dead furrow or back furrow might be placed at a great advantage or disadvantage. If one side of the patch is higher than the other the rows should be planted so that each will have an equal amount of high and low land. These points are exceedingly important, for unless the rows all have an equal chance the results of the test become unreliable.

The breeding plat should be located on land of the same nature and degree of fertility as the farm or the soil in general on which the seed produced in the breeding plat is to be planted. It is a mistake to give the seed plat extra care in the way of heavy fertilization or irrigation. The object of the breeding plat is to increase in a strain of corn the property of producing heavily under the natural conditions of the locality.

By locating the seed plat on soil similar to that of the neighborhood the strain of corn from year to year becomes better adapted to soil of that nature.

In all corn-breeding work isolation is essential. The breeding

plat should be separated from other kinds of corn by at least forty rods. A greater distance is safer, though if strips of timber or hills intervene there is less likelihood of the winds carrying to the breeding plat pollen grains from the inferior corns. The tasseling of volunteer corn stalks near the breeding plat must be prevented.

The size of the breeding plat can be suited to the size of the farm and to the labor available for the work. From forty to sixty corn rows of exactly the same length from 500 to 600 feet long—would form a plat of very desirable size.

PLANTING OF THE BREEDING PLAT.

It is better to drill the corn in the breeding plat rather than to plant it in hills. If planted in hills it is impossible in some cases to distinguish suckers from the main talks. The grower should use the utmost care to get a uniform stand of stalks in all the rows. The fertility of the soil and the available moisture will decide how thick the stand of stalks should be, but it should be the same as for other cornfields planted on similar soil. For convenience in labeling the seed selected from the various rows, it is best to number the rows by means of stakes at one end.

In order that all the rows may be similarly situated, a few border rows should be planted entirely around the breeding plat. Such border rows will often protect the breeding rows from depredations of crows, squirrels, chinch bugs, etc.

The seed used in planting the border rows should, of course, be from very select ears. Usually enough is left of the ears used in planting the breeding rows to plant the border rows.

The breeding plat should be given the same good cultivation that other cornfields require.

DETASSELING TO PREVENT SELF-POLLINATION.

Before the corn comes into tassel, or even earlier, a few rows may exhibit marked weakness. Such rows should have the tassels pulled from all the stalks as soon as the tassels show plainly in the top of the talks and before pollen is discharged. In the same manner the tassels should be pulled from all the undesirable stalks in all the rows. Undesirable stalks consist of barren stalks, stalks with many suckers, feeble or very slender stalks, smutty stalks, etc. If detasselled in time the transmission of these characters to the next generation will be prevented. In order that seed may be selected that has to no extent been self-pollinated, one-half of each row is detasseled. Each row is detasseled from one end to the middle, alternating ends of adjoining rows being detasseled.

Under ordinary field conditions a portion of the kernels are produced by self-pollination, and there is every reason to believe that those kernels which are the result of self-pollination are reduced in power of production. Pulling the tassels from the stalks before they discharge any pollen entirely prevents self-fertilization. In order to do this work thoroughly the plant will have to be gone over every two or three days at tasseling time.

COUNTING THE STALKS.

After the detasseling is finished there is no work to be done in connection with the breeding plat until the stalks turn brown and the ears begin to dry. An exact count should then be made and recorded of the total numbers of stalks, including suckers, contained in each row.

When the majority of the stalks are ripe and the husks and ears are fairly dry, the detasseled portion of each row should be gone over separately and the ears from all desirable stalks removed, weighed and at once spread out to dry, the row number being kept with each lot of ears.

When dry enough to harvest, the ears from each row should be gathered and weighed, and the weight of corn from each row added to the weight of the seed ears that were previously gathered from the

same row. This addition gives the total number of pounds produced by each row.

Having calculated the average production per stalk of each row in the breeding patch, except the very poor ones, the best ears from the ten or dozen highest ranking rows are examined, kernels measured, etc., and six to ten of the very best ears from each of the highest ranking rows preserved for next year's breeding patch.

THE INCREASE FIELD.

It is not supposed that sufficient seed for general planting or for sale will be obtained from the rows of the breeding plat. To obtain seed for general planting and for sale, an increase field is grown from the remaining seed obtained from the desirable stalks of the detasseled portion of the highest ranking rows. Due precaution is taken to prevent the increase plat from being cross-fertilized with inferior strains. Otherwise it is planted and cared for as any other cornfield.

Corn bred for several years for increased production will produce, with exactly the same treatment, ten, twenty or even forty bushels more per acre than unselected seed.

Corn can be considerably improved and rendered quite uniform by selecting from year to year the best ears from the best stalks, without regard to the producing power of individuals or without employing the aid obtained from detasseling. The improvement, however, in such case is not so rapid. Some think it necessary to obtain new seed every few years, claiming that their corn has "run out." A good strain of corn, like a good breed of animals, will "run out" if pains are not taken to propagate from the best individuals. Instead of allowing a strain of corn, through neglect, to "run out," it can be "run up" in producing power by some such system as has been outlined.

CARE OF SEED CORN.

The next step in importance after the growing of good seed corn is its care from the time it is gathered until it is planted. It is advisable that all corn which is to be used as seed—for the breeding plat, for general planting, or for sale—should be preserved in the best manner possible. Good care consists in carefully drying the ears, and at the same time seeing that they dry quite rapidly. This should be done as soon as they are gathered, and they should then be stored in a dry place of even temperature and where they will not be reached by damp air. Seed corn, although it may have become very dry, will absorb moisture if it comes in contact with a damp atmosphere. When first gathered, seed corn may be greatly injured in one day's time if allowed to freeze or to heat.

One satisfactory way of drying seed corn is to place it in thin layers on a series of floors made of narrow strips of board laid just close enough together to keep the ears from falling through. These floors should be in a shed or building that can be well ventilated, and which can be closed during damp weather. Where freezing weather comes as soon as the corn has matured, or even before, artificial heat is needed to keep the corn from freezing; but the heat should be used in connection with an abundance of dry air, as corn is not dried by heating, unless a means is provided for the moist air to pass out.

In southern sections, usually no trouble is encountered in drying seed corn, but it often becomes necessary to treat it in order to prevent its destruction by weevils, grain and flour beetles, and the Angoumois grain moth.

TESTING THE GERMINATION.

Seed corn should be so well cared for that it will contain no ears that will not germinate, and seed testing should be employed as a demonstration of the fact that the seed has received proper attention. If through accident or carelessness seed has been so damaged that a

test of 100 or more ears proves that less than 97 kernels out of every 100 germinate, and better seed can not be procured, it is advisable to test the ears separately and discard the poorest.

This test can very easily be made by numbering the ears and then taking five (or ten) kernels from each ear and placing them in numbered rows in shallow boxes of moist sand, arranging them so that the kernels from ear No. 1 are in row No. 1, etc.

If the boxes used are two or two and one-half inches deep and a damp cloth is spread over the top after the kernels are placed in the sand, no further attention will be necessary for five or six days, when the results of the test can be recorded. The box should be kept in a warm place where the temperature does not fall below 50 degrees Fahrenheit.

SELECTION AND CARE OF SEED CORN.

Some farmers may not have the time to breed their seed corn, nor opportunity to purchase. The crop depends largely on the seed, however, and no farmer can afford to neglect to save and select his seed corn by some careful method. Those who cannot breed their own seed corn or buy carefully bred seed of suitable kind are urged to follow the best method of selecting seed from their field crop, and to give the selected seed the best of care. It is important that the seed corn be thoroughly dried out before it is subjected to severe freezing. Select the seed corn early in the fall, before there is danger of freezing. Light frosts would not injure the seed, but the selection should not be delayed too long, as a severe freeze might greatly injure the vitality of the seed.

Select your seed from that portion of the field which is uniformly the best developed. Husk this portion of the field early in the season to be sure that those ears saved for seed will have been husked and preserved before freezes occur.

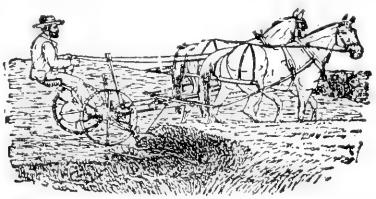
The seed corn selected should be placed in a dry, well-ventilated room where the ears can be spread out. They should not be piled in a heap, as it is important to expose them to a free circulation of air, so that they will dry quickly and thoroughly without molding.

It is important to dry out the seed corn quickly and thoroughly, and the use of some artificial heat is in most cases desirable. It is thus important, especially in damp, cold seasons, to place the seed corn in a room where there is a stove in which a fire can be maintained at least a portion of each day for about two weeks, or until the corn is thoroughly dried out.

After the corn is thoroughly dried out, all the ears should be examined carefully, and a sufficient number of the very best and largest ears should be selected to plant the next year's crop. In making this selection the grower should carefully examine each ear, selecting those having deep and well-formed kernels, which will give the greatest weight of shelled corn per ear. The imperfect kernels at the tips and butts of these selected ears should be shelled off and discarded before the ears are finally shelled for planting.

BARNYARD MANURE MAKES BIG CROPS

W. H. Beal, Department of Agriculture.



It is hard to persuade the farmer to abandon time-honored practices and adopt methods with which he is unfamiliar. He also hesitates about incurring the necessary expense of building suitable re-

ceptacles for the storage of manure, frequently assuming that this is greater than it really is.

It is to be feared that the introduction of commercial fertilizers has not been without effect in increasing the apparent indifference with which this valuable farm resource is so often regarded. Too many farmers lose sight of the fact that, as a rule, commercial fertilizers should supplement and not entirely replace the manurial supplies of the farm.

MANAGEMENT OF MANURE.

Barnyard manure is a material which rapidly undergoes change. Where it is practicable to haul the manure from the stalls and pens and spread it on the field at short intervals the losses of valuable constituents need not be very great, but when (as in winter) the manure must be stored for some time the difficulties of preservation become greatly increased.

Under these conditions, deterioration of manure results from two chief causes: (1) Fermentation, whereby a certain amount of the nitrogen is lost, and (2) weathering or leaching, which involves a loss of the soluble fertilizing constituents, including potash and phosphoric acid as well as nitrogen.

The careful regulation of the fermentation is necessary to the successful rotting of manure. If the heap is too loosly built the decomposition is too rapid. The materials useful for the formation of humus in the soil are destroyed, and the nitrogen especially that of the urine, escapes into the air, partly as ammonia, partly as free nitrogen. On the other hand, if the manure is too firmly packed the decomposition may be too slow and the manure will not become sufficiently disintegrated to produce the best effect in the soil.

A powerful means of controlling fermentation is the supply of moisture. French authorities maintain that the principal precautions necessary to prevent losses of ammonia consist simply in regularly and properly watering the manure with the leachings.

The need of keeping manure moist is especially marked in case of horse manure, which is naturally dry and decomposes with great rapidity. The same is true in a less degree of sheep manure. The common and harmful "fire-fanging" is the result of an insufficient supply of water and may be readily checked by sprinkling. The sprinkling, however, should be regularly done and the heap kept in a constant state of moisture, otherwise the alternate wetting and drying will result in a loss of ammonia.

LEACHING OF MANURE.

Leaching is the second cause of the deterioration of manure. When manure is exposed to the action of the elements and the leachings allowed to drain away it rapidly decreases in value. Both the organic and the mineral constituents originally present, or which have been made soluble by fermentation, are carried off and lost. Experiments indicate that horse manure thrown in a loose pile and subjected to the action of the elements will lose nearly one-half of its valuable fertilizing constituents in the course of six months, and that mixed cow and horse manure in a compact mass and so placed that all water falling upon it quickly runs through and off is subjected to a considerable though not so great loss.

PRESERVATION.

It is a well known fact that certain of the organisms which cause decomposition of manure are voided with the dung and commence their activity at once. In cases of horses and sheep these organisms cause a considerable loss of ammonia in a comparatively short time.

It is necessary therefore to adopt prompt measures in order to reduce loss from this source to a minimum. The means which are available for this purpose are the use of absorbents (litter) and preservatives. The liquid is taken up by the litter preserving it from decomposition, and also absorbs to a considerable extent the am-

monia produced by fermentation and prevents its escape into the air. Peat and peat moss are the best absorbents. They also furnish the largest amounts of fertilizing constituents. Peaty soil is also an effective absorbent, and the use of a mixture of peaty earth with straw as litter has been strongly recommended. An addition of from 35 to 40 pounds of loam per head daily has been found advantageous, and where straw is scarce it has been replaced to the extent of one-fourth or one-third by earth. The amount of litter required for any given animal depends largely upon the character of the food. A safe general rule is that the litter should amount to at least one-third of the dry matter of the food consumed. The following amounts per day for different animals are recommended: Sheep, three-fifths pound of litter; cattle, nine pounds; and horses, six and one-half pounds.

In order to reduce the loss to a minimum, manure heaps should be made compact and kept uniformly moist. Under cover the last result is secured by collecting the liquid manure and at frequent intervals sprinkling it over the heap, or when the supply of this is deficient, by sprinkling with water. Where the manure heap is exposed to the rain in pits from which there is no drainage it probably does not require so much attention, but still care must be taken to prevent loss by alternate leaching when heavy rainfalls occur and drying out in time of drought.

The use of completely covered barnyards for protecting manure has in recent years met with much favor in certain parts of the country. The manure from the horse and cattle stables and the sheep and calf pens is spread out evenly over these yards, covered with coarse litter, and the whole kept firmly packed by allowing animals to run over it, thus preventing injurious fermentation.

Many stables are so situated that by adding a cheap lean-to, "a receptacle for caring for the manure is easily provided. The outside boarding of the lean-to should be, for a part of the way at least, put on horizontally and hung in the form of flat doors, so that the manure can be easily loaded on a wagon standing on the outside of the building."

Whatever the system adopted, the following general rules should be observed in the storage of manure: (1) Spread the manure out uniformly; (2) guard as much as possible against the access of air; (3) keep the manure always moist, but not too wet; (4) protect the heap from extremes of heat as of moisture.

WHEAT CULTURE

M. A. Carleton, Department of Agriculture.

With wheat, as with many other crops, the proper treatment of the soil may be considered half the battle. In wheat growing a great deal depends upon local conditions of soil and climate, and as these conditions in any particular locality can be thoroughly understood only by long residence in that locality, the experiment stations in the several states should be able to give the most reliable advice relative to the adaptability of wheat to any particular section.

On large farms there is much actual area lost by sheer wastefulness in cultivation. For instance, a wide strip is left for turning ground and then perhaps not utilized; and again the plow may be al-

lowed to run quite a distance before it begins turning a furrow. If the amount of land thus thoughtlessly wasted could be calculated, the result would be surprising.

It is found, as a rule, that very early deep plowing is best. This is especially true in arid regions, where conservation of moisture is a very important matter. In such districts subsoiling may be practiced also to advantage.

For spring sowing plowing should generally be done in the fall, and for fall sowing plowing should be done soon after harvest. In spring wheat districts summer fallowing is sometimes practiced. This gives a much needed rest to the land during constant wheat cropping. Root or forage crops may, however, occasionally serve the same purpose, besides being a source of additional profit from the land.

Experience and investigation has formed the conclusion that a roller should never be used on the Western plains, except in the case of late plowing, and even then it should be used only before drilling. This is owing to the fact that roughness of surface is valuable for holding moisture and checking the injurious action of dry winds. The seed-bed should be made very fine and mellow before drilling, and wherever possible the drill rows should run east and west.

TIME FOR SEEDING.

The proper time for seeding varies, of course, with the latitude, while depending also occasionally on the locality and on the variety used. But whatever the conditions otherwise, it is a safe rule to sow at a period which is considered early in the locality where the sowing is done. Experiments show somewhat remarkable increases in yields due to early seedings. In the case of four different seedings made at intervals of one week, the average results for two to four years showed a difference in yield of from ten to twenty-six bushels per acre between the earliest and the latest seedings, the difference being in favor of the former. In apparent contradiction of the foregoing statements, it seems to be pretty well established that spring varieties, when used for fall planting, must be sown quite late. The contradiction, however, is perhaps only apparent, for in regions where the character of the climate permits an extremely late fall sowing, say as late as December, may as correctly be called a very early spring sowing. Turkey, Odessa and allied varieties, in ordinary seasons, may be sown in western Kansas and Nebraska in any month of the winter with equal probability of success.

In the northwestern states especially, only hardy winter varieties should be used for early fall sowing. Spring varieties will kill out in such localities, although abundantly able to make a good start when planted early in the spring. Varieties best adapted to winter seeding in the northern states are perhaps yet to be found.

SELECTION OF VARIETIES.

One of the first things to bear in mind is the uselessness of giving attention to announcements made by quack seed growers of new varieties that make such astonishing yields as fifty to sixty bushels per acre where the farmers best average before had been only twenty-five bushels.

The very fact of such a claim being made for a variety at once stamps it as a fraud. Besides the exaggerated claims made for the new variety, there is always an excessive charge of perhaps $15 per bushel which is generally a second evidence of fraud. Reliable seedsmen should not be compelled to compete with such quacks. Whatever may be in store for the future improvement of cereals there is not at present a known variety in the world that will of itself without proper attention to rational methods of farming give an excess yield of as much as ten bushels.

It is the province of the experiment stations to determine what varieties are best adapted to particular localities in each state, and if they are not informed others are not likely to be.

The judicious selection of varieties is a matter of much import-

ance. There are, no doubt, certain scientific principles which, if better known could be almost wholly and safely relied upon in choosing varieties for a certain locality.

1. There are three great groups of wheats with which this country is particularly concerned: (a) The soft bread wheats, (b) the hard bread wheats, and (c) the durums, or macaroni wheats.

2. Dividing the United States crosswise into three divisions of approximately equal width, the three wheat groups may, in a rough way, be assigned, according to their adaptability, to these three divisions, as follows: (a) The hard wheats to the northern states, (b) the soft wheats to the states in middle latitudes, and (c) the durums to the southern states. In actual experience such distribution is, of course, not exactly attained, because the durums are but little grown in this country. When tried here, however, they do best in southern latitudes, as, for instance, in Texas, where they have been grown with success; and, moreover, the hard and soft bread wheats are grown interchangeably as to latitude. However, the general distribution of the three groups is about as above.

3. The terms most commonly applied to the three groups are hard wheats, soft wheats and durums. The last named are also hard wheats, but are very different in character from the first group. The soft wheats are called club, square head, white, etc.

4. The hard wheats are, as a rule, hardy and especially drought-resistant. They resist the orange-leaf rust quite well, are perfectly adapted to roller-milling, and contain a large per cent of gluten, thus making the best bread.

5. For the general market, therefore, special attention should be given to raising these hard wheats. No ordinary bread wheat does well in the extreme South, but there should be greater effort to push hard wheats into middle latitudes, such as in Kansas, Missouri, Ohio, southern Illinois and Indiana. This has already been done to some extent and should be continued.

6. In foreign markets Kansas hard-winter wheat flour has already gained a reputation distinctively its own, and is classed by some as next to the best Hungarian grades in quality.

7. The sooner millers make a more general use of hard wheats the better, for these are sure to be the varieties most in demand, and those which will grow most successfully in the greater portion of the wheat belt. It is little more than a decade since hard wheats were rarely seen in the region south of Iowa and Nebraska, but now they are the kinds generally grown in the states of the plains.

8. Much of the work of adapting hard wheats to middle latitudes has been done by acclimatizing northern spring varieties, thereby gradually changing them to winter sorts, but it is a question whether it is not better to in introduce hard winter varieties direct.

9. The finest class of bread wheats in the world is grown in southeast Russia. As this region is characterized by a deep, black earth, an arid climate, long and severe winters, and hot dry summers —conditions very similar to those which prevail in our own wheat belt—these wheats should by all means be more extensively tested in the United States than they have been. The wheats in question are both winter and spring-sown varieties. The plants can be readily distinguished at some distance when grown with different varieties in small plats, as they are dark green, slender, with long narrow leaves; small, narrow, compressed heads; small, very hard, red grains, and often (in spring varieties) have a velvety surface. The Turkey, Ames, various sorts called Odessa, Meekins, Mennonite, Krimsh, De Theisse, Girka, Budapest, etc., are examples of such varieties. The high-grade Chubut wheats of southern Argentina are also of much the same quality.

10. The average per cent of dry gluten contained in ordinary bread wheats is about ten, but many of these hard Russian sorts contain over fourteen per cent.

11. Hard wheats do not usually give remarkable yields, but their

average for a series of years will often exceed that of soft wheats, and they almost invariably weigh more per bushel.

VARIETIES FOR SPECIAL PURPOSES.

In wheat growing it is of importance to note that certain kinds of wheat are best adapted for certain uses. As already stated, the hard wheats, as a rule, make the best bread. The kind of flour demanded in foreign markets, however, depends much upon the locality to which it is exported. It is said, for example, that our northern wheat flour is not as desirable in Central American markets as that made farther south. At the Galveston elevators it is claimed that it does not keep so well in transit. The bulk of the hard wheats shipped to England is nearly always mixed with soft wheats before grinding.

The manufacture of macaroni has recently given promise of much success in this country. It is claimed, however, by some, that the quality of the Italian products is unmistakably better than that of the home product, and that the preference given to the latter by many is due chiefly to the difference in price, the American brands usually selling at two and one-half cents per package less than the Italian. It is doubtful if there is much truth in this, but if so the difference in quality in favor of Italian brands is most likely due to the difference in varieties of wheat used in the manufacture. In Italy the durum wheats grown so generally in the warm regions near the Mediterranean Sea are used exclusively for this purpose. It will be seen, therefore, that the further encouragement of the macaroni industry in this country will possibly develop a considerable home market for durum wheats, which give promise of successful growth in the Southern states, especially Texas. Investigation will show that American macaroni is already finding its way into foreign markets.

In the manufacture of crackers the best quality of soft white wheat flour is required. The great bulk of the flour used for this purpose in England factories is imported by them from the St. Louis mills, which turn out soft wheat flour mainly.

CROSS-BREEDING OF WHEAT.

This is a comparatively new feature in agricultural science, but its effectiveness in improving the wheat plant is nevertheless now well recognized.

There is no doubt a vast field for improvement of cereals in this way. Cross-breeding adds so much vigor, and wheat is such a strictly self-fertilizing plant, that it would probably be of much value to at least occasionally practice cross-pollination.

If a hardy bearded variety which is well adapted to a certain locality and a good yielder is crossed with a bald variety of merit the beards may be gotten rid of and the good qualities still retained, or varieties which are liable to rust but are otherwise good may be made more rust resistant if crossed with a variety possessing this quality.

SELECTION OF SEED.

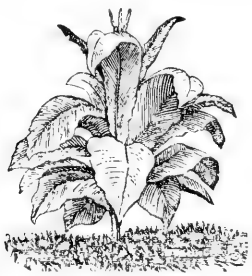
Too much attention can not be given to this subject. Many choice varieties have been developed by selecting from a field certain unusually good heads planting the grains of these separately and thereafter selecting the best each year. It has already been satisfactorily proven that the old idea that rust shriveled grains give as good returns as large healthy ones is erroneous.

Nothing would be of more benefit to the wheat grower than the establishment of special small seed plats of, say one to five acres, from which to select seed each year. The following plan is recommended: At harvest time cut from a good field a strip of the best portion, first eliminate all rye and other foreign heads and large weed seeds. After threshing the wheat from this strip, grade it by means of a fanning mill, with special sieves made for the purpose, so as to obtain only the largest and most vigorous grains. Use the best grade of wheat, both for sowing the small plat and for the general

crop the next season. The next year use none of the field crop for seed, but after grading the wheat from the small plat, as before, use the very best of it for sowing the small plat and all the remainder for sowing the large field, and so on from year to year. In this way seed is never taken from the general crop, which cannot be given the same care as the small plat, and there is a constant selection of seed, which is more and more rigid every year.

THE CULTURE OF TOBACCO

Otto Carl Butterweck, Brooksville, Fla.



Having procured the best seed for the locality and soil, the grower should maintain and improve the quality by proper selection of seed from his own crop or by the production of seed plants in other ways.

The production of tobacco seed requires careful attention because some varieties deteriorate while others improve in a given district.

HOW MUCH SEED TO SOW.

Tobacco seeds are very small and an ounce contains about 300,000 seeds. A large percentage of these will not sprout however. Some are infertile and others have a coat so hard it resists moisture.

Experienced planters usually sow at least three times the amount of seed that they expect to need in order to provide themselves with sufficient plants when the time comes for setting them out. A bed three by fifty feet, producing from 10,000 to 20,000 plants in the aggregate, can be used for sowing about one-third of an ounce of good fresh seed, but it is safer to sow three such beds for this number of plants.

The Cuban grown seed is generally light and chaffy. In saving seed for sale the Cubans frequently allow not only the single spike to go to seed, but the suckers. They are careless also in mixing small and light pods containing many undeveloped seed as well as those which have been injured by insects. They do not winnow the dust and hulls from the seed as well as it is done in this country. It is necessary in planting imported Cuban seed to sow three times as much as of domestic seed.

Before sowing the tobacco seed it is well to test the germinating power. To do this, take 100 seeds carefully counted out, place them between two wet blotters, put these between two china plates so they will remain moist, and keep in a warm place at a temperature of from 70 degrees to 80 degrees. The blotting papers must be kept moist, but not wet. After ten days, separate the blotting papers and count the number of seeds that have sprouted. This will give the percentage of good seeds, and will be a valuable guide as to the quantity of seed to sow.

THE SEED BED.

A southern exposure is always best. Where possible it is advisable to locate the seed bed near water because of the moisture and more uniform temperature in such location. Often there is some danger of frost in such a locality, and in the North it is necessary for

this reason to make the beds on the high, warm land and supply the moisture artificially by means of watering.

Make the bed if possible on new land, as there is less danger of larvae, insects, and weeds and grass seed. As damp locations are more subject to parasitic and fungous diseases, many growers prefer to make their beds on high dry warm soil near the house and keep it damp by frequent sprinkling.

In the South and Cuba an open space in the woods where the midday sun shines is the favorite location for a seed bed, because of the protection afforded by the trees from cold winds and excessive drying out of plants and soil. The conditions are more uniform and there is less danger from frosts and insects.

In the North the seed bed is usually made near the house like a cold frame with muslin over it as protection from insects and excessive evaporation. Seed beds are usually burned in all localities except the perique district of Louisiana. In the North the burning may be done late in the fall or during a mild spell in the winter. In the South the land is burned over just before the seeds are sown. It is necessary to do this unless the land has been kept thoroughly clean for several years, or unless it has been mulched the preceding year, as the ground will be so foul with weeds and grass that the young tobacco plants stand little show when vegetation begins. Burning is also a protection against grubs and insects.

BURNING THE BEDS.

Anyone can readily burn a seed bed. Where any clearing has been done, the site of a burned log heap is as good a place for a bed as can be selected.

The material at hand must determine the way in which the bed should be burned. If the material recently cleared from the land is brush, spread it in a thin layer over the ground and burn it, adding more from time to time so as to keep the heat near the ground. It is not economical to have a high pile, as much of the heat will not then be effective on the soil. If the material at hand consists of rails and logs lay down a few rails or poles several feet apart to keep the burning wood off the ground and to admit air. Lay the wood on these poles from one to several inches apart according to circumstances. Start the fire on the leeward side so that it will burn slowly. A steady slow fire will make a better burn than a flashy quick one. The moisture in the soil to a depth of several inches must be converted into steam. This steam in forming uses up a quantity of heat. The fire must be continued long enough to steam the ground thoroughly to a depth of several inches. The upper layer of the soil to a depth of one-tenth of an inch or so will have the appearance of a burned brick when the operation has gone far enough.

PREPARATION OF THE SOIL.

After the bed has been burned and has had time to cool it should be broken with a hoe or other suitable implement to a depth of about two inches and the surface thoroughly pulverized. The roots and trash must be carefully raked off with a garden rake and the surface left in a level, loose porous condition. A pound of some good commercial fertilizer or guano should be applied to each three square yards and thoroughly raked in.

The surface of the bed must be thoroughly pulverized and loose, so as to permit the delicate plants to grow readily, which they will not do in lumpy soil.

The bed should not be worked deeply as this would tend to prevent the moisture from rising from below and might bring to the surface seeds of grass and weeds which had been buried deeply and escaped the heat. If there is danger of washing by heavy rains it is necessary to protect the bed by shallow ditches on the sides subject

to the flow of water to prevent the sides from being washed away or from being covered up by a deposit of sand and clay.

In the perique tobacco district of Louisiana the making of seed beds is unlike the same work in other states. It begins in October, when cow manure is applied to a depth of six inches to a chosen spot in the forest and turned under with a spade. In December the bed is worked but not burned, and ditches are cut through to secure drainage. The soil is mostly humus and the beds cannot, therefore, be burned.

In ordinary seasons the seeds will be up in two weeks after planting. After the first leaves appear the plants seem to grow very slowly, although the roots are developing then quite rapidly. In two weeks after the plants have appeared they become more vigorous and begin to grow rapidly, especially if watered with weak liquid manures. In from six weeks to two months after the seed is sown the plants are ready for transplanting to the field.

Growers usually make it a rule to plant seed beds a week or ten days apart, as a protection against unexpected cold and other causes of loss. When a bed is killed out with the cold it is immediately resown. When the plants are too thick in a bed they should be immediately thinned to allow space for a good root development. Each plant should be allowed at least a square inch of space for the roots to develop.

PROTECTION.

In any locality it is well to have the bed inclosed with a cold frame and covered with plant muslin. For this purpose, after burning the seed bed and before sowing the seed, inclose the bed with a frame made of one-inch plank, eight or ten inches wide, placed on edge, and nailed at the corners with diagonal strips of one by three-inch plank, countersunk at the corners and securely nailed for additional safety. If there are no planks available, take two poles, four or five inches in diameter, and place one on top of the other, instead of the plank. The bed may be of any desired dimensions, but it is well to have it not over three feet wide in order that all parts of it may be reached from either side. If there is any slope to the land a ditch should be dug on the upper side of the bed to prevent washing, and the earth thrown in against the side of the bed for additional protection against washing and cold winds.

SOWING THE SEEDS.

As the impervious nature of the seed coat is the reason for many of the seeds not sprouting, a very simple method can be employed to obviate this trouble. Spread a newspaper on a table and lay a sheet of the finest emery paper on it. Pour a few seeds on this and with another piece of emery paper rub the seed gently. This will scratch their thick envelopes and enable them to absorb water. It is well to place the seeds in a damp place for a day or two before scratching, for if they are very dry when scratched they are apt to be hulled when treated in this way. After scratching the coat, place the seed in a bowl and pour just enough water on them to cover the seed. Let them stand for forty-eight hours, by which time they will have absorbed all the water. Then mix the seed in the proportion of a quarter of an ounce of seed to two quarts of wood ashes, corn meal, or sterile earth and sow them carefully and evenly over the bed. Do not soak the seed unless you water in sowing. Meal or ashes are preferred to earth, because it is easy to see from the color if the sowing has been evenly done. The seed should be sowed when the wind is quiet. The seed may be sown by the thumb and fingers, or like grain, except that the hand must be held close to the bed and the sweep of the hand limited. After sowing the seed, sweep the bed over carefully with a brush or broom simply disturbing the surface of the bed and being careful not to bury the seed too deep.

The importance of covering the tobacco seed very little will be appreciated when it is remembered that tobacco seed is very much

smaller than timothy. After the seed has been sown and brushed in, it should be thoroughly sprinkled to firm the earth. It may be firmed by carefully tamping with a spade or hoe or by laying down a board and standing upon it, turning the board over and repeating until the bed is gone over.

It may be tamped with square boards eight by ten inches, secured to the feet with straps. The firming is best done by simply thoroughly sprinkling and keeping the bed continually moist.

The sprinkling should be repeated twice a week or even oftener. In hot dry weather sprinkle daily. The beds should be kept covered with canvas or cloth fastened on the side of the frame by means of headless wire nails driven in such a manner as to hold the cloth, or the covering may be fastened to small poles or one-inch strips a few inches longer than the length of the bed placed two feet apart with the cloth fastened to them. Such a covering can readily be rolled up and stored away and will last several seasons. A bed so covered will be protected from insects of all kinds. Moisture will be conserved also.

A week or two before transplanting the covering should be removed about one-half hour after sunrise for an hour or two and the time of exposure increased from day to day until two or three days before planting, when the covering should be left off entirely to harden the plants so they will stand transplanting.

TIME OF SOWING SEED.

There seems to be a general rule for sowing the seed in each state with reference to the frosts which are likely to occur in the spring. Seed beds should be planted from six weeks to two months, according to the variety of the seed before the latest date at which killing frosts has occurred in the locality. This is for domestic seed.

Imported Cuban seed should be planted a month later, and imported Sumatra six weeks later than acclimated seed. Very vigorous varieties will grow large enough to transplant in six weeks, other varieties eight to ten weeks from time of sowing seed. Transplanting should be done as soon as possible after the date on which the last killing frost has occurred in the locality and should be completed within a month. It is frequently advisable to plant earlier and take the chance of a crop being caught. Early planting save much labor in worming, and where air curing is practiced the benefit of the warm weather for the barn curing is quite an advantage. Many prefer to plant as late as the season permits because the warm sun of summer is believed to produce a sweeter product.

As a rule, planting secures the benefit of the winter and spring rains and secures comparative freedom from insects, with the exception of the cutworm. Where the transplanting is done late in the season there is more danger from drought and greater risk of a poor stand.

Where irrigation is practiced tobacco can be planted at a later date, provided it will mature during the growing season.

In localities south of the twenty-eighth degree transplanting is done in February and March. In Louisiana, March 15 to April 15; Tennessee, May 1 to 20; Kentucky, about May 20; East Georgia, about April 10; West Georgia, May 1; South Carolina, April 10; North Carolina, May 1; Virginia, May 10; Pennsylvania, New York, New England and Wisconsin, June 1 to 20.

The date of the earliest autumn frost marks what should be the end of the tobacco growing season. Tobacco is very easily injured by frosts and it should be housed by the time the first killing frost is liable to occur in the autumn. It is easy, therefore, to calculate the season in which the crop has to develop and mature. However, the first killing frost of the autumn varies considerably from year to year,

and the average date is from one to four weeks later than the earliest date in most of the localities given.

PLANTING.

The field selected for the tobacco should be plowed in the fall. This will bring it into good tilth and help to destroy larvae of all kinds. Where the ground freezes it is well to plow in the fall for the purpose of destroying the cutworms. At the fall plowing apply all rough manures, which need time for rotting. In the spring the land is plowed again as early as possible, and the fertilizers are then harrowed in. Two or three weeks from planting the land is again harrowed and laid off in rows either by throwing a furrow each way with a turning plow or with a ridger. The distance apart varies somewhat, but a general rule is from three to three and one-half feet apart each way. Sometimes the land is checked three by four feet, in order that the cultivation may be continued longer. In this case, if in the North, the wide furrows should run north and south for additional sunlight for the crop. With Sumatra tobacco, as grown in the South, four feet are allowed between the rows.

In the Northern States sunlight is sought after, while in Florida and Cuba shade is desired. Tobacco raised in an orange grove in Cuba always brings a better price than tobacco raised in the open field. In Florida open lattice sheds, with strips three inches wide and three inches apart overhead, are provided to shade the tobacco field. This method is growing in popularity.

For the smaller and finer varieties of manufacturing tobacco the checks may be three feet or three feet three inches square. In Sumatra, where the coolie does all the labor by hand, the rows are made two feet apart, and the plants stand two feet apart in the row. In Cuba and in southern Florida, where hand cultivation is still largely practiced, the rows are made two feet six inches apart, and the plants are set from twelve to eighteen inches apart in the row, according to the strength of the soil and the amount of guano applied. Such close planting as this could not, of course, be adopted where horse cultivation is practiced.

The plants are set out when they are from four to six inches high in the seed bed. This is an invariable rule in all the tobacco districts of this country; but in Cuba they are allowed to grow much larger, even as much as eight or ten inches high. In drawing the plants the seed bed is thoroughly watered, so that it will be loose and will not tear the roots much in drawing the plants. Have as much of the soil adhere to the roots when taken up as possible. The drawing should be done in the early morning while the dew is on the plants, as the leaves are less liable to be injured. The plant should be grasped in one hand between the thumb and finger and gently lifted by means of a fork or small pointed stick to prevent as much as possible injury to the stem and roots and to bring up some of the dirt adhering to the roots. The plants are then put in baskets or small boxes, the roots together. The package is then covered with a damp cloth and placed in a shady, cool place until it is time to set out the plants.

In the early spring, especially when the day is cloudy and damp just after a rain, plants may be set out at any time in the day. Later in the season, however, as the air becomes drier and the temperature higher, plants are usually set out after noon. The later the season the later the time of setting out. Also the more southern the locality or the higher the temperature the later in the day plants should be set out.

There are two methods of planting, either by hand or by the use of a planter. In hand planting the plants are dropped at regular intervals, usually by boys, girls or women, while another hand follows with a dibble made of a round stick one and one-fourth inches in diameter and ten inches long. With this he makes a hole into which he inserts the roots of the plant, holding the plant firmly with the leaves

between the thumb and finger. The dirt is then pressed around the roots with the dibble to firm the soil, and then loose earth is brought up around the plant and the whole surface left in as loose a condition as possible. Sometimes the holes are made with a staff—that is, a smooth, round stick about one and one-fourth inches in diameter and four feet long, sharpened at one end. A hand takes the staff and makes the holes with a brisk jab the desired distance apart as he walks along; another follows with a basket of plants, the plants being dropped near the holes; another follows and sets the plants in the holes. The plants should be so firmly imbedded that they can not readily be pulled up by pulling on the top of one of the leaves.

WATERING.

If the soil is damp when the plants are set they will grow without water. If the soil is dry watering will have to be done immediately before planting. A hand precedes the planter and fills the holes with water just before the plant is set in. If the season continues dry the plants may need watering until they establish themselves, which is usually about a week from the time of setting out. It is usually better to make a hole near the plant with the dibble and put the water in that and cover it over with loose dry soil to prevent evaporation. Where possible it is much better to wait for the spring rains to moisten the ground and get it in order for planting.

On large plantations in Cuba no holes are made to set plants in. They "bust out the middle of the row" with a scooter or shovel and set plants in the furrow. The plants are set so that the bud will come just above the level of the field. The furrows are freshly made as the planting proceeds, so that the soil shall not dry out too much for planting. The plants are usually longer than in this country, and if they are of extra length they are planted in a sloping position or are bent in the furrow so that the bud only will be above the level of the field. After planting the rows are leveled with a hoe. Replanting is done where necessary otherwise the soil is not disturbed for about two weeks, or until the plants are established. After that the field is continually worked and is kept like a garden. The Cubans claim that with setting larger plants less loss occurs than with small ones.

The method of transplanting with machines is now very generally practiced in the northern cigar tobacco states. The machine waters the holes uniformly before planting, sets the plant, and firms the earth uniformly and firmly around it. It is claimed that machine set plants usually grow off better than hand set ones and a better stand is obtained.

CULTIVATION.

A tobacco field should be kept clean and in good tilth, both to promote the growth of the plant, and by removing grass, weeds and trash, to lessen insects of all kinds. In ten days or two weeks after the plants have been set out, hoe between them, removing the dry dirt and drawing fresh moist earth to them. They should then be cultivated with a shallow instrument, such as a cultivator or a sweep, throwing a little dirt to the plant. The cultivation should be shallow. Do not cut or disturb the roots of the plant as it checks its growth and tends to make a fibrous, woody leaf. As a rule fields should be cultivated after every rain, as soon as the soil is in condition to work. The surface should be stirred after the rain, both to admit air and to prevent excessive evaporation. When the plants get of large size and begin to throw out buds they will be too large for horse cultivation. The field should then be kept clean from weeds and grass with a hoe. In cultivating, always work the soil to the plant. It is better to pull up a few weeds and bunches of grass near the plant than to use a tool, because of the danger of injuring the roots.

FERTILIZERS.

In fertilizing the tobacco plants it is necessary to consider both the yield of crop and the effect of certain fertilizers upon the quality

of the finished leaf. Certain substances cannot be used without injuring the burning qualities of the leaf. Chlorine, which is contained in common salt, muriate of potash, Kainit and generally in the lower and cheaper forms of potash salts, is decidedly injurious to the burning qualities of tobacco. Sulphate of potash, when used in excess, is believed to be injurious to the burning qualities of the cigar leaf. Excess of phosphoric acid is injurious, as it affects the color of the ash.

According to observations, the more phosphoric acid there is in a soil the more of it is taken up by the tobacco plant.

Excess of nitrogen, especially that in the form of raw animal fertilizers and fresh animal manure, makes a coarse, thick leaf which is unfavorable for the wrapper types, but favorable to some manufacturing and export types. Care must be taken in the production of cigar wrapper leaf and in the bright yellow leaf of Virginia and North Carolina to use only moderate quantities of stable manure or animal nitrogenous manures of any kind, as it is not desired that the leaf should be thick and coarse. With the heavy export types great quantities of these manures may be used to advantage. Large quantities of mineral manures are used in the production of both the wrapper leaf for cigars and the bright yellow tobacco, as these are both grown on very poor, sandy soils, which depend mainly for their food supply upon the minerals furnished.

From 200 pounds to a ton of commercial fertilizers are commonly applied per acre to the tobacco crop. Sometimes as much as two tons are used where a high-grade wrapper leaf or thin, bright tobacco can be produced. The fertilizer may be either broadcasted or drilled in the row just before the plants are set out. Sometimes the fertilizer is applied in two or three applications during the season.

TOPPING.

In a plant like tobacco, which is valued for the quality of the leaf, it is necessary to remove the seed head as it forms, in order that the nutritive substance may remain in the leaf. When the bud is removed the plant throws out suckers at the junction of the leaves, and these also must be promptly removed or the leaf will lose part of the nutritive matter which has been stored up in it.

Just when the proper time to top is a disputed question. It depends upon the variety of the plant, the vigor of growth, and the conditions of soil and climate, as well as upon the use for which the tobacco is intended. To retain the greatest amount of nutritive matter in the leaves and to induce a uniform ripening of the plant, the bloom bud should be removed as soon as it appears.

Just how much of the top should be removed in taking out the bud also depends upon the variety of tobacco and upon the strength and vitality of the plant. Strong, vigorous plants are topped high. When a good stand is obtained at planting, the plants will bud about the same time, but all the plants of a field will not be ready to top at the same time, and a great deal of judgment is required to know when to remove the bud. This judgment is based upon the vitality of the plant and for what purpose the leaves are to be grown. It is necessary, therefore, to go over the field several times to remove the buds, and after the first time the suckers are removed at the same time the buds are taken out. It must not be understood that suckering is not necessary before this time. Some plants send out suckers at an early period of their life, long before the bloom bud appears, and these suckers must be removed as they appear.

In the cigar-tobacco districts from fifteen to twenty leaves are left on the plant. When the tobacco is intended mainly for cigar fillers a less number are left on, as it is desired to have the leaves stronger than where wrappers are produced. On the heavier types of manufacturing and export tobaccos from ten to twelve leaves are left on. More are left in very vigorous plants than on delicate ones. Experienced toppers do not count the leaves but use their judgment

as to the ability of the plant to maintain a certain number which they think should be left on.

In Cuba and Florida a good vigorous sucker is allowed to remain when the plant is cut, and this develops into what is called a sucker crop, which while inferior to first crop, is good for filler purposes.

CUTTING.

There comes a time when the plant ceases to draw food from the air and from the soil and devotes itself to the purpose of concentrating the nourishment that was previously scattered through all its parts. At this period the leaves begin to change color, light yellow spots appear upon them, and the leaf or plant is said to be ripe and ready to cut.

As the leaves ripen from the bottom upward, the rational system is to pick or prime the tobacco as the leaves ripen. This is done in the bright tobacco district and to some extent in the cigar districts in Florida. In other districts, including the cigar districts of the North and manufacturing and export districts, the plant is cut when the middle leaves are ripe. If the plant is not fully matured at the time of cutting it is liable to cure dark, or if the weather happens to be dry or cold, so it dries out quickly, it may cure green and be worthless. The time when a plant is ripe and ready to cut is a matter of judgment and experience. There is a slight change in the color of the leaf, perceptible in looking over a field of tobacco, which shows the experienced grower that it is ready to cut. When the leaf is observed to change color from a rank green to a lighter shade of green, and yellow spots appear it is a certain indication that the constituents of the leaf have performed their duty and are going back to the stalk, to be carried to the upper leaves or to be used for other purposes in the economy of the plant.

Another test of this is to fold the leaf between the fingers, and if the leaf snaps or retains a crease where it was folded it is said to be ripe.

A plant that is topped low, with only eight or ten leaves will mature more uniformly of course, than one that is topped high, like the Sumatra, where eighteen or twenty leaves are left on the plant.

Cutting or priming should not be done when dew or rain is on the plant as it is liable to leave black spots on the cured leaf. In the South cutting is not done until afternoon in midsummer, as the midday sun is liable to sunburn the tobacco in a few moments.

Where priming is done the leaves are placed in baskets or shallow boxes to be carried to the drying sheds, where they are strung on twine or on wires. The leaves are put face to face and back to back, thirty to fifty to a string, according to the size of the leaf. The twine or wire is then stretched on a four-foot lath with a slit about two inches long sawed in each end, and hung in its place in the barn. In harvesting plants it is necessary to go over the field a number of times, and cut them only as they ripen.

Where the whole plant is cut it is allowed to wilt for several hours before being carried to the barn to prevent breaking the turgid leaves. Plants are cut and laid in rows on the ground to wilt, several rows being laid in one for convenience in handling. With the finer grades of cigar wrapper the plant is not allowed to lie on the ground directly, and in many localities the wilting is done after the plant is put on laths, upon which it is to be hung in the barn, and the laths supported on small trestles in the field or in racks arranged for the purpose. When sufficiently wilted the tobacco is hauled to the barn, either on racks made for the purpose or carefully piled on the wagon bed. In hanging the tobacco the butts are either pierced with an iron-pointed lath, or the stalk is split all the way up and the plants strung on the laths in this way. Before being hung remove all worms and eggs from the leaves, as the latter are liable to hatch and the worms do great injury to the leaves while hanging in the barn. All

the suckers should also be removed, or they will continue to grow and absorb the nourishment of the full-grown leaves.

In Cuba and southern Florida the plant is cut in sections in the field. The three top leaves, usually the finest wrappers, are cut in one section, the rest of the stalk is cut in sections of two each. Two rows are taken at a time, and the sections are assorted according to their grade and position on the plant. The field is gone over several times until all the ripe plants have been cut. Boys accompany the experts and receive the sections on their arms, the stems being turned alternately to prevent the loads from falling. When a turn has been received the boys slide the sections on to poles placed on forked stakes at convenient places in the field. These poles when full are carried to the barn. The Cubans use long poles, usually thirteen feet in length. This system has the advantage of sorting the tobacco as it goes into the barn. As the curing progresses in the barn the leaves are separated more and more for a better circulation of air.

Cut tobacco must not be left exposed to the sun and wind, especially when lying on the ground in small piles. It must be hauled to the wilting sheds or barns as soon as the leaves are sufficiently wilted to avoid being broken in handling.

Where priming is practiced the leaves should be left to mature further than where the entire stalk is cut, for while the stalk is hanging in the barn a translocation of the matters from the stalk to the leaves takes place and from the leaf to the stalk, and the leaf ages and matures, therefore, while hanging in the barn. When the leaf is once severed from the stalk, however, in the process of priming or cutting in sections, there is no opportunity for this transfer except to the very small portion of stalk which is left on the section.

SAVING SEED.

The grower should maintain and even improve the quality of his crop by a judicious selection of seed plants. To this end the field is gone over several times during the growing season and typical plants picked out possessing the greatest possible number of good points. After finally deciding upon the plants which should be saved for seed, these are allowed to grow to full maturity without removing the seed head when the rest of the field is topped. As the seeds of a plant are produced from the food material prepared in the leaves, the leaves should be left upon the seed plant until the seed is ripe. It is advisable also to have plants close together in order that they may fertilize each other by the exchange of their pollen. Only the central spike of the plant should be left for seed, the suckers being removed as they develop in order that all the nourishment taken up by the plant should go into the central spike to make heavy seed.

The largest pods will contain the heaviest seed, and these should be selected for planting.

The heavier seeds can be separated from the light by winnowing in a light wind or by screening. Seed plants of different varieties should be separated as far as possible to prevent crossing through the intervention of insects, air currents, etc. Exchanging and mixing seed of the same variety grown some miles distance is good practice, as it tends to make the seed and plants more vigorous.

Tobacco seed will retain its vitality for ten to twenty years, but it must be remembered that all seeds begin to lose their vitality from the moment of ripeness.

INSECT PESTS.

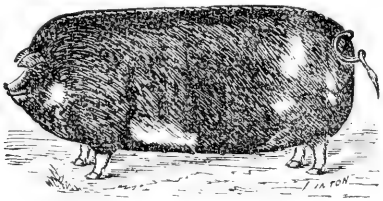
Trouble with insects begins from the moment the seed is sown, and continues even after the tobacco is harvested, and in the curing shed.

Ants in the seed bed, cutworms at the planting of the crop, and tobacco worms throughout the growing season of the plant have to be continuously sought for and destroyed. For cutworms it is best to spread over the field before planting cabbage or turnip leaves,

bunches of grass, or meal dipped in a solution of paris green, a tablespoonful to a bucket of water. Where the meal is used one tablespoonful of Paris green should be mixed with a gallon of meal or flour. Two applications are recommended. After the plants are set it is also well to dust them with a mixture of Paris green and meal. There are several remedies proposed for the destruction of the tobacco worm but the most satisfactory, although the most expensive, is to search for them in the early morning and destroy them by hand. Later in the day they are hard to find. When looking for the worms destroy the eggs of the moth wherever found. These eggs are about the size of tobacco seed and nearly the color of the leaf itself, and are hard to find. Attempts have been made to catch the moths in various kinds of traps, and considerable relief afforded thereby. The field should be gone over three times a week. Destroy the early brood if possible and there will be fewer later in the season when the main brood appears.

PIG MANAGEMENT

George M. Rommel, Bureau of Animal Industry.



The first place in hog raising in the United States is easily with the corn growing sections, and here corn is the first grain thought of when the fattening of hogs is considered. The cheapness and abundance of corn in the corn sections have often led farmers to use it as the exclusive grain feed.

But breeding stock so fed does not thrive so well and is not so prolific as when given a varied ration, and when used for fattening an exclusive corn diet is not generally profitable. The increasing price of corn has forced farmers to economize in its use as much as possible.

Any locality that will grow clover of any species, or that is favorable to the production of alfalfa, peas, or beans, or where grains are readily grown—not only corn, but barley, wheat, oats or rye—will be a favorable situation for the successful production of pork. If it is also a locality where dairying is common, no better advantages are required; for, given leguminous pasture, with a grain feed that can be readily grown, and also dairy by-products, the very highest grade of pork can be produced at a minimum cost. Variety of feed alone it an item of immense importance in feeding.

The few states comprising the corn belt are the source of supply for a great amount of the meat product, especially hams and bacon, that is consumed in other portions of the country. Yet the advantages of many of these corn-belt states are little, if at all, superior to those outside of that district. The South has an abundance of vegetation. Cow peas, velvet beans, and peanuts are leguminous crops that are peculiar to that section. Corn grows readily in all parts of the South, and in the sub-tropical portions the experience of feeders with cassava seems to indicate that it has considerable value for pork production. In addition, there is generally an abundant water supply; the climate is mild, and there is a long period during which green feed is available; the expense of shelter and winter feeding is very greatly lessened.

In the extreme West the alfalfa of the irrigated valleys and the clover of the coast districts give a splendid foundation for successful pork production. In most of these regions there is an abundance of

small grain, particularly barley, that may often be fed economically, while in some localities corn is a successful crop.

Barley is of so much interest and importance in the production of prime pork that it demands more than a passing notice. This grain has not been relied upon to any great extent in America as the principal part of a hog-fattening ration, but the practice of Danish farmers and the results of experiments can very well be studied with profit by American feeders. Farmers in those parts of the country where barley is a prominent crop can well devote attention to their opportunity for pork production; besides, in addition to this grain, some of the leguminous crops can often be grown for pasture, thus furnishing materials for a well-balanced ration.

HOUSES, INCLOSURES, FENCES, ETC.

Hogs are easily affected by extremes of heat and cold, and the character of their shelter will therefore depend on the locality. If the locality is one of severe winters, warm quarters are a necessity. In erecting a piggery in northern latitudes four things should be especially considered—(1) light, (2) ventilation, (3) warmth, and (4) cleanliness. Under cleanliness, ease of cleaning and dryness must be regarded. A well-drained location should be chosen; one that will give the hogs a good climb to reach it will provide needed exercise. The house should be on a north and south line, so that both sides may receive direct sunlight during a part of the day. The size of the house and its equipment will depend upon the size of the herd and the resources of the owner.

Not more than fifty breeding hogs should be confined in one house; sanitary considerations make a smaller number much safer.

Out of doors the number of hogs in an inclosure may be increased without danger.

The arrangement of the pens will depend largely on the climate and the convenience. A very common plan is to have only the sleeping pens under cover, building feeding pens of the same size just outside the hog house and adjoining it. If these pens are floored substantially with concrete they will last well. The house should be well constructed and warm. If boarded up inside with good matched siding, such a house will be comfortable in zero weather, and sows may farrow there with safety. Concrete or brick floors are expensive, but if the initial expense can be incurred and the floors are well laid they will pay good interest in the saving of manure and the dryness of the house. Animals should not be compelled to sleep directly on such floors, for rheumatism and colds are very likely to result. The best floor for a sleeping or farrowing pen is one of wood on concrete, the wood being two by four inch timbers, laid from one-fourth to three-eights inch apart to allow drainage. If not constructed in this way concrete and brick floors should be kept well littered. A clay or ordinary earth floor is excellent, and by some preferred to any other. It is the warmest floor, but not so easily kept clean as one of brick or concrete. If a house is constructed with earth floors care must be taken that the floors are well drained, both underground and on the surface.

The greatest necessity for a good house is at farrowing time, for it is then that more pigs die than at any other. If the sow farrows in a damp or cold place or in drafts, serious results to the sow or the pigs, or to both will follow. At this time the sow is seriously weakened, and she is very susceptible to exposure, while newly born pigs are easily stunted or killed by chilling. Rheumatic ailments are common with pigs, and are often caused by damp, chilly sleeping places.

HOUSING IN MILD CLIMATES.

In the South and in much of the country west of the Rocky Mountains the winters are so mild that they obviate the necessity of constructing buildings of much warmth. Not only are the winters mild,

but they are comparatively short, and green feed is available much longer than in other parts of the country. In such localities a shed will often suffice, but it should be well constructed, in order to provide protection from storms and damp, chilly weather.

PENS AND PASTURES

The question of pens and pastures must be determined by each one for himself. A good rule to follow is to favor large inclosures rather than small ones. A number of pens and several pastures will be found a convenience and are particularly valuable when disease makes its appearance, as hogs affected may then be isolated at once. A quarantine pen with an absolutely tight fence should be arranged on every farm where hogs are kept. Here all newly purchased hogs should be confined after arriving at the farm until all danger of infection is past.

It will generally be a satisfactory practice to keep hogs away from other stock except when following fattening steers. Pregnant brood sows should never be allowed to run in the same yard or pasture with cattle, horses, or mules. Many good sows have been ruined by the playfulness or viciousness of the larger farm animals.

The pen and yard for the boar should be separate from the rest of the herd and out of sight of it. The pen should be so strong that the boar can not tear it down or go through it, and a tightly fenced pasture of one-half to one acre in area should adjoin.

A sow about to farrow, if she is to farrow in the piggery, can have the run of the alley for exercise. If she has a house to herself, a small yard should adjoin.

FENCING.

No man should attempt to raise hogs without adequate fencing of yard and pastures.

For pastures woven wire is the best fencing material, all things considered. Such a fence may be purchased ready-made or may be made on the farm by machines, of which there are several good kinds on the market. From motives of economy it may be desirable to run a fence of woven wire around a field to a height of thirty to thirty-six inches, and above this to stretch two or three strands of ordinary barb wire. This will make a hog-tight fence, and if horses are necessarily placed in the field the fence will be safer than the ordinary one made entirely of barb wire. Midway between the posts the lower strand in the fence should be securely stapled to a small post or stake; this will prevent hogs from working their way under the fence. A further precaution against this may be secured by plowing a furrow against the lower strand.

In building any kind of wire fence, ground wires may be put down to moisture at frequent intervals to give stock protection from lightning.

A board fence makes, perhaps, the most secure inclosure for hogs, but its expense precludes its use generally except for yards and pens.

Barb wire is very poor material for a hog fence. If can hardly be made close enough or strong enough to prevent a shoat from crawling through. In this respect it is only a little better than a hedge, which is expensive and unsatisfactory when used to confine stock. Gates must, of course, be carefully made, hung and fastened.

THE FOUNDATION HERD.

The start should be made with a few animals; five sows should make a large enough herd for the first year. It will be much better to buy one high-class sow than five poor ones. It will be well if a beginner can obtain the assistance of an old and successful breeder in making a start.

The expression "the male is half the herd" is repeatedly quoted. Therefore, if the boar is half the herd, the sows certainly make up the other half, and their selection is a highly important matter. They may be purchased, already bred, some time before the boar,

and quite an item of expense will thus be saved. Then by the time the sows have been watched and studied for a season and have each raised a litter of pigs, the owner will be much better prepared to select a suitable male, and he can then get one to use on both dams and offsprings.

The sows selected should be nearly the same age, which should be about twelve months, and all should be safe in pig, preferably to the same boar. Their individual characteristics should, perhaps, be first looked to. The smoother forehead and lighter, finer neck are points of distinction from the signs of masculinity in a boar. The forehead should be broad between the eyes, the throat clean and trim, the neck moderately thin, and the shoulders smooth and deep; the back should be fairly wide and straight, and ample room for the vital organs should be provided by a good width and depth of chest, well-sprung ribs, and straight, deep sides—a deep, capacious body from end to end. Depth of chest and abdomen are specially important in a brood sow.

It is generally advised that sows with much length of body should be selected for breeding purposes, length of body being regarded by some as an indication of fecundity. It will certainly do no harm to select sows that are especially long, but care should be taken that quality goes with the increase in length. Many very short-bodied sows have proved to be wonderfully prolific breeders. The surest means by which to select prolific sows is to keep an accurate record of the herd and cull out all sows that do not yield a certain percentage of pigs annually. Each sow should have at least twelve well-developed teats, thus providing for the proper nourishment of large litters.

The important qualifications of the market hog should be looked for, namely, smoothly covered shoulders, a wide, straight, deeply fleshed back, well sprung ribs, straight, deep sides, broad rumps, and deep well rounded hams. A broad, well developed pelvic cavity will generally insure easy parturition in a sow. The body should stand on moderately short, straight legs, with a moderate amount of bone. All hogs, particularly breeding animals, should stand well up on the toes. There is a tendency more marked in some breeds, for the pasturns to break down, and the animal walks on the pasterns instead of on the toes.

It is a weakness that seriously impairs the usefulness of the animal and appears oftener in boars than sows.

Uniformity in a herd is the surest index to worth of stock and skill of breeder, and has many advantages. A uniform lot of pigs will feed better, look better when fattened, and command a higher price on market than a mixed lot. With a bunch of sows closely conforming to the same standard, whose reproductive powers are similar, uniform pigs may be expected.

SELECTING THE BOAR.

A boar with the male characteristics strongly developed should be selected preferably as a yearling, or else as a pig that has been purchased at the same time as the sows and allowed to come to maturity before being used. He should have a strongly masculine head and a well crested neck. His shoulders should be developed according to age, but strong shoulder development in pigs under a year or eighteen months is objectionable. The same indications of a good pork producing carcass that the sows required should be seen in the boar. The boar should be selected to correct any defects that may be common to the sows. For example if the sows are coarse in bone and loosely built, the boar should have high quality, fine bone, skin and hair. If the sows tend to over refinement and delicacy the boar should be rather rangy and stronger boned.

It is believed that the male influences the extremities and general appearance of the offspring, and the female the vital organs

(heart, lungs and viscera). The visable organs of the reproductive system should be well developed and clearly defined.

The boar should stand up on his toes. There should not be the slightest indication of weakness in the pasterns of a young one; in a mature boar (two or three years of age) that has seen hard service it may be expected that he will be a little down on his pasterns. Look carefully to the set of the hind legs. The hock should be carefully set and straight.

FEED AND MANAGEMENT.

Hogs require attention, regardless of condition, age, or sex, but the management of the brood sows is the surest test of the breeder's skill. If sows are carelessly fed during pregnancy, trouble of some kind is sure to ensue at farrowing; if overfed after farrowing, losses may occur among the pigs from scours and thumps. At no time is the development of the pigs so easily influenced as while they are depending on the sow's milk—the first month of life. The accidents during farrowing, an attack of scours due to the milk of the dam, or a chill while following the sow in pasture on a wet day may stop growth temporarily, leaving a permanently stunted pig, or may result fatally.

It is assumed that sows that are bred are purchased as the foundation stock. If these sows are not all from the same herd they should not be placed together until they are all known to be free from vermin and contagious disease. They must be washed or dipped and quarantined from each other at least thirty days. If they come from the same herd no quarantine will be necessary.

It is always well for a purchaser to ascertain from the seller the details of management and feeding to which the animals were accustomed before changing owners. This system of feeding should be conformed to, or, if this is not possible, the old ration should be gradually replaced by the more convenient one, taking from ten days to two weeks to make the change. Newcomers should be fed lightly the first few days.

During pregnancy two facts should be borne in mind: First, that the sow is doing double duty. Not only is she keeping up her own bodily functions, but the development of the foetal litter is a constantly increasing drain on her system. Although feeding at this time will not need to be so heavy as after the pigs are farrowed, it should be liberal. The sow's condition should be good, neither too fat nor too lean. If she became too fat it would probably be least injurious.

It is beyond reason that a sow can give birth to a strong litter of pigs after going through a four months' fast. Bad results undoubtedly may be brought about by overfeeding, especially as sows are naturally indolent, and loath to exercise, but a counteracting influence will be found in ample exercise that may be provided by a large pasture or even by driving slowly a mile or two each day.

Secondly the demands upon the sow are the building of new tissue. Hence the kind of feed is important. Bran, peas, beans, oats and barley, and to a moderate extent wheat should be fed. Forage plants are specially suitable to pregnant brood sows, clovers and alfalfa, peas, beans, vetches, etc. The ordinary pasture grasses are also of much value. Feed should be given in such form that the system of the sow will be at its best. All breeders lay special emphasis on the condition of the bowels during pregnancy, and particularly at farrowing, the special danger to be avoided being constipation. To this end the greater part, if not all, of the grain ration is given as slop, and toward the close of the period of gestation oil meal or a small amount of flaxseed meal is introduced into the ration. Corn should not be fed in large amounts to breeding stock.

During the winter more care will be needed to keep the sow in good health on account of the absence of pasture. Not only does the hog's system crave green feed, but more or less bulk is demanded. This is especially needed when a considerable amount of confinement

is necessary. To offset the lack of green feed nothing surpasses roots. These may be sliced or pulped and mixed with the grain or may be given whole, as a noon feed. Some care must be used in feeding roots, as they are laxative in effect, and if fed in excessive amounts may bring about profuse action of the bowels. Some Eastern farmers recommend the use of silage. If neither is available, clover or alfalfa hay, sheaf oats, or corn fodder may supply the bulky requirement of the ration with good results. Charcoal, ashes, and salt should be accessible at all times. These act as a vermifuge and prevention of disease and meet the hog's craving for mineral matter in the feed. During the entire period care should be taken to keep the system well toned. The sow should become accustomed to being handled, and should look upon her attendant as a friend.

All the brood sows may run together up to within two weeks of farrowing time; then it is well to separate them, placing each sow by herself in a yard with a small house, which should be dry, airy and clean. The farrowing pen should be provided with fenders around at least three sides about six or eight inches from the floor and six or eight inches from the wall. These should be strong enough to support the weight of the sow should she lie on them. They will, to a great extent, protect the pigs from being lain upon during the first few days of their lives. This will go far to prevent a very fruitful cause of loss among young pigs. The little fellows will soon learn to creep under these fenders when the sow lies down.

FARROWING TIME.

Sows vary little in the period of gestation. This period is about one hundred and twelve days from the date of breeding. This date should be known, to avoid mistakes that may result in loss of pigs. As the time for farrowing approaches the sow should be watched carefully, in order that assistance may be given, if necessary. If she has already farrowed a litter, and has been properly fed and cared for during pregnancy, little difficulty may be expected. With young sows, particularly those bred at an immature age, there is a considerable element of risk at this time not only to the pigs, but to the sow herself.

The bedding of a sow at farrowing time should be sufficient only for cleanliness and dryness. If furnished in large amount, the pigs will burrow into it and get lost or be crushed. The best bedding is rye straw and wheat straw, and if the straw is cut it makes an almost ideal bed. Chaff is excellent if it can be obtained. Oat straw is not so valuable.

The management of sows during farrowing will depend largely on the animal and on the weather conditions. Assistance should be at hand if needed, but the sow should not be helped if she is getting along nicely alone.

If the sow's nervousness or ill nature leads her to eat her pigs put her into pork at the first opportunity.

When farrowing occurs during warm weather little attention will be needed. The pigs are less likely to chill and will generally find their way to the teats unaided. If a sow farrows in very cold weather the pigs will likely chill unless the house is heated. When farrowing is over place the pigs to the teats, care being taken to see that each gets his share. Burn the afterbirth immediately on passing, as it may teach the sow to eat her pigs, if she eats it.

For the first twenty-four hours the sow needs no feed. If she shows signs of hunger a thin slop of bran and shorts, or thin oatmeal gruel may be given. Tepid water should be given for drink. Don't give cold water. For the first three or four days feeding should be light and a week or ten days should be spent in getting the sow on full feed.

THE SOW AS A MOTHER.

No time should be lost after farrowing in getting the sow into open air. If the pigs are farrowed in winter months, care will be

needed, and it may be necessary to let the pigs reach the age of two weeks before turning them out. They can, however, get considerable exercise in the piggery or in the lot with the sow. Avoid particularly allowing the pigs to run out during a cold rain.

The appetite for something besides the dam's milk may begin to assert itself by the time the pigs reach three weeks of age. They will be noticed nibbling at grass, rooting a little, and even investigating the sow's feed. A pen should be arranged adjoining that of the dam and separated from it by a partition, with sufficient room at the bottom to allow the pigs to run under. In this inclosure put a low, shallow trough and place in it a little skim milk or a thin gruel similar to that recommended for the sow the first day after farrowing. This gruel may be made with any concentrate that is free from woody matter. If ground barley or oats is fed the meal should be first sifted to remove the hulls. There is a great variety of feeding stuffs that can be used. The main point to be observed is that the pig's stomach is very easily deranged at this age and feeds must be given that will digest readily. The trough in which the pigs are fed should be kept clean. No stale feed should be allowed to remain in it from one feed to the next.

As the pigs learn to eat the feed may be increased. Skim milk should be used liberally, using rather large quantities at first—from six to twelve pounds of milk to each pound of grain. During this period comparatively little corn should be fed, as a rule. More growth can be obtained with a narrow ration, and the corn should be withheld until the fattening period comes. The pigs should be kept growing constantly, and the best results will come with feeding a little under their capacity rather than all they can consume. To counteract the tendency to become too fat they should have plenty of exercise.

Scours and thumps often cause very serious losses among young pigs. The former is caused usually by overfeeding, by feeding badly spoiled feed, by an abrupt change of feed, or by a change in the feed of the dam that affects her milk. Thumps is generally caused by overfeeding and lack of exercise.

WEANING.

If the pigs have been properly managed for the month after they first begin to eat, and are taking feed in amounts sufficient to make them more or less independent of the sow's milk, weaning will not be a difficult process, and will be brought about so that it will be scarcely perceptible, so far as the effects on the pigs are concerned. The time to wean will depend on the way the pigs are eating and the convenience of the breeder. If they are not thoroughly accustomed to a grain and skim milk ration the time must be delayed, and if there is no occasion for breeding the sow no harm is done by allowing the pigs to run with her for twelve weeks, or more.

The method of weaning will depend on circumstances. If the pigs are so little dependent on the sow's milk that she is gaining rapidly in flesh and lessening in milk flow the weaning may be abrupt, the sow being taken away out of hearing. If she is still milking considerably she may be returned to the pigs once a day for several days, or the pigs may be taken away in detachments. Whether the weaning is done direct or gradually it should be complete and decisive. The pigs should be placed apart from the sows without any means of communication.

THE PIGS AFTER WEANING.

Those that are to be retained as breeding animals should be continued on a growing ration, that is, one which will develop bone and muscle largely. Those fattened for market should be fed more liberally and carbonaceous food. To build a successful breeding animal, give ample range, plenty of exercise and a narrow ration. Keep growing and feed plentiful. Don't give pigs so little feed and large range that bone only will develop; neither so much to eat that

they will become indolent and will not take the exercise necessary for making bone and muscle. Exercise strengthens the sinews and develops strong muscles, as well as firm joints and strong legs, and a well filled stomach will nourish these.

Gilts should not be served before the age of eight months, bringing first litter at twelve months. As soon as determined what pigs are to be fed for market start fattening at once. Young animals fatten cheaper than old ones, and delay in finishing is a loss.

Corn should be part of the ration now, and a variety of feeds given to give keen appetite and digestion good. Feed milk feeds, dairy by-products, and succulent feeds and good pasture. If skim milk, whey and buttermilk are at hand they are a great help with other ration. Start with two pounds of milk to one of grain at weaning time, reducing until the pigs are finished on grain alone. A pig gives best results on dairy by-products, while young fattening pigs should gain one to one and one-half pounds daily, and should weigh 250 to 300 pounds at nine or ten months. Gains made after this time cost double, and a well bred pig at about 250 pounds fills the market requirements.

Pigs which are to be used for breeding purposes should be selected when the pigs are with the sow. If the breeder is raising hogs for market he will select sows only, castrating all boars. Castrate during cool weather as soon as the testicles descend into the scrotum. The practice of speying sows is not general, and is more difficult than castration.

MANAGEMENT OF THE DRY SOWS.

After the pigs are weaned the dry sows should be placed in a pasture by themselves and given very little grain. Those that show themselves to be prolific and good mothers should be retained as breeders; those having a deficient breeding record or are otherwise unsatisfactory in any way should be fattened and sold as soon as possible.

If a second litter is wanted during a year the sows should be put to the boar during the first heat after weaning. There is little reason why a sow should not have two litters a year.

The use of a breeding crate is growing in popularity. When a small sow is to be bred to a large, heavy boar it is almost a necessity.

MANAGEMENT OF THE BOAR.

When the boar arrives at the farm he should be dipped, as a precaution against vermin. A quarantine pen should be ready for him, especially if epidemics are prevalent. His feed before change of owners should be known, and either adhered to or changed gradually to suit the new conditions. If he has come from a long distance it will be well to feed lightly until he is well acclimated.

His permanent quarters should be a clean, dry, warm, well-lighted, and well ventilated pen, ten or twelve feet square, with a yard adjoining, where sows may be brought for service. This yard should be large enough to give him some exercise during the brooding season, when it may be inconvenient to allow him the run of a pasture. Adjoining the yard should be the boar's pasture, from one-half acre to an acre in extent, consisting of clover, alfalfa, or good pasture grasses that thrive in the locality.

Breeders generally advocate the practice of keeping a boar to himself during the entire year—out of sight and hearing of the sows. However, a boar is often allowed to run with the sows after they are safe in pig; but during the breeding season it is by far the best policy to keep him by himself, admitting a sow to his yard for mating, and allowing but one service. This produces best results in many ways. The male is not overtaxed, he will serve a larger number, and the litters will be larger and stronger. For the boar when not in service, mainly pasture and cut green forage in summer and roots in winter

are best, although some grain should be given to keep him in condition.

Mill feeds, shorts, middlings, bran, some oil meal, and leguminous grains with a little corn. On approach of the breeding season increase the feed so the boar will be in good condition. See that the boar gets exercise while not in service, even if the whip is necessary. During the breeding season he will not get so much exercise, and care must be taken not to waste his energies by unnecessary service. Careful feeding will do much to counteract this disadvantage.

A fully matured boar should not serve more than two sows daily, one in the morning and one in the afternoon. He should serve fifty to sixty per season without difficulty.

SANITATION IN THE HOG LOT.

The greatest drawback to the hog industry in this country is found in losses which occur from hog cholera, or swine plague, tuberculosis, or infestation of animals, especially young pigs, from parasites.

PREVENTION OF DISEASE.

Preventive measures must be most relied upon. The animal must be given dry and well-ventilated quarters, which must be kept clean.

Hogs have some habits which raise them above other domestic animals from the standpoint of cleanliness. For example, unless compelled to do so, a hog will not sleep in its own filth. If part of the floor of the pen is raised and kept well bedded with straw, while the rest is not, all excrement will be left on the unbedded portion of the floor, and the bed itself will be always clean.

In addition to cleanliness, close attention should be given to the feed which is supplied, that nothing may be fed which will convey the germs of disease, especially tuberculosis, to the herd. If the hogs are fed milk in any form obtained from cows kept upon the same farm, the cows should be subjected to the tuberculin test. Animals dead from any disease should not be fed to the hogs until the meat has been made safe by cooking. Skim milk or refuse from a public creamery should not be fed to hogs until it has been thoroughly sterilized.

Feeding and drinking places should be clean and the water supply pure. Unless the origin is known to be uncontaminated and there has been no possibility of infection during its course, hogs should not be allowed access to any stream. Wallows should be drained out or kept filled up as much as possible. At least once a month the quarters should be disinfected with air-slacked lime or a five per cent solution of crude carbolic acid. These precautions will be found valuable aids in the destruction of the various animal parasites, as well as a protection from some more serious troubles.

Whenever any animals are brought to the farm, or when animals are brought home from shows or from neighboring farms, they should be kept apart from the rest of the herd for at least three weeks. If they have been exposed to hog cholera or swine plague the diseases will be manifested within this time, and the sick animals can be treated or killed and disposed of at once.

TREATMENT OF DISEASES.

As soon as sickness appears in the herd the unaffected hogs should at once be removed to clean, disinfected quarters, preferably without much range. Their feed should be carefully regulated, and, if they have previously been on pasture, should include some green feed, roots, or an abundance of skim milk.

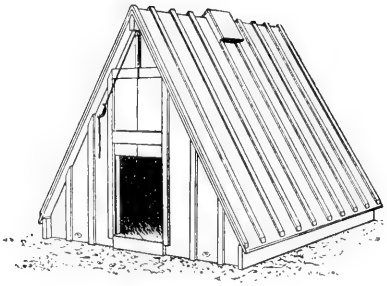
The quarters in which the sickness first appeared should be thoroughly cleaned, all bedding and rubbish burned, and loose boards and old partitions torn out and burned. If the pen is old, knock it to pieces and burn it. Disinfect pens and sleeping places, using air-

slaked lime on the floors and the carbolic acid solution on the walls and ceilings. Whitewash everything.

VERMIN.

Hogs often suffer very much from vermin. Lice are introduced from neighboring herds, and the losses in feeding are often severe, especially among young pigs, when death is sometimes a secondary if not an immediate result. When very numerous, lice are a very serious drain on vitality, fattening is prevented, and in case of exposure to disease the lousy hogs are much more liable to contract and succumb to it. In severe cases where the whole herd is affected, thorough spraying or dipping should be resorted to.

AN IMPROVED HOG COT



In a previous article an A-shaped or wigwam hog cot used at the Wisconsin Station was described. Since that article was written the cot has been "considerably modified and improved in order to adapt the main additional features are a permanent floor, a door in each end, and a ventilating system, all of which greatly increase the stability and utility of the structure.

It is constructed by nailing inch boards on 6 joists 2x4 inches by 8 feet long for the floor. Beneath the joists are nailed 3 stringers 2 by 6 inches, 8 feet long, which serve as runners for moving the house. Next is spiked a piece 2 by 8 inches, 9 feet 4 inches long, at the ends of the joists, having the bottom of the 2 by 8 even with the bottom of the joist which will allow it to project above the floor 3 inches. It will also extend out 7 inches at each end. This 2 by 8 forms a plate to which the rafters and roof boards are nailed. The 7-inch extension of the plate at the ends supports the lower corners of the roof which otherwise would be easily split off. These 2 by 8's, besides strengthening the house, raise the rafters and roof boards nailed to them at least 3 inches off the floor and thereby materially increase the floor space and the capacity of the house.

If the house is to be used in extremely cold weather an easily manipulated door is necessary. The cut shows a door 2 feet wide and 2 feet 6 inches high, made to slide up and down and held in place by cleats. It is suspended by a rope which passes through a pulley at the top and is fastened to a cleat at the side near the roof. The cut also shows two iron eyes, bolted into the front joist of the building, to which the hitch is made when the building is moved.

A rear door, identical in size with the front door, is held in place by cleats nailed across it on the inside and by buttons fastened on the outside. This door is not opened regularly, but provides ventilation in summer and aids in handling sows at farrowing time. Above the

rear door is a small sliding door, 8 by 12 inches, to admit light and air.

Another important feature of this house is the ventilator, which is a small cap covering a hole at the top and center of the roof. The hole is made by sawing off opposite ends of two roof boards and covering it with a cap so arranged as to leave openings 3 inches by 12 inches on each side of the roof. This is sufficient ventilation for two or three animals when all the doors are shut, and if more ventilation is desired it can easily be secured by opening the small sliding door in the rear. This simple plan of ventilation avoids any direct drafts upon the animals and proves very efficient.

With these improvements the cost in building the A-shaped house is somewhat increased. All the boards except those used for the floor should be dressed on one side.

The following lumber is necessary to construct this portable house as shown in figure 2: Nine pieces 1 by 12 inches, 16 feet long, and 11 O. G. battens 16 feet long, for roof; 5 pieces 1 by 12 inches, 14 feet long, for ends; 1 piece 2 by 4 inches, 10 feet long, for ridge; 2 pieces 2 by 8 inches, 10 feet long, for plates; 7 pieces 2 by 4 inches, 16 feet long, for rafters and braces in frame; 3 pieces 2 by 6 inches, 8 feet long, for stringers; and 4 pieces 1 by 12 inches, 16 feet long, rough, for flooring.

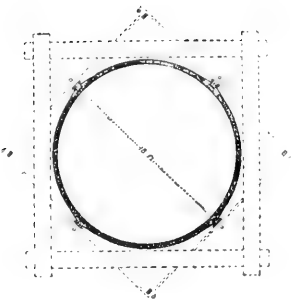
THE STAVE SILO

The value of silage, properly made and properly fed, is no longer questioned. "Especially to the dairy farmer has the silo become an almost necessary adjunct to the equipment of the farm." This being true, the proper construction of silos becomes a question of the highest importance. A silo adapted to general use must be cheap, durable, simple in construction, and effective in preserving the silage. According to a bulletin of the New York Cornwell Station the stave silo fully meets these requirements and "is the most practical and successful silo which can be constructed." The same bulletin makes the following suggestions regarding the construction of stave silos:

Convenience in feeding should determine the location of the silo. Its bottom should be on a level with the floor on which the silage is to be fed. It is cheaper to elevate the silage at the time of filling the silo, when it can be done on a carrier by steam power, than to elevate it in baskets at time of feeding when it must usually be done by man power. The practice of digging pits into which to put the silage is not to be commended, as it causes an unnecessary expense at the outset and is afterwards a source of extra labor and annoyance when the silage is fed. The silo may be placed inside or outside of the barn as circumstances render advisable.

In calculating the amount of silage which will likely be needed, it is customary to estimate that a 1,000-pound cow will consume about 40 pounds or 1 cubic foot of silage per day. This gives a basis upon which to calculate the capacity of the silo required to carry a certain amount of stock

A foundation 3 or 4 inches deep should be laid of stone and gravel well packed down and finished with cement. The diameter of this foundation should be at least 2 feet greater than that of the proposed silo.

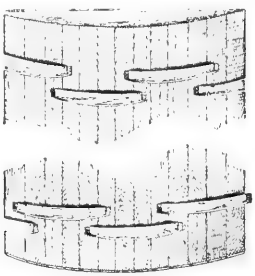


The posts (a,a,a,a) should be of 6 by 6 material and run the entire length of the silo. These should be first set up vertically and stayed securely in place.

* * * The scaffolding may be constructed by setting up 2 by 4 scantling. Boards nailed from these 2 by 4 scantling and to the 6 by 6 posts will form a rigid framework across which the planks for the scaffold platform may be laid. Before the scaffolding is all in place the staves should be stood up within the inclosure; otherwise difficulty will be experienced in getting them into position.

No better material can be obtained for the staves than Southern cypress. Hemlock is one of the cheapest, satisfactory materials which can be purchased, and it is probably as good as any of the cheaper materials. It should be sound and free from loose knots.

If the silo is to have a diameter of 12 feet or less, the staves should be made of either 2 by 4 material unbeveled on the edges and neither tongued nor grooved, or of 2 by 6 material beveled slightly on the edges to make the staves conform to the circular shape of the silo. If the silo is to have a diameter of more than 12 feet, the staves should be 2 by 6 material and neither beveled nor tongued and grooved on the edges. * * * The staves should be surfaced on the inside so that a smooth face may be presented which will facilitate the settling of the silage. * * * The first stave set up should be made plumb and should be toe nailed at the top to one of the posts originally set. * * * Immediately a stave is set in place it should be toe nailed at the top to preceding stave set. It has been found that the work of setting up and preserving the circular outline may be materially aided by the use of old barrel staves. For a silo



12 feet in diameter the curve in the stave of the sugar barrel is best adapted; for a 16-foot silo the flour barrel stave is best, and for a silo 20 feet or more in diameter the stave of the cement barrel is best. * * * If when the silo staves are put in place they are toe

nailed securely to the ones previously set; if they are fastened firmly to the permanent upright posts; if the barrel staves are used as directed above, the silo will have sufficient rigidity to stand until the hoops are put in place. However, if it becomes necessary for any reason to delay for any considerable time the putting on of the hoops, boards should be nailed across the top of the silo.

When it is found impossible to secure staves of the full length desired, a joint or split must be made.

For a silo 30 feet deep, staves 20 feet in length may be used. A part of these should be used at their full length and part should be sawed through the middle, thus making staves of 20 and 10 feet length. In setting them up the ends which meet at the splice should be squared and toe nailed securely together. They should alternate so that first a long stave is at the bottom then a short one, thus breaking joints at 10 feet and 20 feet from the base.

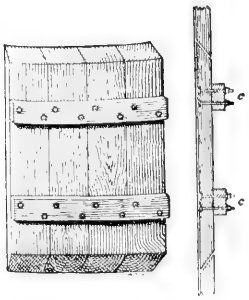
For the hoops five-eighths inch round iron or steel rods are recommended, although cheaper substitutes have been found very satisfactory. Each hoop should be in three sections for a silo 12 feet in diameter; in four sections for a silo 16 or more feet in diameter.

If the method of construction shown in fig. 2 is followed, then the hoops will need to be in four sections each, the ends being passed through the upright 6 by 6 posts and secured by heavy washers and nuts. * * * The bottom hoop should be about 6 inches from the base of the silo; the second hoop should be not more than 2 feet from the first; the third hoop 2½ feet from the second, the distance between hoops being increased by one-half foot until they are 3½ feet apart, which distance should be maintained except for the hoops at the top of the silo, which may be 4 feet apart. * * To hold both the hoops and the staves in place during the summer when the silo is empty, staples should be driven over the hoops into the staves.

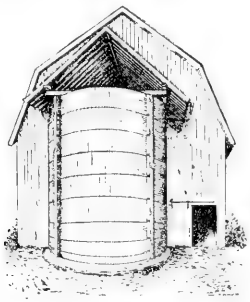
The hoops should be drawn fairly tight before the silo is filled, but not perfectly tight. They must be tight enough to close up the space between the staves, thus preventing any foreign matter from getting into the cracks which would prevent the staves from closing up as they swell, thus allowing air to enter. * * * The hoops should be watched very closely for a few days after the silo is filled. If the strain becomes quite intense, the nuts should be slightly loosened. If during the summer when the silo is empty and the staves thoroughly dry the hoops are tightened so that the staves are drawn closely together, when the silo is filled and the wood absorbs moisture and begins to swell the hoops must be eased somewhat to allow for the expansion.

The doors, 2 feet wide by 2½ feet high, should be located where convenience in feeding dictates.

The lower door should be between the second and third hoops at the bottom and other doors will usually be needed in every second space between there and the top, except that no door will be needed in the top space, as the silage when settled will be sufficiently low to enable it to be taken out at the door in the space below. Plans should be made for the doors at the time the staves are set. When the place is reached where it is desired to have the doors, a saw should be started in the edge of the stave at the points where the top and bottom of the doors are to come. The saw should be inserted so that the door can be sawed out on a level, making the opening larger on



the side of the silo. This will enable the door to be removed and put in place only from the inside, and when set in place and pressed down with silage the harder the pressure the tighter will the door fit. * * * After the silo is set up and the hoops have been put on and tightened the cutting out of the doors may be completed. * * * Before cutting out the doors cleats 2 inches by 3 inches in length equal to the width of the door, should be made which will conform to the circular shape of the silo. One of these cleats should be securely bolted to the top and one to the bottom of where the door is to be cut After the bolting the door may be sawed out, and it is then ready for use. When set in place at time of filling the silo a piece of tarred paper inserted at the top and bottom will fill the opening made by the saw and prevent the entrance of any air around the door.



If the silo is built outside of the barn some sort of roof is necessary. This should be sufficiently wide to protect the walls of the silo as thoroughly as possible.

ICE HOUSES FOR THE FARMS

An ample supply of ice is of greater economic importance in the country home than in the city residence. City people can purchase perishable supplies as needed, but the remoteness of the country homes from markets often renders it necessary to use canned, corned, or smoked meat products during the season of the year when the table should be supplied with fresh meats. Not only is ice appreciated because of its use in the preservation of fresh meats, butter, and other table supplies, but the production of high-grade domestic dairy products is almost impossible without it. Many markets to which milk is now shipped demand that it be cooled before shipment to a degree not attainable without the use of ice.

Ice is one of those luxuries which in many sections of the country can be had for the gathering. The cost of harvesting and storing it is not great as compared with the comfort that it brings.

INEXPENSIVE ICE HOUSES

An inexpensive ice house which will give good satisfaction can be constructed as follows: As a site for the structure choose a well-sheltered location convenient to the place where the bulk of the ice will be used during the season. If the area is not well drained naturally, grade the surface so that no surface water can ever flow into or through the building and so that the water from the melting of the ice will be quickly disposed of. In some instances it may be necessary to provide tile drains laid 15 or 18 inches below the surface to care for this water.

Having properly provided against water, both from without and from within the ice house, set a line of squared or flattened poles 4 feet apart, so as to form a square of the dimensions desired. The height of the poles should be the same as the length of the side of the square, if the greatest economy of space and the best keeping conditions for the ice are desired, i. e., a building 14 feet square should be 14 feet high. A house of this size will provide storage for a cube of ice 11 by 11 by 11 feet, which, without allowance for voids, is equivalent to about 38 tons. (A cubic foot of ice weighs approximately 58 pounds, and 1 ton of ice occupies nearly 35 cubic feet.) To complete the ice house, cut the posts to a uniform height and nail a double 2 by 4 inch or 2 by 6 inch plate on top of them. The sides may be inclosed by boarding both inside and outside with rough lumber. To give a neat outside appearance the outside boards may be planed and ship-lapped, or ship-lap siding may be placed over the rough sheating. The space between the two board walls may or may not be packed with shavings or sawdust. If packed, the packing material should be perfectly dry. The roof may be either a simple even-span one-third pitch roof, with the gables boarded up, or a hip.

In order that the house may be filled without unnecessary labor a continuous door should be provided in the middle of one end. The door should be made in two or three sections, and as the house is filled loose planks of proper length should be at hand to place across the opening of the door to hold the packing material in place as the heap of ice grows in height.

The ice must be placed on a bed of sawdust, shavings, or other packing material at least 15 inches deep, and the rick of ice should not approach the side walls closer than 15 or 18 inches, the intervening space being filled with packing material and thoroughly rammed.

MASONRY ICE HOUSES

Instead of the cheap, temporary construction just described, ice houses of a permanent nature can be built from brick, stone, or concrete. In these, as in frame-constructed houses, the mass of ice should approach as closely as possible a cube in form. If the masonry house is to be used in the same manner as the temporary house no inside lining will be necessary. The packing used about the mass of ice may be allowed to come in direct contact with the wall. A 13-inch brick wall or a 12-inch concrete wall will provide the necessary strength. The masonry walls are not as good nonconductors as timber walls. It will therefore be necessary for the protection of the ice to rely on the packing material rather than on the wall itself. If the house is to be used for storing ice without the use of sawdust or shavings this construction must be followed. The lining must be as complete on the floor and ceiling as on the side walls in order to provide safe insulation.

Masonry houses may be constructed entirely above ground or partly below the surface, as convenience or necessity may dictate.

TO MEASURE TIMBER

For five-inch timber multiply five-twelfths of the length by the width.

For six-inch timber, multiply one-half the length by the breadth.

For seven-inch timber, multiply seven-twelfths the length by the breadth.

For eight-inch lumber, multiply two-thirds the length by the breadth.

For nine-inch lumber, multiply three-fourths the length by the breadth.

For ten-inch lumber, multiply five-sixths the length by the breadth.

For eleven-inch lumber, multiply eleven-twelfths the length by the breadth.

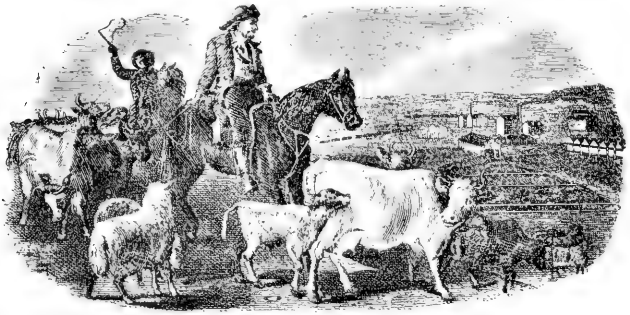
For twelve-inch lumber, multiply the length by the breadth.

For battens, or two and a half inch plank, multiply five twenty-fourths the length by the breadth.

P. S.—The above rules give the contents in feet of board measure.

THE DAIRY HERD

Henry E. Alvord, Bureau of Animal Industry.



Dairymen are divided in opinion as to the kind of cow which is most profitable. Some prefer a "general-purpose cow," which is a member of a specially developed milk-producing family from one of the beef breeds, or grades of such stock. An animal is thus secured which has a large frame, is easily kept in good flesh, and fattens soon when not milking heavily; such a one also has large calves, profitable for veal or for growing as steers. Even if such animals are not so productive while in the dairy, their meat-making proclivities may make up for it. There are two or three of the established breeds of cattle which claim to possess combined qualities for meat and milk. On the other hand, many dairymen prefer cattle of the distinct class of type especially adapted to dairy purposes alone. This class includes various families and breeds, all having the marked characteristics which distinguish the milk producer. Owners of such cows expect them to be so profitable as milkers that their beef-producing qualities and the final disposition of their carcasses may be entirely ignored, and the calves, except so far as wanted to raise for the dairy, are given little consideration. Which of these lines of policy should be pursued every dairyman must determine for himself. To succeed in his business he should select his herd or its foundation with a view to profit.

FORMATION FOR THE DAIRY HERD.

It may be done by buying or by breeding or combining the two. Purchasing is practiced frequently by those who produce milk for town

and city supply. Cows are bought at their prime, judged exclusively by their milk yield, are highly fed to keep them gaining in flesh and are sold for killing as soon as they cease to be profitable milkers. The bull may be of any kind, so long as he gets the cows in calf, as these calves are only valuable as causing "fresh" cows and are disposed of as soon as possible. Good cows may be kept several seasons, and heifers may be raised from some of the best milkers to replenish the herd. Rare judgment in buying and abundant capital is necessary in this method. Another way is to begin with a few well selected animals, and gradually build up by breeding and natural increase. This method takes time, and is safe and satisfactory. A desirable way is to buy a number of good cows at the start, also if possible a few extra fine cows and a first class bull. Let the cows selected have had two or three calves, to judge of their development and yet be young enough to improve and be in full profit for some years. Begin at once with these the work of breeding and improvement.

PURE GRADE DAIRY CATTLE AND GRADES.

If the sole object and dependence is to be the profits of the dairy herd it will hardly be possible for most dairymen to buy at once a full stock of pure bred cattle as the expense is too great. The probabilities of success however are on the side of pure bred registered stock and in the hands of experienced men they prove most profitable. Successful dairying has proven that the greater profits comes from the best cows, whatever their kind, whether pure bred or common cows. It is better to pay $300 for three first class cows than the same money for four or five ordinary ones. A really superior dairy cow of a superior family and which gives assurance of calves as good or better than herself is always worth a large price. Such an animal adds much to the average value of any dairy herd. In buying registered cattle deal only with men of reputation as breeders and of strict integrity. "The best part of a pedigree is the name of the breeder."

THE BULL AND HIS TREATMENT.

In getting a bull, get the best; or at least approach that standard as nearly as possible. Make a study of the animal's pedigree and the dairy history of his ancestors, and especially of the females among his nearest of kin. Then see that the good qualities of his progenitors appear to be reproduced in the animal in question. A common error among dairymen is to use immature bulls and to dispose of good ones before their merits as sires has been fairly proven. Bull calves are cheap, and young bulls are considered much easier to handle. But it is good advice to the buyer to purchase a bull of some age, whose progeny prove his value as a breeder, rather than a calf of exceptional pedigree; and to the owner, having a sire of proved excellence, to keep him and use him for years, or as long as he shows himself potent and prepotent. Of course the question of too close inbreeding is not forgotten and must not be overlooked by the breeder.

In rearing a bull, accustom it to being handled from calfhood, but without fondling or encouraging frolic. Give it kind, quiet, firm, and unvarying treatment, and keep it always under subjection, that it may never know its strength and power. Insert the nose ring before it is a year old, keep this renewed so as to be always strong, and always lead and handle the animal with staff in the hands of a discreet and trusty man. The bull should never run loose in yard or pasture, but should be provided with abundant and regular exercise, always under restraint and full control.

It is much better to keep the bull as much as possible in the presence or in full sight of the herd than stabled by himself in a lonely place. Let him be in the same room with the cows during the stabling season, and at milking times the rest of the year.

CULLING THE HERD BY ITS RECORD.

As soon as the herd is established and in working order, the study of every individual animal should begin. To guide rational

treatment and insure greatest profits, the owner must become familiar with the characteristics of every cow. The record should include a concise history and description of every member of the herd, with a summary of the dairy preformance. The latter requires a daily record of the milk yield of every cow, with notes explaining irregularities, etc. If the quality of milk is of importance, a fat test should be made of the milk of every cow, as often as practical. Good judges believe that in the entire country one-fourth of the cows kept for milk do not pay the cost of their keeping and nearly another fourth do not yield profit. Every dairyman should keep a record of quantity and quality of milk, cost of production and weed out the unprofitable members of his herd.

ACCOMMODATIONS.

The cow house should be on the ground level, not in a basement, and be light, dry and roomy. A room open to the roof, which is fairly high, is better than a low level ceiling above the cows. Where the climate permits cows should stand on dry ground, the clay packed hard and raised somewhat above the level around the buildings. Shallow gutters behind the cows, and a feeding floor in front of them. Box stalls 8 to 10 feet square would be best and the cow left untied if possible. At least give each cow her own stall, wide enough for comfort of cow and milker, and well protected from the neighbors on either side; 3½ feet in width is little enough and 4 feet is better.

From the great variety of cattle ties one should be selected which combines, in greatest measure, freedom of movement, comfort, and cleanliness. There are serious objections to all stanchions; if some form of this device is insisted upon, let it be one which is so hung as to move a few inches in any direction.

An open, level feeding floor in front of the cows seems to be better than any form of boxes; if boxes are used, they should be as large as possible and yet have every part within reach of the cow as tied, and they should be so constructed as to be easily cleaned. A manure gutter behind the animals aids in cleanliness, but while it should have good width—16 to 24 inches—it should not be too deep; if enough to hold the droppings of a night, that is sufficient.

The length of stall from fastening to gutter should suit the size of the cow; it is bad practice to have them so long as to induce filthy udders and legs, and also to have them so short that the cows stand habitually with hind feet in the gutter. Arrangements should be convenient for removing the manure and for supplying absorbents for the urine, and a part of the bedding. Liberal use of land plaster about the gutters and the floors over which the cattle pass is very desirable as a disinfectant and conserver of ammonia. Lime should be used with equal freedom as whitewash on the walls of the cow house, but not on its floors.

The stable should be provided with windows to admit light and air abundantly and arranged to let sunlight as nearly as possible into every portion of the apartment where the cows stand during some hour of every clear day. Yet the windows should be shaded when desired, and they should be fixed to open partly without subjecting the cows to direct drafts of air.

The extremes in providing water for the cows are to be avoided. The best plan seems to be to provide one or more tanks in the yard and one or more in the stable, at each of which but one cow should drink at a time. These should fill quickly after use and freely overflow, that every cow may find the surface fresh and clear. Bring water in severely cold weather to a temperature of about 50 degrees F., if it can be cheaply done.

Attached to the cow house should be an exercise yard for the daily use of the cows during the stabling season. Roomy, open sheds should form a part of this inclosure, and the whole may well be roofed

over, if arranged for the free circulation of air and for admitting sunshine to a large share of it, while excluding wind and storm.

HEALTH OF THE HERD.

Get perfectly healthy stock, strong in constitution and of healthful vigor. It is advised that all be tuberculin-tested and this of course, should be done by a competent veterinarian. Besides the robust character of the individuals the breeding stock from which they are descended, and the herd, stables and farm from which they come, should be closely examined, on the score of health. Breeding and rearing animals needed to replenish and increase the herd, and refusing to allow strange animals on the farm, are the best safeguards against the introduction of disease. On every farm of any size a well-secluded building for a stock quarantine and hospital, suitably arranged and equipped, is a useful adjunct.

There are many of the ordinary accidents and ailments to which domestic animals are subject which can be managed by an intelligent owner, or under his direction, without professional assistance. But in case of uncertainty take no chances, summon a veterinarian. Close confinement, with impure air and lack of exercise is prejudicial to the cow's health. Every member of the herd should be examined daily and the least symptoms of disorder, like dullness, loss of appetite, rough coat and irregularity of milk, manure or urine noted and given attention.

FALL FRESH COWS MOST PROFITABLE.

Much has been said about best time for cows to drop calves. Opinions differs and the larger number are allowed to "come in" in the spring. September however is the best month in most parts of the country for a heifer to drop her first calf, in order to best develop as a cow. Calves born in the fall are easier reared and make better cows than those born in spring or summer. The cow or heifer calving in the fall needs the most healthy and nutritious pasturage just following the strain and while coming into full flow. Just at the time when some falling off is likely to occur, the animal is brought to the stables and receives good care; the winter feeding and the returns from it may be depended upon to exceed the midsummer results for any like period. At the stage of milking and of gestation, when another dropping off in the milk yield may be looked for, the fresh pasturage induces a fresh flow, lengthens the milking season, and increases the year's total product. December and January are good months in which to control and supervise the service of the bull. Midsummer and the dogdays are a good time for the cow to be dry and preparing to calve again, and a most unprofitable and annoying time to make milk or handle it. With fall-fresh cows the greatest product and the richest comes at the season when milk and butter are always comparatively high in price. In actual practice four fall-fresh cows have been found to equal five which calved in the spring, in twelve months' product, and at about four-fifths the cost.

DRYING OFF COWS AND CALVING TIME.

When the time comes for drying off a cow the grain food should be gradually withdrawn. This may of itself cause milk to cease forming. If not, omit one milking a day, then milk but once in two days, and thus extend the drying period over two weeks. The udder must be watched, and if any hardening or unnatural heat is shown regular milking must be resumed. If a sow continues to secrete milk it must be drawn. No cow should be forced to "go dry" against manifestly natural resistance to so doing. On the other hand, if an unpleasant pungent or "smoky" taste appears in the cow's milk she may as well be dried at once, regardless of dates, as her milk will not be good until she is fresh again.

The dry cow may be kept on pasture alone, not too luxuriant, or on a low stable diet, mainly of coarse forage, until about two weeks

before calving. Yet the ration, while comparatively "wide," should be nutritious, and it should include a share of succulent food—roots or silage. Then a slow but steady increase of feeding may proceed, of a nourishing, cool, and laxative kind, so as to become narrower in ratio. Wheat bran is good material to use at this time, but new process linseed meal is better. A week before calving remove the cow to a roomy, comfortable, quiet box stall, preferably within hearing of the herd, if not in sight. Be sure the bowels are quite loose and moving freely for two days before calving.

ABORTION AND MILK FEVER.

In case abortion occurs in the stable, yard or pasture, take the animal to the hospital at once and use every exertion to thoroughly clean and disinfect the place where the accident occurred. The aborted cow should be carefully nursed, and the genital organs dressed with antiseptic solutions. The animal should not return to the herd until fully cured, clean and free from all vaginal discharge. Milk fever is another scourge twin to abortion. It comes without warning, attacks the deepest and richest milkers, is sudden in attack, rapid in progress and generally fatal. Symptoms are a chill, twitching of head and muscles, failure to eat, chew the cud, or pass manure, distended udder without milk, insensibility of the hind quarters when pinched or pricked, later cow becomes unsteady on hind legs and presently drops. Good cows should be watched for forty-eight hours after calving, and if such warnings appear a veterinarian cannot be called too soon. Preventative measures are best in this disease. The cow should have abundant exercise up to the week before calving, and then quiet and good care, with daily grooming and active rubbing. Keep the bowels active with proper food, or purgatives, if necessary. Insure comfort, guard against cold, and endeavor to maintain active circulation on the surface of the body. A strong dose of physic and brisk grooming may be used immediately after calving in the case of cows believed to be predisposed to milk fever.

CARE OF CALVES AND YOUNG STOCK.

Among dairy cattle the best practice is to remove the calf from the cow within twenty-four hours after birth and at once teach it to drink. The earlier the calf is taken in hand and its feeding regulated the better for the calf. The younger it is the easier it learns to drink. It is also better for the dairy cow to be regularly milked by the hand than to suckle a calf. The milk of good cows is often too rich for their calves, and the latter are apt to take too much if left to help themselves. The calf should have the milk of its dam or some other fresh cow and receive it while warm, and at least three times a day (preferably four) for a week or more. During this time, if the milk is rich, it should be diluted with warm water one-fifth to one-third its own bulk, according to the richness, or the milk may be kept a few hours, the best of the cream removed, and then warmed and fed. To make a good calf, three feedings a day should be kept up for a month or six weeks, and the milk should be fed warm for a longer period, especially if the weather is cold. But after ten days or so milk set twelve hours and lightly skimmed will do, and after ten days more the skimming may be gradually made closer, until at the end of a month, or soon after, a skim-milk diet is reached. No rule can be given for quantity in feeding calves, they differ so much in size and food requirements. Judgment must be used, the feeding effects observed, and the calf given enough to thrive and be active, but not too much. More calves suffer from overfeeding than from scant diet. Keep the calf a little hungry and eager for more rather than fill it to dullness. The endeavor should be to prevent the beginning of indigestion, which leads to scouring and perhaps fatal diarrhoea. Absolute cleanliness about the feeding vessels is essential, with frequent scalding. If gritting the teeth or other symptoms of indigestion appear a little lime

water in the milk or a little baking soda will usually prove a correction. Keep the calf dry and clean, fairly warm, but in pure air, and allow it to exercise. If its box is small turn it daily into a covered yard. Young calves like company, but if kept together learn bad sucking habits.

The calf referred to above is not for veal, but to be raised for dairy stock. The treatment should be accompanied by early lessons inducing it to eat sweet hay and a little grain. The sooner it learns to eat hay or rough forage and the more it eats the better, but keep up the milk feeding as long as possible if only once a day. Grain should be fed sparingly, oats and bran preferred; perhaps a little linseed. Don't turn out to grass too soon. If a spring calf carry it over to the second summer without pasturage. A fall calf will be in good shape to get its living from pasturage during its first summer. From the time milk ceases to be the main food of the calf until the heifer drops her first calf, at which time she becomes a cow, the feeding of the animal should be with a view to nourishment and growth, without accumulation of flesh. If pasturage is good nothing is better for the calf after six months. If grass is short or dry supplement with clover hay, wheat, bran or oats. At other times let the food be mainly forage of bulky kinds; the digestive organs need to be developed. Give long forage, fodder or roughness, the preference with young stock, and use grain sparingly. A fall calf well bred and healthful should come in when about 2 years old.

Everyone should be quiet, even-tempered and gentle, regular and cleanly in habits. Cows hate unclean persons. Tobacco is obnoxious in dairying. All work should be done by system and regularity, stable cleaning, grooming, exercise, watering, feeding, milking, a fixed time for everything. Quickness is an essential feature in milking. The quicker the milking the richer the milk, if the work is done well and completely. The milk fat or butter fat comes from the cow, but it is the expert milker that gets the most of it. It pays to have milking done in the very best way and by the best milkers that can be found. The milking room being scrupulously clean, with plenty of pure air, there is almost no "animal odors" in milk which are really stable odors or odors from the milker. Except extra large milkers, or for short periods, when the yield is largest, there is no gain in milking cows more than twice a day.

PASTURE SEASON AND SOILING.

As soon as the spring grass gets high enough for the cows to get a bite let them have it. At first the time daily on pasture should be very short, for the good of both pasture and cow. The latter should be gradually changed from stable feeding to pasturage, especially if the feeding has been of dry material or mostly so. And the stable feeding should continue unchanged, undiminished, until the cow herself indicates that she is getting enough grass to replace a part of the stable ration. Then, as the pasturage improves, indoor feeding may be lessened and finally discontinued.

Shade and water should be carefully looked after in connection with pasturage, as well as the grass. In very large pastures there should be watering places in different parts of the inclosure, as well as shade, that the cows may not be compelled to travel far to find either.

Until flies become troublesome cows had better stay in pasture by day and in stable by night, or be left out all the time. But in the worst fly time, and perhaps when the sun's heat is greatest, it is good practice to stable the herd during the day in an airy but shaded cow-house, and turn it on pasture at night. If the pasture has not abundant shade and water this course should certainly be followed. Heat and flies reduce both quality and quantity of milk product. The trouble from flies can be largely remedied by spraying the cows with

a very weak mixture of water and some one of the approved sheep-dip preparations. Such a spraying will last a week or ten days, unless there are hard rains meanwhile. The entire interior of the cow-house should be sprayed with a solution of this kind, and strong enough for an insecticide, weekly, throughout the summer. If pasturage is short, even temporarily deficient, the cows should be fed enough of grain, hay, silage, or green forage to supply the deficiency.

The advantages of soiling over pasturage are so great, especially where dairying on high-priced land, that every dairyman should carefully study the question of adopting this system. Much depends upon the supply, character and cost of labor at one's command. It may be profitable to practice partial soiling, where it will not be, to do more.

For this system of feeding stock a variety of green crops is necessary, grown so as to come to best feeding condition in well-arranged succession throughout the growing season. There must be no breaks; the supply must be certain and sufficient. It is well to aim to grow about twice as much of every crop as one expects to use; any surplus can be saved by drying or putting in a silo. Crops well adapted to soiling in most parts of the country are these: Red clover and timothy, sown separately in July and August; crimson clover and barley, sown in August and September; and wheat and rye, sown in September and October—all these for use in (an open) winter and early spring. Oats, spring barley, and peas sown early in the spring; vetches, also corn and soy beans, planted or sown in May; cowpeas, corn, millets and Hungarian grass, sown in June—these for cutting in the summer and fall. The first and second crops from the regular mowing lands of grass and clover will fill in the gaps. By the soiling system, well managed, one acre may feed two cows for five or six months, and three acres for five cows is a conservative estimate.

One of the points of gain by soiling is saving the food expended by the animal in its exertion to procure its food at pasture.

Moderate exercise should accompany soiling, and a small pasture or paddock should be provided for use of the herd, especially at night.

THE STABLING SEASON.

Up to a certain point fall pasturage is as good as in any part of the year. After one or two hard frosts it is well to give the cows good hay at night. If they eat it with relish the season has arrived to gradually change the herd from pasture to stable. The cows should not be left out at night after it gets chilly weather. Allow them in the field a few hours each day until snow flies, but don't expect them to get much except water and exercise. Be gradual in changing from pasture to stable diet. Assign every cow her particular place for the winter, and see that she always has that place. Bedding, absorbents, and disinfectants should be provided in abundance, and quite dry. Don't use damp material, rotten straw, moist earth nor sawdust under the cow.

A good bedding combination is 5 or 6 pounds of straw and 10 or 12 of earth or sawdust (all dry). Land plaster is a good disinfectant and deodorizer, for the cow house. Cows need much water.

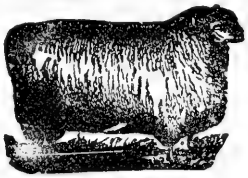
If they can be induced to drink twice or three times a day, it should be done.

FEEDING THE HERD.

To feed all the cows in a herd alike, day after day and month after month, as is so often done, is an absurd and wasteful practice. Some are sure not to get enough for greatest profit, and others are likely to get more than they will use to advantage. This as to quantity only; but differences in kind of feed may be equally desirable. In a thorough study and comprehension of the question of feeding lies the greatest opportunity for the exercise of real economy in the management of the dairy herd.

RAISING SHEEP FOR MUTTON

CHARLES F. CURTISS,
Director of the Iowa Agricultural Experiment Station.



The American people have been characterized as a nation of pork eaters and pork producers, with little or no appreciation of good mutton. However this may have been in the past, the conditions are rapidly changing. There is a constantly increasing demand for good mutton in the United States.

SHEEP PRODUCTION AS A FEATURE OF AMERICAN AGRICULTURE.

The production of prime mutton for American and European markets is rapidly becoming a permanently established industry of vast proportions in the United States. Our rich lands and abundant feeds are well suited to the economical production of superior mutton, and it has been clearly demonstrated that mutton sheep properly selected can grow a large part, if not all, of the wool demanded for American manufacturing. The erroneous impression has prevailed that sheep are only suited to inferior lands. No greater error can be imagined. While it is true that sheep are well adapted to scanty vegetation and capable of profitably grazing semiarid lands, they also render as large returns for a liberal ration of good feeds as any domestic animal, with the possible exception of the hog. The high-priced agricultural lands of Great Britain sustain 680 sheep per thousand acres, and Scotland in 1893 had even as high as 1,380 sheep per thousand acres of agricultural lands. The leading agricultural states of the Union have not to exceed 25 sheep per thousand acres of land.

The sale of $1,000 worth of corn at present prices takes from the soil producing the crop about $300 worth of fertility; that is, it takes materials for which the owner of the land would have to pay this amount if he were obliged to purchase commercial fertilizers at the rates usually prevailing in the market, but the same amount of corn can be converted into good mutton and sold at an advanced price and it will take from the land not to exceed $50 worth of fertility, or if sold in the form of wool it will not take from the land over $2 or $3 worth of fertility. It will be incomparably better for American farming and for our system of agriculture to convert the surplus grain products into prime meats to the extent at least of supplying home demands, and then find foreign markets for the condensed and high-priced meat products rather than export the corn and other grains as such.

The market of good mutton has been continually expanding, and the experience of every successful sheep raiser in any section of the United States emphatically refutes the doctrine that any of our lands are too valuable for mutton production.

MUTTON THE PRIMARY CONSIDERATION.

Notwithstanding apparent contraction of our flocks the sheep industry has made substantial progress. It has been established on a more permanent and lasting basis by making mutton the primary consideration and wool incidental, instead of the reverse, as has generally

been the case heretofore. On this basis, sheep raising will return a satisfactory profit one year with another, independent of the price of wool, or nearly so, as it has been clearly demonstrated that it does not cost any more, if even as much, to produce a pound of mutton from good mutton sheep under average farm conditions than to produce a pound of beef, when the wool is left entirely out of consideration; and the wool always has some value; it seldom goes so low that well-bred mutton sheep will not yield a fleece worth from 75 cents to $1.50.

Large numbers of sheep have been fattened annually in the grain-producing states the past few years, and many important truths and fundamental facts pertaining to this industry have been established. These all tend to place sheep raising on a more permanent basis. Practical feeders and farmers have found that there is no more profitable outlet for surplus grain products, particularly after the country has suffered from the ravages of hog cholera, than in mutton production.

WHAT CONSTITUTES A GOOD SHEEP.

Not all the animals belonging to any of the improved breeds are possessed of a high degree of excellence. No graver error can be made than the assumption of uniform excellence in the stock constituting any breed, no matter how much prominence it may have attained. Individual animals always differ more than breeds; and there are relatively few really good animals in any breed. This seems to be strikingly true of the mutton sheep. The chief trouble in mutton production is and always has been the scarcity of stock sheep, particularly sires, that have sufficient merit to fill the standard of excellence for a strictly prime carcass. Until we reach this higher degree of excellence the mutton sheep will not assume its rightful place in American agriculture. The American market has become the most discriminating in the world on beef products, and it will demand a corresponding superiority in mutton. With this in view a brief consideration of what constitutes a good mutton sheep may be of interest.

First, let there be pronounced masculinity in the male and femininity of the female. Sheep should be neither sexless nor characterless. They should bear the stamp and character of the breed they represent. This breed character is a mark of good blood, and it should be manifest in no unmistakable manner. The sire should be impressive, resolute, and of noble bearing. He should be distinctly the head of the flock in every sense of the word. To meet these requirements he must have good constitutional and vital powers. Without these no animal is fit to head a herd or flock. In selecting a sire, look first at the head. If defective there, look no further, but reject at once. Insist upon a head that faces you boldly with a wide face, a clear, prominent eye, and a robust character throughout. The head should be joined to a well-filled, round, muscular neck, wide at the poll and back of the ears and gradually enlarging in all lines to a strong, full junction at the shoulder, as seen from top, sides, or bottom. This should be accompanied by a wide chest, a prominent, well-filled brisket, and a full heart girth, giving straight, even lines from the shoulders back. A depression either in front of or behind the shoulder, whether at the top, side, or bottom line is an indication of weakness. The back should be strong, wide, and well meated from shoulder point to tail. The hind quarters should be full and well let down in the leg and flank, in order to yield well of high-priced meat. The legs should be placed wide apart and stand straight. Sickle-shaped hocks and weak, sloping pasterns afford sufficient reason for condemning an otherwise good sheep.

ESSENTIALS OF A GOOD FLEECE.

The modern mutton sheep must also be a wool producer. Our future wool supply must come largely from sheep grown primarily

for mutton. It is essential, then, that a mutton sheep have a good fleece as well as a good carcass. This combination is both practicable and profitable; and it is no longer regarded necessary to grow one sheep for a fleece, another for a carcass, and another for a lamb. The intelligent flock-master combines them all in one class. Some of the best mutton sheep are producing as profitable fleeces as those kept exclusively for wool, and their lambs are decidedly superior. One of the first essentials in a good fleece is compactness or density. This quality not only insures a better yield of wool, but it affords better protection against storm and indicates a hardier animal, better able to withstand exposure. A close, even, dense fleece with no breaks should cover all parts of the body, including the head, limbs, and under parts. The tendency in improvement of the wool-producing qualities of all modern breeds has been toward carrying the fleece more completely over the head, face, limbs, and lower line. The advantage is not so much in the increased yield of wool grown on these parts, as that is of little consequence, but in the accompanying tendency to a larger and better yield of wool in all parts. A barefaced and barelegged sheep is always a relatively light shearer, and in contrast with this the sheep wooled from "the eyes to the toes" always yields a heavy fleece and the wool is generally of a better quality than from those having a scanty covering.

Fineness, length, and strength of fiber are essential qualities in a good fleece that should always have prominent consideration in the selection of breeding stock, as these qualities largely determine the market value. Neglect or undue exposure of the flock, a period of sickness, or anything that induces unthrift and impaired vitality invariably results in diminishing both the length and strength of fiber. Well-fed sheep always produce the most and best wool. Softness and pliancy of wool usually correspond in degree with fineness. Harshness and dryness are always detrimental to the quality, even if the fiber is otherwise good. As a rule, this condition may be taken as an indication of poor breeding, although it may be due to disease, old age, or improper treatment. Generally, a fleece begins to decline in value and yield after a sheep becomes 4 years old. Softness and pliancy are to a considerable extent due to the secretions of the skin. A clear pink or yellowish skin is an indication of a good quality of wool, while a pale or bluish skin is generally accompanied by an inferior fleece. The yolk is the oily secretion which gives color, softness, pliancy, and luster to the fleece. The composition of the yolk consists of a soapy matter, principally animal oil and potash, which promotes the growth of the fleece and prevents friction, wearing of the fibers, and cotting. Good feeding, shelter, and care promote liberal secretions of yolk, while exposure and alkali soils result in injury to wool by diminishing the yolk. The secretions are always more abundant under high temperature, hence blanketing and confinement in close, warm quarters will stimulate the production and insure a finer fibre. A liberal secretion of yolk is favorable to the production of a good fleece, but the yolk should be clear and transparent and not too thick and gummy. In addition to these qualities, a fleece should possess the properties of evenness and uniformity; this refers to covering, density, and quality. A good fleece should be as nearly uniform in all parts as practicable. Avoid the fleeces that run to coarse, kempy fibers at the thighs and along the lower line. The best grade and quality of wool is found on the rear part of the shoulder, and the nearer all other parts of the fleece measure up to this standard in length and fineness of fiber the higher will be its value. Wrinkles or folds of the skin about the neck or other parts of the body are detrimental, as the wool that grows within these folds is unlike the other parts of the fleece, and there is a consequent lack of uniformity.

REGULAR FEEDING ESSENTIAL.

Regularity and uniformity in feeding are of prime importance.

Some of the most successful feeders manage a large feeding establishment with absolute regularity and precision. The system generally practiced consists in having a feeding yard separate from the other quarters. One feeding yard serves for five to ten lots of sheep ranging from three to five hundred in number. The grain ration is placed in the troughs and the sheep admitted and returned to their regular quarters in ten or fifteen minutes after the grain is eaten. The sheep themselves become wonderfully punctual and regular in their habits. When properly managed, the feeding begins at precisely the same time and proceeds in regular order each day. This procedure becomes so well understood by the sheep that they always expect their ration promptly on time, and they will take their place at the gate admitting them to the feed yard in regular order by lots. For instance, lot one at its feeding time will be waiting for admittance while lot two in the pen adjoining five minutes before feeding time will be lying contentedly and taking no notice of what is going on outside; a few minutes later, however, they will be crowded at the gate and eagerly waiting their turn. When the feeder is a quarter of an hour late, every animal in the lot seems to recognize and resent his tardiness.

Attention to these and numerous other minor details have a great deal to do with the profits resulting from extensive feeding operations. The loss from indigestion and other troubles frequently reaches four or five per cent under negligent methods, but in careful, judicious handling this can be reduced to less than one per cent.

Restricting the amount of grain to a very limited quantity at the beginning is absolutely essential to the best results in fattening western sheep; a lighter grain feed should then be used in preference to one that is more concentrated, and during the finishing stages a heavier and richer grain ration will be productive of good results.

ALFALFA

J. M. WESTGATE.
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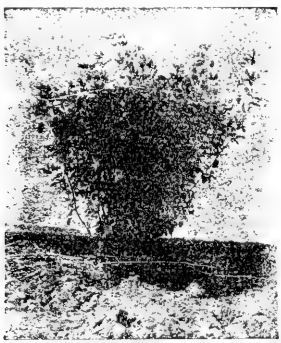

Alfalfa is a deep rooted, long lived, herbaceous forage plant. Its flowers are violet, clover shaped and borne in clusters. Pods are small, hairy and spirally coiled. Seeds are about one-twelfth of an inch long and several in each pod. One of the important characters of alfalfa is its long taproot, often extending 15 or more feet in the soil. The plant thus obtains plant food not obtained by other field crops, and this taproot also enables it to stand much drouth in sections of limited rainfall.

Alfalfa can be grown in every state in the Union, but is very exacting in the humid sections as to soil and treatment.

Below sea level in Southern California and 8,000 feet in Colorado it is grown. By irrigation it yields abundant crops even among the deserts of Arizona, the hottest in this country. Hardy strains withstand the severe winters of the North Central states. It is raised without irrigation in semi-arid sections where the rainfall is only 14 inches a year, and in the Gulf states where the annual rainfall may be 65 inches. Rainfall of 36 inches a year is ample for this crop and an amount in excess of this is usually detrimental.

Although the adaptability of alfalfa is great, yet in the areas not perfectly suited to its successful production care is necessary to provide the very favorable conditions required by the young plants in order to overcome the natural drawbacks.

A deep, fertile, well-drained soil rich in lime and reasonably free from weeds is necessary for alfalfa. The lack of any one of these essentials is very apt to be the cause for failure, especially in the Eastern and Southern states, where alfalfa is at best produced with some difficulty.

A deep, permeable soil should be chosen if possible.

IMPORTANCE OF A FERTILE SOIL.

Since large yields of alfalfa draw on the soil rather heavily for the other elements of soil fertility, it usually requires the richest and best-drained soil the farm affords, and if successful will bring returns to justify the use of this land. There is risk, however, in selecting bottom lands for alfalfa, both on account of their failure to drain promptly and owing to the danger from weeds on such soils. In the east it is usually best to develop the fertility of some of the higher rolling land and seed this to alfalfa.

West of the Mississippi River the soils are usually fertile enough for alfalfa without the use of fertilizer. In the East and South, however, they usually require some artificial treatment to bring them up to the proper degree of fertility before alfalfa can be safely planted. This result may be brought about by the plowing under of some green-manure crop, the application of commercial fertilizers, or the spreading of barnyard manure.

Well-rotted barnyard manure is usually the most satisfactory fertilizer for alfalfa. Fresh manure is apt to carry large numbers of weed seeds; therefore, if necessary to use it, the application should be made to the preceding crop. This will give time for the germinating weed seeds to be destroyed by the cultivation of the preceding crop or by the stirring of the ground incident to the preparation of the seed bed for the alfalfa.

Green manure crops are especially efficient in increasing the humus content of the soil, and this is exactly what many soils require if alfalfa is to be raised upon them. In the South cowpeas, crimson clover, vetches and even bur clover are successfully used. In the states further north crimson clover, cowpeas, soy beans and vetches may be utilized. It is usually best to follow the green-manure crop with some clean-culture crop before seeding the land to alfalfa, as the decaying vines induce acid conditions in the soil that are unfavorable to the alfalfa plants.

If barnyard manure is not available and if there is not time for the utilization of green-manure crops, it is necessary to apply commercial fertilizer liberally to any soil that may be lacking in fertility. This fertilizer should be reasonably rich in phosphoric acid and potash, but may be poor in nitrogen. However, the kind and amount of fertilizer necessary vary greatly with the soil and section, and exact recommendations cannot be made.

PREPARING THE SEED BED.

The tender nature of the young alfalfa plants requires that the soil be in excellent tilth at planting time. The seed bed should be fine

on top but thoroughly settled. The young taproot of the alfalfa plant strikes down immediately and is apt to be seriously injured if it encounters a layer of loose, dry soil at the bottom of the old furrow. As a general rule about six weeks are required for plowed land to settle enough for alfalfa seeding. It is sufficient, however, with many soils that they be disked instead of plowed. Less time is required for the disked land to settle and the operation is much less expensive than plowing.

It is important that the preparation be uniformly good, as the poorly prepared spots are apt to fail. These bare places form the centers from which weeds may spread and ultimately destroy the whole stand. Summer fallowing is often practiced in the semi-arid regions to conserve sufficient moisture for the germination of the seed at planting time. This method is also effective in any section for ridding the ground of weeds.

It is often difficult to establish alfalfa on soils that are so sandy that they drift when bare. The young unprotected alfalfa plants are very apt to be cut off by the drifting sand unless special precautions are taken. This danger may be avoided by applying a light top-dressing of straw or coarse manure just after seeding. Another method is to drill the alfalfa into the high-cut stubble of cane, kafir, or millet; or the alfalfa may be seeded in a thin young stand of small grain, such as oats, which makes a rapid early growth and thus protects the seedling alfalfa plants.

SELECTION OF SEED.

The selection of the seed is an important matter. The original source of the seed, its vitality, and its impurities should each receive consideration. Experiments indicate that it is not harmful to sow northern-grown seed in the South, but southern-grown seed should not be seeded in the Northern States on account of danger from winterkilling. It is usually desirable to secure samples from more than one source and test them as to germination and purity before purchasing.

METHODS OF SEEDING.

The manner of seeding varies considerably in the different sections, but the various methods agree in that it is necessary for the seed to be covered and not sown on the surface of the ground, as is sometimes done with grasses and clovers. Alfalfa may be planted with a drill or seeded broadcast with a hand seeder or wheelbarrow seeder, or by hand. It is usually best to sow half the seed one way across the field and the other half at right angles to the line of the first sowing.

The depth of planting depends on the soil conditions. Covering from three-fourths to one inch deep is usually sufficient on clay soils, but an inch and a half is necessary on sandy soils or in the semi-arid sections, where deep covering is required to insure sufficient moisture for the germination of the seed. When seeded broadcast, a light harrow, weeder, or brush is used to cover the seed. In case the soil is light it may be rolled, but this is not usually advisable, as the soil is more apt to become dried out before the plants can become established. A smaller quantity of seed is used when it is drilled. If a grain drill is used, the amount seeded may be regulated by the use of leather thongs to reduce the feed.

RATE OF SEEDING.

The quantity of seed required per acre is much greater in the humid sections than in the semi-arid and irrigated sections of the country. In the West fair stands have been secured with as little as 1 to 5 pounds of seed per acre, but this has been under perfectly ideal conditions. Good stands from 5 pounds of seed to the acre are not unusual in the West. Twenty pounds per acre is the amount usually recommended, however, and even this must be increased

where the danger from weeds is serious and it is necessary that the alfalfa plants cover the ground from the start to prevent the weeds from becoming established. A pound of ordinary alfalfa contains about 220,000 seeds. As there are 43,560 square feet in an acre, each pound seeded would give about 5 seeds to the square foot. At the rate of 20 pounds per acre each square foot would receive 100 seeds. Many of these fail to grow, and the young plants meet with many accidents.

The following recommendations as to the rate of seeding are made for the different sections of the country: Atlantic and Southern States, 24 to 28 pounds per acre: states east of the ninety-eight meridian and west of the Appalachian Mountains, 20 to 24 pounds; semi-arid sections of the Great Plains, from 5 to 15 pounds, depending on the average rainfall; 15 pounds is commonly seeded in the irrigated sections by the experienced growers.

TREATMENT THE FIRST SEASON.

If seeded in the late summer, or early autumn, alfalfa will require no treatment that autumn unless a growth of more than 12 inches is made before cold weather. If this occurs, the plants should be clipped back so they will go into winter with 8 to 10 inches of growth. In this condition they will be best able to stand the winter and renew growth the following spring. First cutting should be in late spring.

On the other hand if seed has been sown late in fall, or in spring little more than a clipping can be secured in the late spring or summer. This clipping should be made preferably when the basal shoots start and should be made 3 or 4 inches high, as the plants will be slow in recovering if cut too low. It may be necessary to cut at some other time than the ideal time indicated, as, for instance, when the weeds threaten to choke out the young plants, when the blossoms appear, or when the plants begin to turn yellow. Except in the latter case the clippings are usually left on the ground as mulch. If the plants have turned yellow owing to some disease, the clippings should be raked up and removed. A top-dressing of nitrate of soda will sometimes invigorate the diseased plants. The same statements govern subsequent cuttings the first summer, except that the growth is usually too heavy to be left on the field.

TREATMENT THE SECOND SEASON.

Ordinarily no treatment is required during the second season except to cut the hay when the plants are about one-tenth in bloom, or, better, when the new crown or basal shoots are starting. It is important to get the hay off the field as soon as possible, in order to allow the new growth to commence uniformly over the field. If the windrows or cocks are allowed to remain too long on the ground, the alfalfa plants will be smothered out and then bare spaces will form the centers from which weeds will spread.

No pasturing should be allowed during the first or second season, as the crowns have not become sufficiently well developed to withstand the effect of trampling. About three-fourths to a full crop may be expected the next season after late summer seeding in the humid regions. Nearly a full crop is usual the second season after spring seeding if the weeds of the first summer have not seriously injured the stand.

TREATMENT DURING SUBSEQUENT SEASONS.

As long as an alfalfa field shows a perfect stand, with no tendency to run to weeds, it is not customary to give the field any special treatment. If the weeds begin to prove troublesome, it is advisable to disk the alfalfa after cutting. This process loosens up the soil and aerates it, which is decidedly advantageous to the alfalfa. The taproots of the alfalfa plants are not usually injured by this practice if

the disks are set nearly straight, while the weeds are, to a great extent, destroyed. A spike-toothed harrow may follow the disk to level the ground.

In the East an implement known as an alfalfa renovator is meeting with success. It is a modification of a disk harrow with spike teeth on the disks. It is adapted to loosening up the ground and destroying the weeds without serious injury to the alfalfa. Many growers who have a large acreage of alfalfa disk their fields each season. Disking, however, is apt to be destructive to the alfalfa in sections where the alfalfa does not thrive.

If there is a considerable growth of fall weeds or grasses these may be burned off the following spring before the alfalfa starts. The field should be burned before a strong wind to avoid injury to the alfalfa crowns. In sections where soils require liming, it is sometimes advantageous to make an application of lime either in the spring or after the first cutting. Slacked lime may be used, but ground unburned limestone is preferable, as this will not injure the alfalfa plants. A top-dressing of well-rotted or weed-free barnyard manure may be made during the early winter with advantage on most of the soils in the eastern half of the United States.

IMPORTANCE OF THE LEAVES FOR HAY.

One of the dangers to be guarded against in alfalfa hay making is the scattering of the leaves. Only two-fifths of the total weight of the alfalfa plant is in the leaves, yet three-fifths of all the protein is contained in them. That is 44 pounds of the leaves, contain as much protein as 100 pounds of stems. Analysis show that the leaves are somewhat richer than bran for feeding purposes. Much of the loss of leaves ordinarily occurring during harvesting may be saved by proper attention to the curing operations.

ALFALFA PASTURE.

Alfalfa should never be pastured during the first or second season of its growth. Even an old field of alfalfa should be grazed rather sparingly if a uniform stand is to be maintained. The last crop of alfalfa is frequently pastured off, as other grazing is often short in the autumn. Care should be taken not to pasture too closely in the late autumn, as the plants should be allowed to go into the winter with some growth upon the crowns. This will enable them to withstand the winter better and also to store up reserve food material for a vigorous early growth the following spring. The evil effects of the trampling of the stock while grazing can be overcome by disking to loosen up the compacted ground.

EFFECT OF ALFALFA ON THE GROUND.

Alfalfa acts in a manner similar to red clover and other leguminous crops in increasing the yields of the succeeding crops. The roots add nitrogen directly to the soil and are efficient by reason of their deep-feeding habit, bringing up other mineral constituents from the lower layers of the soil and thus rendering them accessible to the shallow-feeding crops.

SEED PRODUCTION OF ALFALFA.

The alfalfa seed producing sections of the United States are much more limited in extent than are the sections where the hay can be successfully raised. Alfalfa sets seed in paying quantities only when there is a comparative shortage in the moisture supply. In the irrigated sections it is the practice to withhold one irrigation when seed is desired. In the sections where the alfalfa is raised without irrigation, a seed crop is usually secured in the dry years only.

Alfalfa requires a dry, hot season for the best development of the seed crop, and for this reason it is customary to save that crop for seed which will mature during the hottest and driest part of the summer. This is ordinarily the second crop, but south of central

Kansas it may be the third crop, and in the northern sections may have to be the first crop, owing to the short growing season. In sections where the second crop would come only a little too late for the heat of midsummer, it is the practice to clip back the first crop when half grown. The alfalfa then comes on more evenly than had it not been cut back, and in addition blooms considerably earlier than had the full first crop been matured.

When allowed to make seed the alfalfa should be cut when from two-thirds to three-fourths of the pods have turned brown, as this will insure greatest quantity of good seed. The methods of harvesting the seed vary widely in the different sections. A self-rake reaper, a mower with a dropping or bunching attachment, or a self-binder with the tying attachment removed is sometimes used. These leave the alfalfa in convenient forkfuls which reduce the amount of shattering in handling.

Alfalfa is threshed from the field if possible, but it is often necessary to stack the crop before threshing. An alfalfa huller built along the lines of a clover huller is usually most satisfactory, but few sections produce enough alfalfa seed to justify the use of these special hullers. Very satisfactory results can be secured with the ordinary grain thresher by screwing down the concaves and providing a set of alfalfa sieves.

A thin stand of alfalfa is best for seed-producing purposes. The yields usually run from 2 to 5 bushels to the acre, but occasionally much higher yields are secured. Most of the alfalfa seed is produced in Utah, Idaho, Colorado, California, Arizona, Montana, Kansas, and Nebraska. The supply of seed raised in this country is far short of the demand.

BARLEY: GROWING THE CROP

By H. B. DERR.
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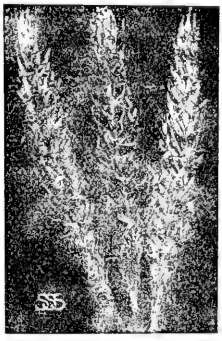

Barley is supposed to be a native of western Asia, where wild forms still exist. It was one of the first cereals cultivated for food. Barley belongs to the grass family or Gramineaé, and to the genus Hordeum.

There are two groups of barley, the two-rowed and the six-rowed. Further subdivisions are made into bearded and hooded (beardless) types, including both the common and the hull-less varieties in each type.

This crop was introduced into America by the early colonists. Improved varieties were first distributed in the United States about 1845. Among the most important introductions were the hooded types, including hull-less forms. In recent years a number of valuable varieties have been introduced by the Department of Agriculture from Europe.

The greater portion of the crop is produced in the States of Minnesota, California, Wisconsin, North Dakota and South Dakota.

The six-rowed barley is most widely grown in the United States. The best yielding varieties are Manchuria, Oderbrucker, Odessa, Gatami, and California. Among the best of the two-rowed varieties may be mentioned Chevalier, Hannchen, Swan Neck, Kitzing, and Hanna. The hooded (beardless) and hull-less barleys yield well in the semi-arid and Rocky Mountain States. In the Southern and Central States the winter varieties are the most profitable ones to grow.

Barley requires a well-drained, porous soil for its best development. Loamy soils give the best yields.

Barnyard and green manures should be plowed under for some time previous to the planting of this crop. If fertilizers are used, they should be rich in phosphates.

Barley should follow corn, potatoes, or other cultivated crops in the rotation. It is an excellent nurse crop for legumes and grasses.

In preparing the soil for barley it should be well worked and free from weeds.

All light seed and impurities should be removed by fanning and screening or by the skimming process.

In the Northern States barley is sown from April 1 to May 15, while in the Central States seeding is generally done from March 15 to April 15. In the Pacific States this crop is sown either in the winter or spring. Winter barley in the Southern States is usually sown from September 15 to October 15. The usual rate of seeding in humid regions is 2 bushels; where the rainfall is slight, best results are obtained from the use of 4 to 6 pecks. Drilling gives better results than broadcast seeding.

In the semi-arid regions harrowing after the plants come up is often beneficial. Considerable barley is grown under irrigation in the Inter-mountain States.

To obtain the best quality of grain, barley should be cut when in the hard-dough stage. Some growers prefer to cut when fully ripe. The grain should be shocked in oblong rather than round shocks, as the oblong shock allows it to cure better. Where there are no high winds, the shocks should be capped. The grain is of much better color and quality if the crop is stacked instead of being allowed to stand in the shock till threshing time. In threshing barley the concaves should not be set too close, or there will be considerable broken grain. The grain should be carefully housed after threshing to prevent injury from moisture and insects.

Barley is subject to both loose and covered smut. Loose smut can be controlled by the modified hot-water treatment, while treating the seed with formalin will destroy the covered smut.

The growing grain is sometimes injured by the "green bug," chinch bug, and Hessian fly. Rotation of crops, and, for the Hessian fly, rotation with reasonably late seeding, are the most efficient remedies. Insects which attack barley in the bin can be kept in check by fumigating with hydrocyanic-acid gas or carbon bisulphid.

Numerous tests of varieties of barley have been made at the various State agricultural experiment stations. Oderbrucker, a six-rowed variety, produced the highest yield at the Wisconsin station. At the Minnesota station Manchuria and Russian were the best six-rowed varieties; Hannchen, Chevalier and Primus are the best two-rowed. At the North Dakota station Russian was the best six-rowed barley and Moravian the best two-rowed. At the Edgeley and Dickinson substations the two-rowed varieties led in yield, while at Williston the six-rowed were best. The best six-rowed barley yielded slightly more than the best two-rowed at the South Dakota station. At the Highmore substation and the Bellefourche Experiment Farm the two-rowed varieties yielded best. At Manhattan, Kans., Tennessee Winter

barley led in yield and Manchuria was the best spring variety. At McPherson, Kans., the six-rowed spring varieties yielded best. At the Montana station the largest feed returns were obtained from the hull-less varieties. The two-rowed barleys were superior to the six-rowed at the Wyoming station. At Akron, Colo., and Modesto, Cal., these two groups differed little in yield. At Nephi, Utah, the six-rowed barleys are the most profitable.

In order to prevent its running out or deteriorating, the seed grain should be thoroughly cleaned and graded before planting. This will insure strong, healthy plants and a good quality of grain. Where no fanning mill is available, the skimming process gives excellent results.

A small breeding plat, in which is planted the seed from selected heads gathered from the standing grain, will enable the farmer to improve the yield and quality of this crop.

OATS: GROWING THE CROP

C. W. WARBURTON,
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Oats were probably first cultivated in eastern Europe and western Asia, where the original wild form is supposed to have existed.

The oats belongs to the grass family and is known botanically as Avena sativa.

This crop grows best on soils with good water-holding capacity, as it requires a great deal of moisture. When grown for grain, phosphorus is usually the most important fertilizing element which can be added. Very rich soils, especially if deficient in phosphorus, cause rank growth, with lodging as a result. When grown for hay or forage nitrogenous fertilizers may be used.

Oats are usually grown in rotation after a cultivated crop, and are used as a nurse crop for grasses or clover. They are sometimes grown in combination with other crops. When grown with barley large yields of grain for feeding can be obtained, while with Canada field peas or vetch excellent forage is produced.

Oats do best on rather loose, well-prepared seed bed. The common method of sowing the grain broadcast on cornstalk land without preparation and covering it with the disk harrow is careless and uncertain. Thorough preparation of the seed bed is strongly advised.

Only plump, heavy oats should be used for seed. The seed should be treated for smut before sowing. The formalin treatment is effective and easily applied.

Drilling usually gives better germination, a more nearly uniform stand, and higher yields than broadcast seeding. The rate of seeding varies with the locality and other factors. In the upper Mississippi

Valley 2½ to 3 bushels are usually sown to the acre. Oats should be sown as early in the spring as the ground can be worked.

In dry-farming sections harrowing drilled oats while the plants are small increases the yield. Spraying with a solution of iron sulphate to kill weeds is recommended by some of the agricultural experiment stations. The largest yield of oats per inch of water applied is usually obtained in the irrigated sections by the use of 15 to 20 inches.

Oats are usually harvested with the grain binder, set up in shocks of ten or more bundles, and allowed to cure for ten days or two weeks. They are then stacked or hauled direct to the thresher and threshed. In the humid regions a better quality of grain is usually obtained at slightly increased cost from stack threshing than from shock threshing. Where there is little rainfall there is no advantage in stacking. The mixing of grain in the separator and the introduction of weeds from neighboring farms by the thrashing outfit should be carefully avoided. The threshing machine should be adjusted to remove all the grain from the straw and to remove the trash from the grain. The grain should be stored in clean, dry bins, well protected from the weather, and kept free from vermin.

The average yields of oats vary from 15 to 25 bushels in the Southern States, from 25 to 40 bushels in the Northern States, and from 35 to 45 bushels in the Rocky Mountain and Pacific States. Yields of 100 to 150 bushels to the acre are sometimes produced in the Northwestern States, particularly in the irrigated regions.

The cost of prduction is estimated at from 20 to 25 cents a bushel. The cost per bushel of very low yields is considerably greater.

Many varieties of oats are grown in the United States. These varieties differ in the size, color, and shape of the grain, the length of time required to attain maturity, the shape and size of the head, the yield, and in winter hardiness. The number of varieties adapted to any particular section is comparatively small. In general, reddish brown (Red Rustproof) or gray (Winter Turf) oats are adapted to the South; early oats, usually yellow in color (Sixty-Day and Kherson), to the Central States; and white, large-grained, later varieties (Swedish Select, Clydesdale, Silvermine, etc.) to the Northern States.

The improvement of the crop can be effected through the seed by grading and sowing only the large, plump grain, by bulk selection of the best plants, and by individual plant selections. The latter is the only method by which pedigreed varieties can be established. Good varieties are sometimes obtained by importation from foreign countries.

The principal diseases of oats are smut and rust. Smut may be controlled by the use of the formalin solution; good preventive measures against rust are the sowing of early varieties and sowing only on well-drained land.

The principal insect enemies of growing oats are the spring grain-aphis, the chinch bug, and the army worm. The remedies applicable to other small-grain crops apply to oats. Grain weevils and moths do rather less injury to oats than to other grains, because the hull of oats serves as a protection; fumigation with carbon bisulphid or hydrocyanic-acid gas is recommended for these insects.

MILLETS

THOMAS A. WILLIAMS,
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PLACE OF MILLET ON THE FARM.

On the whole, it is doubtful if there are many sections in this country where millets should be made a primary crop. Their place is rather that of a supplementary one—a "catch crop," when the corn has been destroyed by hail or otherwise; a substitute for corn where that crop is not easily grown; a crop to be grown on a piece of land that might otherwise lie idle; a readily available crop for use in short rotations; an excellent thing to grow on foul land to get rid of weeds, giving practically the same results as fallowing, or summer cultivation, and in addition a crop of forage; a supplement to the regular and permanent pastures and meadows. It is in such ways that the millets are most valuable on the average farm, and such is the place they should be given in American agriculture.

PREPARATION OF THE SOIL.

For this crop a fertile, mellow soil is preferable. Loams with but little clay and not too much sand give the best results. Heavy clay soils require considerable working in order to get them into proper condition. For spring sowing the land may be plowed in the same manner and at about the same time, or perhaps a little later, as for a crop of corn.

Millets draw their nourishment largely from the surface soil; hence the supply of plant food should be concentrated in the upper layers of the soil and should be in forms readily available to the plant. If the surface soil does not already contain sufficient available plant food, this should be supplied in the form of barnyard manure or commercial fertilizers; those containing large percentages of nitrogen, phosphoric acid, and potash in readily available forms are most valuable. Among such are muriate of potash, ground bone, cottonseed meal, and tankage. The barnyard manure may be scattered on the land and plowed under, but the others had best be sown on the land after it has been plowed and worked into the soil with a harrow. The amount and the exact character of the fertilizer required will, of course, depend upon the kind and condition of the soil. In most instances a mixture of muriate of potash, nitrate of soda, and ground bone or superphosphate will be found beneficial, and on some soils lime may be used to advantage. A light dressing of barnyard manure supplemented by a light application of some such mixture as the above will usually give good results in the East, while on the rich prairies of the West little, if any, fertilizing will be found necessary.

In case the land is cloddy, as frequently happens when much clay is present, the harrow or roller should be used to reduce the surface to a smooth condition. This is necessary, because it is of prime importance that the seed bed should be in condition to insure prompt germination and an even development of the grass; it also facilitates the harvesting operations.

In the West it is the common practice to delay the preparation of the land for millet until near the close of corn planting. This allows the first growth of weeds to get well started, and the thorough plowing required in preparing the land leaves it so well cleaned that the millet easily keeps ahead of the weeds. If the land is very foul, the crop may be cut early, before the second growth of weeds goes to seed, and the land plowed again. Used in this way, millet is one of the best crops that can be grown for the purpose of ridding the land of weeds.

When millet is sown late in the season as a catch crop or as a second crop after rye or some other maturing crop has been harvested, it is not always expedient to go to so much trouble in preparing the land. The seed may be sown on the freshly plowed stubble; or, if the land is quite loose and mellow, as is the case in parts of the west, the stubble may be "disked" or gone over with a cultivator to kill the weeds and the seed sown and harrowed in. This "disking" or cultivating is the most common practice when millet is used as a catch crop after the main crop of corn or small grain has been destroyed by hail, as is not infrequently the case in the Middle West. Another quite common practice is to sow on newly broken ground, either without any other preparation than simply breaking up the sod, or, as is more often the case, the "breaking" is torn up with a "disk" or heavy iron-toothed harrow.

SEEDING.

When millet is handled as a primary crop, seeding is generally done during the latter part of May or early in June in the North, and, of course, correspondingly earlier in the South; or, if the moisture conditions are favorable, it may be delayed as late as August 1 in the latter region. It is a general rule to sow millet as soon as the corn is planted. The foxtail and broom-corn millets and some of the Barnyard millets are quite sensitive to cold, and hence seeding should be postponed until the ground has become thoroughly warm and danger from protracted cold is past. It should, however, take place before the dry period of the summer begins. A succession of crops for soiling or silage can easily be obtained by sowing at periods of two or three weeks from May 10 to late in July.

The seed may be sown broadcast or with a grain drill. Ordinarily, there is but little if any choice between the two methods when the crop is to be cut for hay, except that the drilled seed gives an evener stand and a little less seed is required. For a crop of grain or for soiling or ensilage, drilling will generally give better results. On some soils it is a good plan, when growing for seed, to plant in drills far enough apart to allow cultivation to prevent packing of the soil and loss of moisture, particularly when barnyard millet is planted.

The common practice is to sow from one-half to three-fourths of a bushel of seed of foxtail or broom-corn millets, or one-fourth to one-half of a bushel of barnyard millet per acre for a crop of hay and somewhat less for a crop of grain. Rich, well-prepared land will require less seed than that which is poor and thin; and it is not necessary to use quite so much seed when the crop is to be ensiled or fed in the fresh state as when it is intended for hay. Thin seeding is likely to result in coarse-stalked plants, which are not desirable for hay. Some of the varieties may require a smaller quantity of seed than others on account of the greater tendency of the plants to "stool" but as the amount of "stooling" depends so much upon soil and climatic conditions, it is not usually safe to allow very much for it.

HARVESTING.

Cutting foxtail millets for hay should never be delayed until the seed has begun to ripen, particularly if it is to be fed to horses. On the other hand, it is best not to cut too early, as the hay is liable to have a more or less laxative effect upon the animals eating it. However, it is better cut early than late. The hay may be safely cut any time during the period from complete "heading out" to late bloom. Professor Chilcott, of the South Dakota experiment station, who has had much experience in growing and feeding this crop, says: "The best time to cut millet for hay is when a majority of the heads have distinctly appeared." The tough, fibrous nature of the stems and the stiff beards on the heads of millet that has been allowed to approach too close to maturity detract much from the palatability of the hay, and, although something is gained from the seeds by way of nutriment, enough is lost in palatability and increased fiber to more than make up for it. Moreover, the earlier cut hay is a much safer food for all kinds of stock. On account of the succulency of the stems and leaves the curing takes place rather slowly, and the seeds may make a great deal of development after the plants are cut; hence, if cutting is delayed until after the seeds are well formed, they will often develop sufficiently during the process of curing to germinate. Cutting for soiling or for the silo can be done a little later than for hay, but should take place before the seed has begun to ripen.

For soiling or for early hay, barnyard millets may be cut as soon as the grass "heads out," or even before. The best quality of forage will be obtained by cutting during the blooming period, and when the crop is to be cured for hay this is the best time for harvesting. For silage the crop may be cut any time between "heading out" and the formation of the seed, preferably when most of the plants are in late bloom. The quality of the forage seems to deteriorate more rapidly with age than in the foxtail millets; hence it is more imperative that cutting should be done while the plants are at their best.

On account of the greater succulency of the stems, barnyard millet is more difficult to cure than either the broom-corn or the foxtail millets, but when properly cured the quality of the hay is better than that of the other millets, and in some localities the yield is said to be greater.

One of the best methods of preserving this crop is by the use of the silo. Those who have tried this method have obtained excellent results. A fine quality of ensilage may be made by using barnyard millet and a leguminous crop like soy beans or clover.

The broom-corn millets are not difficult to cure, and the same methods may be employed as for any coarse grass. What has been said regarding the time for cutting barnyard millet for various purposes applies as well to the millets of this group. The forage deteriorates rapidly upon reaching maturity, and hence cutting should not be delayed too long.

The common practice is to use a horse mower or a scythe when cutting for hay or soiling. In localities where curing takes place rapidly and there is little or no rain during haying time, the self-rake and the self-binder have been used with good results. The bunches left by the self-rake are allowed to lie without further attention until cured; or possibly, in the case of a heavy yield, they may be turned over once or twice to facilitate drying. When the self-binder is used the bundles are loosely made and are set up "two and two" in long shocks extending north and south, so that the bundles may get the full benefit of the sunshine. It is not often that this method can be employed in cutting for hay, but when practicable it saves much labor and leaves the hay in condition to be stored easily and well. Another way of using the self binder is to allow the millet to be dropped unbound to the ground, the bunches then being handled as when the self-rake is used.

One of the best methods for curing the hay is to allow the grass to lie in a swath until partially dry, then gather into cocks and let stand until thoroughly cured, after the manner of curing alfalfa and clover. Hay cured in this way is of better quality than that allowed to lie in the swath exposed to the sun until dry.

Millets may be harvested for the seed in the same manner as small grain of any sort. One of the best ways is to cut with a self-binder, place the bundles "two and two" in long, narrow shocks, with the long diameter north and south, let stand until dry, and thrash from the shocks. This method is quite generally practiced where the millets are most extensively grown for seed. It is possible that seed of a better quality may be obtained by stacking the millet before thrashing; but whether or not the gain would be sufficient to pay for the expense of stacking is doubtful. The crop should not be allowed to become too ripe before cutting, for the seed falls out badly during the process of curing and thrashing. Probably the best time for harvesting for a crop of seed is when the seed is in a "stiff dough."

SWEET CLOVER

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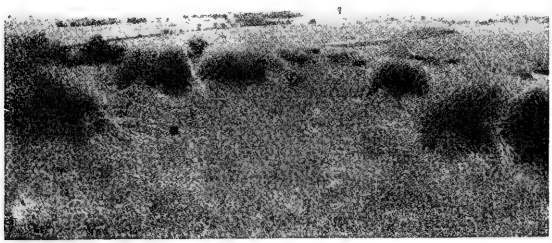

When properly handled sweet clover is a valuable addition to the farm crops of many sections.

It is efficient as a soil renovator, by reason of the large amount of nitrogen it is able to take from the air as well as the humus added to the soil when it is turned under or from the decay of roots when the crop is harvested.

Sweet clover will grow on soils too low in humus content for the favorable growth of most other legumes.

Its large roots, which develop the first year, facilitate drainage and do much to break up and improve the tilth of the soils which lie below the reach of the plow, as these roots rapidly decay when the plant dies, and their effect is therefore almost immediate.

Sweet clover occurs as a weed usually along roadsides, in vacant lots, in fence corners, along irrigation ditches, and in other places not utilized or cultivated.

It is not troublesome in cultivated fields or meadows as ordinarily treated, because it can not persevere more than two years from one seeding.

The presence of some hard seed which does not usually germinate the first season may enable it to continue in a meadow for a number of years longer.

Sweet clover can usually be killed by mowing when in full or late bloom.

It is regarded as a pest in irrigated fields of the West, where the irrigating water carries in the seed from scattered plants which quite commonly grow along the ditch banks.

In irrigated sections where alfalfa succeeds well, the introduction of sweet clover is not to be recommended.

The presence of sweet clover on otherwise bare soils, even as a weed; is not necessarily to be condemned and is thus adding to the soil is both humus and nitrogen content and is thus preparing it for subsequent profitable crops.

The great numbers of failures in obtaining a stand of sweet clover are due in part to the high percentage of hard seed and in part to seeding on too loose a seed bed, especially when combined with a lack of inoculation.

Spring seedings in general are satisfactory, but in the South excellent stands are also obtained from late winter seedings. The latter method may prove generally applicable wherever there is abundant rainfall.

Analysis and feeding experiments indicate that it is nearly equal to alfalfa in feeding value.

The feeding value, palatability, and presumably the digestibility decrease rapidly after the blooming period.

RAPE AS A FORAGE CROP

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Rape is best adapted to rather cool, moist climates, such as prevail in portions of Canada and the Northern United States. It can, however, be successfully grown as a forage crop in many of the warmer and drier sections. In the Northern States the biennial rape will not survive the winter; hence does not produce seed. In the South it may be grown as a fall or winter forage. The annual varieties used for the production of oil form seed the first year, but these kinds are not suitable for forage. In favorable seasons, or with small amount of irrigation, excellent crops of rape are grown in Wyoming, Montana, the Dakotas, and other States in the so-called semi-arid region, and many instances are on record where good crops have been produced without irrigation, under conditions of drought so severe as to cause the failure of corn and other farm crops.

In the Middle South rape can not compete with crimson clover for forage.

SOIL REQUIREMENTS.

When it is grown as the primary crop of the season, the land should be prepared by deep and thorough plowing, preferably early in the preceding autumn. In some soils a second plowing should be

given in the spring before the seed is sown; but in soils that are naturally loose and mellow, such as are found in portions of the Northwest, a simple stirring of the surface with a cultivator or disk harrow will often be sufficient. The land should be well pulverized by harrowing before the seed is sown. When the land needs fertilizing, barnyard manure may be applied before plowing in the autumn, or if the land is plowed twice the manure may be spread on during the winter or early spring before the last plowing. Commercial fertilizers may be applied by harrowing in at the time that the land is being pulverized previous to seeding. Whatever treatment the land is given in preparation for this crop, it should be such as to afford a deep, mellow seed bed, as free as possible from noxious weeds. One of the advantages of the rape plant is the rapidity with which it grows under favorable conditions. It then produces a succulent, crisp, and tender foliage which is much relished. Hence it is desirable to supply a crop with sufficient plant food and adapt its early growth as much as possible to the usual rains. During prolonged dry weather the foliage becomes tough and somewhat leathery.

SEEDING.

Throughout the Northern States generally seeding may take place from the first week in May to the middle or last of July, according to the season and locality. In the South the seed may be sown in September or early in October. Under favorable conditions 2 to 3 pounds of seed per acre will be sufficient, and it will never be necessary to use more than 5 pounds per acre. The seed should be planted in drills far enough apart to allow cultivation. In practice the distance varies, but it is seldom less than 20 inches nor more than 32; 24 to 28 being perhaps the most satisfactory, all things considered. For planting small fields any of the common garden drills will be found quite satisfactory, but for large fields a grain drill, with some of the feed hoppers closed may be used. When the ground is clean and in proper cultivation otherwise, good results may be obtained by using the grain drill with all feed hoppers open, and giving no after cultivation. As a rule, however, it will be best to plant in wide drills and give sufficient shallow cultivation to keep the soil in good physical condition and destroy weeds.

With favorable soil and climatic conditions, good crops of rape may be obtained from broadcast seeding; but whenever there is any danger of the surface soil becoming very dry during the time the seed is germinating or when land is at all foul, drilling will give much better results. When sown broadcast, 4 or 5 pounds of seed may be needed but it is not advisable to sow too thickly as the plants do not make so vigorous a growth.

Drilling in rows has many advantages. The cultivation increases the yield, conserves the moisture, and keeps down the weeds. Furthermore, if the crop is to be pastured there is much less waste when the plants are in rows as the animals are inclined to follow between the rows rather than crossing them and trampling on the plants. Some advocate drilling the seed on ridges. This may be an advantage where there is an excess of moisture, as the plants have better drainage and the animals while feeding are less likely to cross the rows. On the other hand the crop will not withstand drouth so well as when given level culture.

Rape resists drouth fairly well, but in regions subject to a summer drouth the sowing should take place early enough to get the plants well started before this period or it should be delayed until after the drouth. During a prolonged dry period the plants are often attacked by a kind of plant louse which causes them to wilt and become valueless for forage. Where rape is depended upon as a chief crop, it is advisable to make several successive growings. If a particular crop comes on too early, it may be cut and thus make the second growth available later.

Rape seed is mostly imported, but can be grown in the Middle South and certain localities along the Pacific coast. Rape is reported to have become a troublesome weed in places along the Lower Columbia River, Oregon.

CULTIVATION OF THE CROP.

If the seed has been drilled, the crop should receive at least three or four cultivations during its early growth. This should commence as soon as the plants are large enough, and be continued until the plants have spread so much as to prevent further passage. If the crop is cut it is best to follow with a cultivator, as this causes the stems to send out new shoots more rapidly.

HARVESTING AND UTILIZING THE CROP.

The rape is usually ready for use in about 8 or 10 weeks from the date of the seeding. The general practice is to use it as a soiling crop or as pasturage. Sheep and swine may be turned into the field and allowed to remain until the rape is pastured off. Cattle may also be allowed to run on the field, but as they waste much of the forage by trampling it is better to cut the rape with a scythe or mower and feed it to them. While it may be utilized for feeding cattle it is probably not as well suited for these as are some of the other succulent fodders. For this reason it may not be advisable to grow rape for cattle only.

Although rape can be used as a soiling crop and is so used in many places, it is doubtful whether it will supplant other plants for this purpose. Its chief use is for pasture, especially for hogs and sheep. Geese and other fowls will do well upon such pasture, and those who are raising poultry as a chief industry will find a field of rape a useful adjunct. It can not be recommended for curing as a dry fodder or for silage. It is so succulent that it cures with difficulty and it can not be compared to corn for silage.

In cutting rape for soiling it is best to cut about 4 inches from the ground. It is advisable to arrange the cutting so that each day's product will be consumed within that time, as the foliage soon wilts and is not then relished so much. Rape is especially valuable for breeding ewes in midsummer when the pastures begin to fail, as the succulent feed keeps up the supply of milk for the lambs. If the crop is to be cut the first week in July, the seed must be sown early in May, as it usually takes about two months to reach the proper stage for soiling. Furthermore, by sowing early, as many as three cuttings can be made during summer and fall.

FEEDING VALUE.

Rape has a high feeding value. It makes an excellent feed for fattening sheep and swine and for producing an abundant flow of milk in milch cows. On account of danger of tainting the milk many people do not feed it to the cows until after milking. Rape can be used to good advantage as a part of the ration for animals that are being fed in pens or for the show ring. It is also a valuable food for young lambs at weaning time. By beginning as early as practicable in the spring and seeding at intervals of two or three weeks, a continuous succession of rape can be produced throughout the period when the permanent pastures are most likely to be short. Rape will endure quite severe cold weather, and thus will last a long time after the ordinary pasture grasses succumb to the frost. By the use of this crop stock can be gotten into good condition for the holiday markets or for winter, and there need be no check in growth, fat, and milk production through insufficient succulent food during the late summer and autumn months, as is too frequently the case.

DANGER FROM BLOATING.

There is no danger to hogs from bloating, but cattle and sheep may suffer seriously if sufficient care is not taken. It is best to give the animals a full feed of grain just before they are turned into the rape.

It is also advisable to allow the animals to run on a grass pasture or to have feed racks of hay or straw accessible. Salt should be freely supplied. There is little danger when animals are put upon rape for the first time, as it is usually necessary for them to acquire a taste for the plant. For pasturing lambs it is an excellent plan to employ hurdles of movable fences. The animals may be inclosed in a limited space and are not likely to get enough forage to cause damage. There is by this method less waste. Hurdling may be employed also for geese.

SOY BEANS

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For intensive farming the soy bean is the best annual legume to grow for forage in the southern part of the cotton belt and into the southern part of the corn belt.

The soy bean, whether used as hay, grain, straw, or ensilage, is very valuable as feed for live stock.

Soy bean hay is practically identical in feeding value with alfalfa and yields from 2 to 3 tons per acre. To make good soy-bean hay the crop must be cut when about half the pods are full grown or when the top leaves first begin to turn yellow.

Soy bean grain is more valuable than cotton-seed meal as a supplemental feed in the production of pork, mutton, wool, beef, milk, and butter. A bushel of soy beans is at least twice as valuable for feed as a bushel of corn. As the grain is hard it is usually desirable to grind it into the meal for feeding. This is best done by mixing with corn before the grinding to prevent gumming up the milling.

Harvesting ordinarily should be done when the leaves first begin to turn yellow, as the quality of the straw rapidly deteriorates thereafter and the yield of seed will be practically as large as at any later time. From 20 to 30 bushels of grain and 1½ to 2 tons of straw per acre are not uncommon.

If soy beans are grown for the seed alone, and sometimes this is desirable, the harvesting can be done most easily by waiting until all the leaves have fallen.

Soy-bean straw, if the crop is cut before the leaves fall, is fully as valuable for feeding as timothy hay for cattle, and is eaten by stock with much relish. Even when the harvesting is delayed until all the leaves have fallen, stock will eat the straw readily.

Mixed with corn, soy beans are excellent for ensilage. The two crops may be grown together, but it is usually better practice to plant in separate fields and mix when putting into the silo.

It is necessary to give the soil thorough preparation in order to be successful with soy beans. Only fresh seed or seed which has been tested for germination should be planted. Two-year-old seed is usually not reliable. The seed should be planted shallow, not to exceed 2 inches in depth, and preferably in rows 30 or, better, 36 inches apart to permit sufficient cultivation to keep down weeds.

For harvesting soy beans a mower with or without a side-delivery attachment, a self-rake reaper, or self-binder can be used. A binder can be used only with the tall varieties. The threshing can be done with a grain separator by using blank concaves and running the cylinder much slower than for small grains or by the use of machines specially designed for handling soy beans and cowpeas.

Soy beans and cowpeas can be grown together satisfactorily; the hay of such a mixture is better than either crop alone and the yield is generally greater. In planting the two together the seed should not be covered too deeply, as deep planting will result in a poor stand of soy beans.

As a crop in a short rotation soy beans are very desirable. They can be grown so as to use an entire season in the case of the late varieties, or two crops in one season can be secured from some of the earlier ones. They can also be used very advantageously to follow a small-grain crop the same season.

The important commercial varieties of soy beans are the Mammoth, the Hollybrook, and the Ito San. Among the most valuable new varieties are the Austin, the Wilson, the Riceland, the Meyer, and the Haberlandt.

BROOM CORN

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LOCAL FACTORS GOVERNING THE GROWING OF BROOM CORN.

Climate and soil are the leading factors that determine whether broom corn can be profitably grown in any particular locality. The growing season will be found long enough in almost any part of the United States, since but from two to three months of good growing weather is all that is needed to produce a crop. Any soil that will produce a good crop of corn is sufficiently fertile for broom corn. For the best grades of fine, short, tough, dwarf broom corn light, sandy soils have been found preferable, richer soils having a tendency to produce coarser brush. For good crops of long standard brush a fertile soil is required, but river bottoms that are overflowed are unsatisfactory, because deposited weed seed will give trouble when the broom-corn plants are young and slow of growth.

TIME OF PLANTING.

The date of planting must be governed by the climatic conditions of the locality in which the crop is grown, but it can be said that nowhere should planting be begun until the soil has become quite warm. Broom corn will not stand as early planting as Indian corn, and if the seed be put in cold soil they will rot or germinate poorly, giving an irregular stand of weakly plants. The fact that this crop requires later planting than corn and many other farm crops is a consideration in favor of broom-corn growing, since it permits a more equal distribution of spring work. In localities having long growing seasons it may be desirable to plant so that the crop will be ready for harvesting at the season when dry weather is most likely to prevail. In California planting usually takes place from the middle of April to the middle of May, while in Oklahoma and Missouri it is done during May. In Central Illinois, where standard broom corn is grown so extensive that three counties (Coles, Douglas, and Moultrie) sometimes produce one-half of the total crop of the United States, the planting season extends from the middle of May till the middle of June and harvesting lasts from the middle of August to the middle of September. Where the acreage is extensive it is best to plant various fields at intervals of a week or more, so that all the fields will not blossom at the same time and all can be harvested when in the proper condition.

METHODS OF PLANTING.

Standard broom corn should be planted in rows 3¼ to 3½ feet apart, while dwarf corn will give better yields if the rows are about 3 feet apart. The dwarf sort should also stand closer in the rows, about 6 or 8 plants to the foot. An Illinois grower of much experience gives 3 inches as the best distance apart in the row for the plants of standard broom corn. Drilling is the usual method, but sometimes, for convenience in hoeing, it is thought best to plant in hills. When this method is employed, 16 to 18 inches in a good distance between hills, with 5 or 6 stalks of standard or 8 to 10 of dwarf corn to the hill. On poorer soil a thinner stand is required than on richer soil.

Almost all corn planters can be arranged to plant broom-corn seed. If there are no plates with sufficiently small holes, the holes of the plates used for planting corn can be run full of melted lead and then bored of the desired size. Too often the mistake is made of planting too much seed, and this often comes about by reasoning that it is better to plant a little too much than not quite enough, for if too thick the plants can be thinned. It is true the superfluous plants could be properly removed, but as a matter of fact they very seldom are. Thinning out plants of this nature is a tedious task and requires more time than to plant the field a second time. It is thus best to plant exactly the proper quantity of good seed; then should any unusual circumstances produce a poor stand the field should be cultivated and harrowed and planted again. No pains should be spared to get an even stand of plants, for otherwise the crop will not be of uniform quality.

It is hardly necessary to state that before planting the soil must be brought to a finely cultivated condition, for growers know that this is advisable with all crops; but it is especially true of broom-corn because of the slow-growing habit of the young plants. If the land is rough and cloddy, early cultivation can not be accomplished without covering the plants. For the same reason listing or planting in deep furrows is not satisfactory. On heavy clay soil the seed should be planted one-half inch deep, but on very sandy soils or light soils containing much vegetable mold an inch will not be too deep. If dry, the soil should be rolled after planting.

CULTIVATING.

Cultivation must be commenced early and repeated frequently to

prevent weeds from getting start of the slow-growing young plants. As hoeing and hand weeding are too expensive, large weeders, harrows, and very narrow-shoveled cultivators with fenders to keep the soil off the plants are employed until the plants attain a height of about a foot, after which they grow rapidly and will thrive with the same cultivation as does Indian corn. Many find it advisable to harrow lengthwise with the rows with a sharp-toothed harrow just as the plants are coming up. With a wide harrow and plenty of horsepower this operation is quickly accomplished. Old stalks and other trash should never be left on the surface of a field planted to broom corn, or it will seriously interfere with the early cultivation of the crop. Level culture is most satisfactory from the beginning till the crop is laid by, and will leave the field in good condition for harvesting. Cultivations should be frequent enough to keep the soil from becoming crusted and hard, for in this condition the moisture passes off most quickly leaving the soil dry and the soluble salts or plant food at the surface and entirely out of reach of the roots of the plants. An inch or two of finely divided soil or dust serves as a thick blanket in conserving the moisture and keeping the dissolved plant food accessible to the roots.

TIME TO HARVEST.

In most states broom corn harvest comes at a time when it does not conflict with work on the principal field crops. It comes after oat and wheat harvest is finished and before corn is ripe. The present market demands brush of good green color, and to obtain this the crop must be gathered when in bloom or when the antlers are falling from the heads. In this condition the seeds are of course undeveloped and are therefore of little value except as fertilizer. In some sections, notably California, the seed is allowed to ripen before the crop is harvested, about a ton of seed per acre thus being obtained, which is used as feed for hogs and poultry, or it is ground into meal and used as a bread-stuff for making griddle cakes. When the crop is allowed to ripen the brush sells for a very low price, and this practice cannot be recommended. In California home-grown brush sells for $35 to $95 per ton, while the same market quotes eastern-grown brush at $125 per ton. If the crop is grown for brush, it should be harvested at a time when it is of the best quality. If grain is what is wanted, much better crops can be obtained by growing Kaffir corn, another variety of this species that has been improved for seed and forage production. If forage is the product desired, sorghum will give better returns. Kaffir corn, sorghum, and broom corn being closely related plants, that have been developed along different lines for different purposes, illustrate how susceptible of modification is this species. It is likely that before long plant breeders will be able to produce a variety that will yield good brush for brooms as well as stocks rich in sugar for making syrup.

DWARF AND STANDARD VARIETIES.

The method employed in harvesting dwarf broom corn is quite different from that used in the case of standard. Because the dwarf plant is but 4 to 6 feet in height and the head is partly inclosed in the sheath of the upper leaf, it is found more convenient to pull the heads than to cut them and then remove the "boot." In some parts of Oklahoma and in some other sections the pulling of dwarf broom corn is accomplished by going through the field two or three times, each time pulling the heads that are sufficiently advanced and piling them on the ground and shading the piles with stalks or blades. This practice can be followed only in sections where dry weather prevails at harvest time, and even in such sections its not the most satisfactory. By making sure of an even stand of plants and by yearly selecting seed from plants that have ripened at the same time, crops can be produced with plants so uniform that the entire field may be pulled at one operation and loaded directly upon wagons. This lessens the amount of harvest work and increases the possibility of producing brush of good and uniform quality.

Because of the partial inclosure of the heads within the "boot" the dwarf sort is more subject to injury from rains at harvest time than the standard. Water collects in the "boot" around the head and causes it to redden, which reduces the value of the crop by about one-half. If weather conditions are favorable, dwarf broom corn can be harvested in first-class condition and with less labor per acre than can standard, but doubtless the greater yields of the latter make it as easy to bend down the tall stalks and cut a ton of brush from 3 acres as it is to pull a ton of dwarf corn from 5 acres, these being the averages, respectively, of the two kinds required to produce a ton of brush.

TABLING.

The greater height of the standard broom corn made necessary some method of bringing the heads down within easy reach for cutting, and the system of tabling is universally used because of its convenience and because the brush is thereby kept clean and dry after it is cut. Tabling consists in bending at a height of 2½ or 3 feet the stalks of two adjacent rows diagonally across the intervening space so that the portion of the stalks above the sharp bend is supported in a horizontal position, with the seed heads of one row extending about 2 feet beyond the opposite row. The operator walks backward, bending a few stalks first from one row and then from the other, thus forming a self-supporting "table" from every 2 rows, and bringing the seed heads into a convenient position for cutting. One man can table as fast as two can cut, the three doing about 2 acres per day.

CUTTING.

In cutting the operator passes along the spaces between the tables and with a knife similar to a shoe knife cuts the heads 6 to 8 inches below the attachment of the straws. As this portion of the stalk is often surrounded by a leaf sheath it becomes a matter of much importance for cutters to learn to cut through the stalks but not quite through the sheath, so that the latter will remain attached and not be lifted away with the head. Cutters wear a leather stall on the right forefinger, and grasping the stalks between the forefinger and the knife blade they cut the stalk by pressure of the thumb upon the back of the blade. While 8 inches is the length custom has established for cutting the stems below the attachment of the straws, some growers, either ignorantly or for the purpose of making their yields weigh heavier, cut the stems much too long, thereby reducing the value of their crops. Six inches of stem is sufficient to meet all of the requirements of the manufacturer and thus, with a minimum of waste, the brush will command a higher price per pound.

The brush as cut is laid by handfuls upon every second table being so placed that the top end of all the piles on any two tables will point toward the empty table between. By thus placing the brush from four rows upon every alternate table wagons can be driven over the empty tables on either side.

HAULING.

In hauling the brush from the field to the scraper, wagons are driven over the empty tables and a man on either side takes up the piles of cut brush with tops toward him, turns and places them on the rack in such a manner that the load is formed of a double row of seed heads, having the stems lapping in the middle to bind on the load.

Dump racks are quite essential to the broom-corn business. They reduce to a minimum the work of unloading, being so arranged that by dropping a lever to the ground and driving forward the bed is shoved back till the rear end drops to the ground and allows the brush to slip off in an even pile just as it was on the rack.

SORTING.

Those who have grown broom-corn for many years know the necessity of separating the crooked brush from the straight, as a few crooked heads will lower the market price of an entire bale. This sorting can best be done in the field while the brush is in small piles on the tables, where such crooked heads can be easily distinguished and separated. Crooked brush sells for about half the price of straight brush, is much harder to handle, and can not be so neatly baled, so that a grower is fortunate if his crop contains but little crooked brush.

If harvest is delayed a few days many heads that would have been straight if cut at the proper time will become crooked by the weight of the forming seeds or by the weight of water that will hang to the heads in heavy drops during wet weather. As rain injures the quality, the cut brush should be hauled to the scraper, seeded, and put in sheds as soon as possible after being cut.

Since no less than twelve men can advantageously thresh broom-corn and place it in sheds, most growers do not keep a sufficient force to table, cut, and haul at the same time the threshing is in progress. Consequently many adopt the practice of working the force in the field the greater portion of the day, and in the evening threshing and putting away to dry what has been cut during the day.

THRESHING.

The removing of the seeds from the brush is variously termed seeding, scraping or threshing. This is accomplished by bringing the heads in contact with a rapidly revolving cylinder the surface of which is set with teeth or spikes. A thresher of the kind now in general use in sections growing much broom corn, costs from $150 to $200. Such a machine, with eighteen to twenty men to keep it running steadily can clean the brush from 30 to 40 acres per day. The seed heads are not drawn entirely through between the cylinders as in threshing grain, but are held firmly and evenly by means of a toothed belt which carries an even stream of brush in front of and at an angle with the cylinders, so that, beginning at the top portion, the seed is removed as the heads are carried farther and farther between the cylinders. With all the seed removed the belt deposits the brush on a table at the other end of the cylinders, The feeding of the seed heads to the thresher and the removal of the cleaned brush and storing it in the drying sheds, requires a force of twelve to fifteen men.

In some sections crews with threshing machinery travel from farm to farm and thresh the crop. Growers should see that the seed is all removed from the heads, or manufacturers will be justified in reducing the price, as they can not be expected to pay 5 cents per pound for material which they can not use.

DRYING.

That the brush may retain a fresh green color after drying, it is necessary that it be dried rapidly and not exposed to strong light while drying. To meet these requirements broom corn is ordinarily dried in sheds. During the broom-corn season these sheds are used expressly for drying the crop, but during the remainder of the year they can be used for storing corn fodder or farm implements, or for various other purposes. A shed 48 feet long, 16 feet wide, and 10 feet to the eaves will usually furnish sufficient room for drying the crop from 40 acres. If there is an interval of three or four weeks between the harvesting of one 40 acres and a later 40 acres, the brush from the first can be bulked or baled and the same shed used for the second.

Understanding the requirements, most farmers will be ingenious enough to construct very convenient drying sheds. The main requisites are a dry location, a good roof, with eaves extending some distance

beyond the sides, and good ventilation throughout. A common method of construction is to place uprights, 8 feet apart in each direction, and nail to these, 4 inches apart, strips 1¼ inches wide, reaching across the shed. For a shed 48 feet long this plan gives six transverse sections, each 8 feet wide, with ends open for free circulation of air. Slats, 2 inches wide and 8 feet long, are required in large numbers, but are not put in place until the filling of the shed with brush is begun. For a shed of the size mentioned above 2,200 such slats are needed. Beginning at the bottom a shelf is formed by placing two of these moveable slats across a section, resting their ends in the lowest spaces between the transverse strips nailed to the uprights. The brush is then evenly spread 2 or 3 inches deep upon these two slats, and then another shelf is made 4 inches above the first, and so one, till the shed is filled. If placed more than 3 inches deep the brush will not dry quickly and well, and may become musty or "shed burned."

BULKING.

In the shed the crop is safe from injury by rain, although warm, dry weather is desirable to cause it to dry rapidly. Just as soon as dry, so that the stems seem to contain no moisture when squeezed or twisted, the brush should be taken from the slats and piled in straight, compact tiers. In dry weather from two to four weeks will be sufficient to dry the broom corn for bulking, which should be done as soon as it is dry in order to prevent bleaching.

BALING.

This process consists in pressing the brush into compact bales and binding with wire. It is very important that it be well and neatly done, for to some extent the appearance of the bales determines their market value.

Baling can be done at any time after the brush has become thoroughly dry, but as long as it is the least damp or "in the sweat" it should remain bulked. Manufacturers frequently open bales that have become moldy after baling which would have been good stock had the baling been delayed till the brush became thoroughly dry. Baling is accomplished usually by a horse-power press.

COW PEAS

H. T. NIELSON.
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A system of agriculture without the use of a leguminous crop tends to lessen the productivity of the soil and makes necessary large outlays for nitrogenous fertilizers. With a leguminous crop grown at frequent intervals, the productivity may be maintained or even

increased. The cowpea is at the present time, and probably will continue to be, the most valuable legume for the entire cotton belt, and can be depended upon to succeed on practically all types of soils. It has been well said tha tthe cowpea is to the South what red clover is to the North and alfalfa to the West.

It is safe to say that no one thing can add more to the agriculturel wealth of the South than the more extensive growing of the cowpea. This will supply the southern markets with much of their hay, which is now shipped in from the North and West. It will tend to increase the production of live stock, which is very essential in securing the maximum returns in any system of agriculture; and it will go far toward keeping the soil in good tilth and maintaining its productiveness.

While cowpea culture has greatly increased in late years, this very fact has in part brought about a large increase in the price of seed. The more extensive use of the crop will be seriously retarded until seed becomes more plentiful than at present. Fortunately the development of improved machinery for handling cowpeas makes it certain that this will soon be the case and that the price of seed will be materially reduced without lessening the profit to the grower.

Cowpea seed for planting should be fresh and of good quality; or if old, should be tested for germination, as seed more than one year old is likely to be very low in vitality. It is practically certain that seed which ripens and is harvested in dry weather is of superior quality. Varieties with hard seeds are injured to a less extent by wet weather at harvest time than those with soft seeds. They also retain their vitality for a longer time and are less subject to the ravages of weevils. The Iron cowpea is the only common variety which has any advantage over other sorts in this respect.

The cowpea is the best legume for the entire cotton belt, and can be profitably grown much farther north. It is especially suitable for combined hay and seed production or for hay alone.

To make good cowpea hay requires careful handling of the crop. The plant should have made its growth and have at least the first pods ripe when the mowing is done. Uniformity in maturing is essential in getting the best results. The use of a tedder is very helpful. The serious loss of leaves can be avoided by not handling the hay when the leaves are dry and brittle. The curing is best done in small cocks, and the hay is ready for the stack or barn when no moisture can be wrung from the stem by twisting it with considerable force.

Cowpeas for hay production are very advantageously grown in mixture with sorghum, Johnson grass or soy peas. The yield is thus increased, the quality improved, and the curing more easily done. Cowpeas give very good results when grown with sorghum in cultivated rows and are very commonly planted in corn and used for grazing or ensilage.

Pasturing cowpeas is not the most economical practice, but it is frequently resorted to because of the small expense it entails. Cowpeas are especially suitable for grazing hogs.

Cowpea hay is very nutritious. It is nearly equal to wheat bran as part of a ration. It is satisfactory for work stock and for beef or milk production, and it gives good results when fed to poultry. The grain is a rich feed, excellent for poultry, but little used for other feeding. Cowpea straw is an excellent roughness and nearly as valuable as the hay.

Cheaper cowpea seed will result in the much more extensive growing of the crop. Harvesting for seed can be done most cheaply by the use of machinery. The crop should be cut with a mower or self-rake reaper when half or more of the pods are ripe. When thoroughly dry the thrashing may be done with an ordinary grain separator with some modifications, with a two-cylinder cowpea thrasher, or with a one-

cylinder special machine which has all the threshing spikes sharpened in addition to having ingenious devices which make it the most satisfactory thresher for handling cowpeas.

Cowpeas add nitrogen to the soil and improve its mechanical condition. They are most profitably grown in rotation with other crops. The following rotations are good ones:

Cotton, three years; corn and cowpeas fourth year; and then cotton again. This is all right on the better soils of the South, but the cotton should be planted only two years in succession on the poorer soils.

Wheat or oats with cowpeas each season after the removal of the grain crop, the land being seeded to grain again in the fall, making two crops a year from the same land.

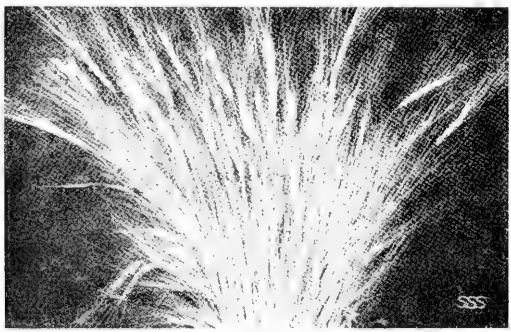
Cotton, first year; corn and cowpeas, second year; winter oats or wheat followed by cowpeas as a catch crop, third year; and then cotton again.

The most valuable varieties are the Whippoorwill, the Unknown or Wonderful, the New Era, and the Iron for field purposes; and the Blackeye for table use.

The Iron cowpea is practically immune to the two serious diseases, wilt and root-knot, which attack the other varieties more or less. It alone should therefore be grown wherever these diseases are prevalent.

WINTER EMMER

MARK ALFRED CARLETON,
Bureau of Plant Industry.



The grain is somewhat similar to that of spelt, but is usually harder, more compressed at the sides, and redder. Emmer is a more hardy plant than spelt in every way. Almost all varieties of emmer are considerably resistant to drouth, and certain varieties are very resistant to rust. Moreover, emmer is a crop adapted to general conditions, more so than other cereals, and will withstand to a consirable degree the effects of wet weather in humid climates. Fall-sown varieties are also quite winter hardy. Emmer will produce a fair crop under almost any condition of soil and climate, but thrives best in a dry prairie region with hot summers, where it gives excellent yields.

CULTIVATION OF WINTER EMMER.

The preparation of the land, seeding, and subsequent management of the winter-emmer crop are practically the same as that required for rye and winter wheat. As the crop is well adapted as a

winter cereal to intermountain districts of the West where dry farming is practiced, the first requisite, of course, is to have the land thoroughly prepared for the conservation of moisture. It may be sown either on summer fallow or follow a cultivated crop. If following an uncultivated crop, the ground should be plowed rather deeply as soon as possible after the latter crop is removed and thereafter often surface cultivated, particularly after rains, to conserve as much moisture as possible for the emmer. Seeding should be done only with a drill. It should be sown about the same time as winter wheat, the date ranging from about August 20 to October 1. In the drier districts the rate of seeding should be about the same as for barley—that is, from 4 to 6 pecks per acre.

In the Eastern and Southern States, where the rainfall is greater it is nevertheless often rather dry near seeding time. Much the same treatment of the soil should, therefore, be practiced as in the Western States, except that the need of conserving moisture will not usually be so great. Also, in the humid areas it is possible to follow a cultivated crop with emmer and it is never necessary to sow it on summer fallow. The crop may take the place of winter wheat or winter barley in systems of rotation.

Emmer has been known as a profitable crop in parts of the United States for 15 to 20 years. Both winter and spring varieties are grown, but the spring varieties have been most commonly planted.

There is an increasingly strong demand for a drought-resistant winter feeding crop in many parts of the country.

Emmer is commonly but incorrectly called spelt or "speltz." True spelt is a distinct crop. Emmer has stouter, compact, and usually bearded spikes which on breaking up in thrashing leave a short, pointed pedicel attached to each spikelet. Spelt spikes are more slender and loose, both bearded and beardless, and, in breaking up, the pedicel usually does not remain attached to the base of the spikelet.

All varieties of emmer are considerably resistant to drought and certain varieties are very resistant to rust. They are also considerably resistant to the effects of wet weather in humid climates, though best adapted to rather dry regions with hot summers.

Emmers are cultivated throughout southern Europe and to some extent in east-central Africa. They are very largely grown in Russia.

Black winter emmer was first introduced from France by the Department of Agriculture in 1904, and the seed has been increased and distributed as rapidly as possible since that date.

It has been tested on many of the Departmental experiment farms with good results. A 5-year test at McPherson, Kans., gave an average acre yield of 45.5 bushels, the highest yield obtained being 77 bushels in 1908. Five crops grown in the Panhandle of Texas averaged about 35 bushels per acre.

Many co-operating farmers in the Western States report yields ranging from 25 to 60 bushels per acre. A seed-breeding farm in Wyoming has been selecting a strain of this Black Winter emmer with special reference to winter resistence. In 1909 this variety yielded at the rate of 42.5 bushels per acre and in 1910 a 10-acre field yielded at the rate of 69.1 bushels per acre. Both crops were grown under irrigation.

Emmer withstands extremes of climate much better than any other cereal and is well adapted for use as a general-purpose crop.

Winter emmer is likely to prove of value as a feeding crop in a number of the Central, Southern and Eastern States where oats are not profitably grown. It will ripen earlier and yield better than oats and may furnish fall and winter pasturage also.

In the Rocky Mountains and Pacific coast States emmer will be particularly valuable as a stock feed under dry farming. The best

results, so far, have been obtained in intermountain districts. It will probably not be winter resistant in the Northern States east of the Rocky Mountains.

In Europe emmer is often used as human food, in Russia chiefly in the form of a breakfast food, and in the other countries to a considerable extent in bread making.

In the United States it has been and is likely to be most used for stock feeding. In a considerable number of feeding tests conducted at different stations emmer has been found nearly, if not quite, equal to barley and oats for sheep and cattle.

In deciding the value of emmer not only its comparative feeding value but its comparative productiveness and certainty in western dry-farming areas must be taken into account.

Since the emmer kernel does not become separated from the chaff in threshing, emmer is more comparable to oats and barley than to wheat as a feeding grain.

The preparation of the land, the seeding, and subsequent management of the winter emmer crop are practically the same as required for rye and winter wheat.

Emmer is really a subspecies of wheat and can be readily crossed with wheat by artificial means. It is being used in this way for the purpose of adding rust resistance to wheat hybrids.

FLAX CULTURE

H. L. BOLLEY,
Collaborator of the Bureau of Plant Industry.

In America flax growers make little distinction as to what type of soil they select on which to grow the crop. Speaking generally, the farmers of the Netherlands, Belgium, Germany, and Russia follow the same course. The writer's observations show that the kinds of soil upon which the crop reaches the standard of perfection are very uniform in all regions, though fair crops may be raised upon soils of a great diversity of types:

For the fiber crop the texture of the upper layers of soil should be such as to give a finely compact surface, well drained, but of sufficiently sandy and loamy nature to allow the first growths of the root system of the young plant to be rapid, and yet it should not be so loose as to cause rapid drying or so compact as to cause baking and cracking. A feature of the greatest importance is that there should be a heavy, rather compact subsoil capable of persistent retention of moisture. The best types of the fiber crop of the Netherlands and of Russia were found upon soils which seemed to possess these general

characteristics with a fine admixture of sea sand, giving a type surface which could stand a large amount of water without baking and cracking during periods of partial drought.

The matter of fertility seems to be of minor importance. The flax crop can be grown upon a soil so poor in the chemical elements needed for plant nutrition that scarcely any other crop could succeed, provided the other and more important conditions are favorable. In hot dry regions, where the crop is more commonly grown for seed, the features of the soil which are of extreme importance are those which insure a shallow but compact seed bed, a rapid first growth, and a steady water supply from a heavy underlying subsoil. While good crops of seed flax may be grown upon light sand with a gravel subsoil, this can only be expected in years when the season of boll formation has an abundant rainfall or receives its equivalent by irrigation.

As to the application of manures and fertilizers, the growers in the Netherlands do not recommend barnyard manure upon lands which are to be used for the production of fiber flax. They claim that this fertilizer produces too much wood in the straw and thickens the fiber. Many of the growers, who have to deal with lands of light quality that need pushing, apply a light top-dressing of saltpeter at about the blossoming period. This is said to lengthen the growth period and to soften and lengthen the straw.

The matter of soil fertility and the use of fertilizer is one which must be worked out for each individual district and in many cases for each particular farm. The application of properly composted barnyard manures to the crop which is being grown for seed purposes can not be condemned, as the strong woody stem in this case is of material benefit in seed production. North Dakotans have found that the application of barnyard manure to this crop in the presence of the flax wilt is extremely harmful, the land being entirely ruined for flax in some cases by one application. After investigating the matter, the writer has come to the conclusion that this, in all cases, may be traced to the fact that diseased flax straw had been used for feeding the cattle, bedding them down, etc. Flax-disease fungi were thus able to permeate all of the resulting manure. Thorough composting of such manures has been found to be a preventive of this difficulty.

As flax is at present grown the importance of selecting new or previously unused land seems to be almost imperative. It is probable that this feature of flax culture can only be escaped by a judicious system of crop rotation, soil resting, and seed treatment, not because the soil is exhausted for flax, but because of the disease. Until a wise system of rotation or soil rest can be introduced, the farmer who expects success ought not to undertake the production of a flax crop on other than practically virgin soil. He must also practice careful selection, grading, and treatment of the seed if he wishes to continue successful production for any extended period.

THE SEED BED.

Great stress is usually placed by English writers on flax culture upon the idea of deep-working the soil in preparing the seed bed. The writer's work has shown that this idea is correct where compactness of soil is provided; but those who contend for a loosening and softening of the seed bed seem to be wholly in the wrong. The one thing that the flax crop can not stand is a friable, loose-textured soil. The best flax soils are found to be those with an admixture of very fine sea sand or silt resting upon a heavy compact subsoil. Where the better crops of Belgium, the Netherlands, and northwest Russia are seen growing, the topsoil, with its fine admixture of sand, soon after preparation becomes very compact, save only a slight blanket of surface sand which, worked to the top by means of rain, acts as a mulch or blanket to prevent cracking and baking in periods of slight drought.

The character of the soil naturally determines the time for working and plowing, but usually fall plowing is apt to give the best results in all those types of soil which tend to become more compact by working. In all cases in which the soil after deep plowing become more thoroughly compact by harrowing or top-working, much harrowing is desirable. In very rich, loamy soils, which are liable to become loose and friable by persistent working—such, for example, as the lands of the Red River Valley—the top-working should be confined to the destruction of weeds and should be stopped at the slightest sign that overwork is tending to looseness, liability to blow, etc.

The aim is to provide a well-worked undersoil so as to give it a close texture and continuity for the ascent of water and at the same time to provide such surface working as to give a fine, shallow seed bed. Regardless of traditional theories, observations show that a compact soil underlying a shallow seed bed of not to exceed 1 inch in depth always give the best results. The deep plowing and working should precede the seeding time just as long as possible, as its value consists in a proper aeration of the underlying soil for the preparation of food materials for the coming crop.

SEEDING TIME.

The seeding time for the fiber crop is always essentially the same in all regions. The seed is sown as soon in the spring as the work can be accomplished and not have the young plants injured by frost. the date varies according to the latitude and climatic features. The rather cool rapid-growth months of spring and early summer tend to produce long and fine types of fiber. The fiber plant can not withstand the hardening influence of the high dry heat of the late summer months.

In the case of the seed crop the same features will be found to hold true in regions having a long dry summer season. Northward and northwestward in America, including the Dakotas and Minnesota, the crop may be sown with hope of success even until the 10th or 20th of June, as the crop often takes on a very heavy growth in the cool autumn days. In North Dakota, if the late crop is not caught by early frosts, the yield is apt to be even greater than that from the early sown crop, which at times may be compelled to ripen too rapidly by the action of heat in August. The early crop also seems to be more often injured by rust. However, the date of seeding in North Dakota cannot be much earlier than May 20 or later than June 20 without loss from frost.

SEEDING METHODS.

The methods of seeding for flax are as various as the people who grow the crop. The larger areas of the Netherlands and Belgium are seeded with ordinary grain drills, and such machinery is also used upon the larger estates in Russia where the crop is grown for oil production. Small areas in all countries are seeded by hand broadcast and harrowed in. Many fiber growers contend that this method gives best results. Russian peasants broadcast by hand almost exclusively.. If evenly cast it is supposed that all straws are shaded alike, and therefore mature evenly as to fiber.

The chief merits of any method of seeding must depend upon three points. The seed should be imbedded at an even depth, not too deeply, and should be evenly distributed. The brush harrow, as commonly made by American farmers, gives good results when properly handled, but no scheme of broadcast seeding can give the regularity of depth that yields best results with this crop.

Considering entire crops, the best ones are quite the most apt to follow the drill. Regularity of depth in seeding is of the utmost importance with flax, whether planted for oil or for fiber purposes. If the seeds are buried at different depths there is very great irregu-

larity of first growth, resulting in unequal maturing. Trials at the North Dakota Agricultural Experiment Station have demonstrated that a matter of difference in depth of planting may cause differences of several weeks in ripening the seed crop. Where this difference in depth of planting occurs in a field it is evident that a crop of evenly matured seed can not be harvested. There will be at harvest time plants in blossom and others which are losing seed by shelling, etc. This is a common fault in the large seed fields of North Dakota and can only be overcome by the careful preparation of the seed bed and careful use of the drill. More of the crop is lost in the Red River Valley region through too deep drilling upon too mellow soil than through any other cause. The young plants often are compelled to waste all of the energy stored in the seed before they expand any leaf surfaces to the sunlight and thus become able to gain strength. With the fiber crop evenness of growth and maturing of the straw is of first importance.

CROP ROTATION.

With the flax grower, crop rotation is of great practical importance. He must either rotate or cease to grow the crop. This is the view of the writer, based on observation and experiment, and it is the verdict of all experienced growers. There seems to be but one alternative—breeding and selection. Crop rotation is the natural remedy for many troubles which come from too constant growth of one crop upon a given type of soil. Work at the North Dakota Experiment Station has pointed out that the chief reason flax fails so certainly after a few crops lies in the action of a fungous disease, but this is no argument against crop rotation, nor is it proof that the continuous culture of one crop is not a ruinous policy. While flax is not a gross feeder like other plants—and it can be proved that it does not feed more heavily upon the available plant foods than wheat, oats, or other cereals—yet it is probable that it has its own particular ways of depleting the soil and that a rest period, regardless of the disease problem, can not fail to be beneficial to the crop.

An effort to learn the best possible system of rotation for flax resulted in showing that among growers there is much confusion of ideas. Only one fact that was characteristic of all replies obtained, viz: that there should be as long a period of years intervening between flax crops as possible. Most growers in the Netherlands and Belgium hold that the chief necessity for long series of crops in the rotations is due to the destructive action of flax wilt, but they also believe in the process as one that is essential to general agriculture. Of the best producers of fiber flax, few believe in less than seven-year series. Many recommend much longer rotation periods and favor the introduction of grass and pasture in the series of crops. A very common rotation in the Netherlands is as follows: (1) Manure or rape; (2) wheat; (3) rye; (4) legumes (horse beans); (5) flax; (6) potatoes; (7) potatoes; and (8) fallow—rest, and crop of weeds turned under as a green manure late in the season. If the soil is very fertile, the potatoes follow legumes, preceding the flax.

The feature more widely observed is that on light soils a leguminous crop is of much benefit in preparing the soil for flax culture. If, however, the soil naturally posesses much available nitrogen, the flax is sown as long after the leguminous crop as possible and is usually preceded by grass or other hay crops. The most common procedure in all countries seems to be the placing of flax in the series after several years of grass and pasture. This seems important when freedom from the destructive action of wilts is considered. During the writer's investigations, however, no grower was found who believed that any sort of rotation series could serve as a complete specific against the occurrence of flax-sick soil. It is also self-evident that no rotation can be given which will fit all soils and regions. Experi-

ments at the North Dakota Experiment Station seem to point to the marked value of one or more crops of cultivated corn in the series with the flax crop, preceded by hay and pasture sod of several years' standing.

CONTROL OF WEEDS.

Very little need be said of weeds. It is not supposed that they should be allowed in any carefully grown crop; yet there is probably no crop in which their presence is more pernicious than in flax culture. In the case of the fiber crop they must all be removed from the straw by hand before retting, a very costly process. Their presence in the crop also causes unevenness of growth and maturing, with the associated evils. In the seed crop they occasion by their extra foliage great difficulty in properly drying and curing the seed bolls for threshing. The greatest difficulty is also experienced in attempting to grade weed seed from flaxseed; and whether the seed is being purchased for oil or for sowing purposes, there must be a loss to the grower on account of the low price obtainable for such inferior seed. As the Russian peasant, even though he pulls the crop by hand, always puts into the seed he sells all the weed seed available, and as the seed exported by Russian seed houses is made up of many separate small collections of flaxseed from many different districts, one is apt to find many types of very bad weeds in any importation.

HARVESTING THE SEED.

Whether the seed is to be used for sowing purposes or for oil, great care is necessary in the harvesting process in order to hold the quality of the seed. The essentials are that the seed should be allowed to mature, be harvested dry, and be kept in a dry condition. Since there are no growers who practice growing fiber flax for seed purposes it is easy to account for the fact that even the best which is to be had is of very uneven grade. In Russia the seed is sown so thick that only two or three of the topmost bolls are able to mature. When the crop is pulled the other bolls furnish weak, half-mature, scaly seeds. No Russian peasant grows any great quantity of seed, and before it reaches a seedsman many different lots are mingled.

SORGHUM

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CULTURE OF SORGHUM

While sorghum is a crop that is generally thought to require little attention, its yield and value can be materially increased by using care

in its culture. Good seed of the right variety is necessary for the best yields, but there are other equally important factors that must not be neglected, such as preparation of the soil, time and rate of seeding, and manner of planting. Perhaps more failures to get satisfactory crops are due to improper seeding than to any other cause, and too great care can not be given to planning for and planting the crop.

PREPARING THE SEED BED.

Although a large portion of the land planted to sorghum is left unplowed until a short time before seeding, this practice is by no means advisable. For the best yields there must be a firm seed bed, obtained by plowing the land early in the fall and harrowing or disking to keep down weeds until seeding time. Such preparation allows whatever vegetation there may be in the soil to decay and leaves it in the best tillable condition. In the drier regions this treatment serves to take in and retain any moisture that may come during the winter season and to decrease the chance of failure from drought. In the same manner it increases the yield in more favorable seasons. In the more humid sections early preparation is preferable, though not so necessary as in the drier regions. The land is sometimes prepared by "bedding" or listing with a middle buster or a turning plow.

PLANTING.

The planting of sorghum deserves more careful attention than any other operation entering into the production of the crop. The time, method, and rate of seeding means success or failure in the degree in which it has been properly or improperly done. It is therefore of vital importance that the farmer attend carefully to the planting of his crop.

Time of planting.—The sorghums are usually planted soon after corn, when the ground is thoroughly warm. They may be planted at any time after that date until as late as will permit the crop to mature safely. In the Southern States the first of April is considered early planting. Northward, using the northern line of Louisiana as a base, the season gets later at the rate of about a week for every 2 degrees, or 150 miles. Early seeding is preferable for the reason that it may produce a second crop which can be used for forage. It is usually well to make two or three different plantings at intervals of about ten days or two weeks so as not to have all the crop mature at the same time.

Method of planting.—For sirup production sorghum should always be planted in rows 3 or 3½ feet apart. This may be done with a single or double row planter either on a bed, on the surface, or in a listed furrow, as is most advisable, depending on the section where the crop is grown. Furrow planting is most common in the drier regions, but it is practiced to some extent in the humid sections. In some of the lower and poorly drained lands planting is made on a bed, but only under such conditions should this method be used.

Rate of seeding.—The rate and regularity of seeding largely influence the yield of sirup regardless of the method used. Seeding should be done so that the plants will be very evenly distributed and average a distance of 4 to 6 inches in the row, or even thinner in the drier regions. A special plate for the drill can be made that will plant the crop very satisfactorily and thus avoid a great deal of labor in thinning. A very small quantity of seed is required to plant an acre, at most not more than 1 to 2 pounds.

CULTIVATION.

While sorghum will grow and give fair yields with little or no cultivation, this is by no means the most profitable method of producing the crop. Careful cultivation has repeatedly been known to

increase materially the yield per acre. The first cultivation can be given with a spike-toothed harrow, and as soon as possible afterward is should be cultivated deeply with sweeps or shovels. Later in the season at least two additional shallower cultivatings should be given for the best results. Sorghum can be cultivated to advantage until it begins to put out heads, provided care is taken not to destroy the surface feeding roots.

HARVESTING.

The stage at which the sorghum contains its greatest sugar content, a matter of the greatest importance to the sirup maker, has been the subject of much investigation in former years. It appears that from the time the seed is in the late milk stage until it is becoming dry, the cane is in the best condition for sirup making. Some prefer to wait until the seed is hard before cutting, as the sugar content is still higher then, but they run the danger of a frost before all of the cane is worked up.

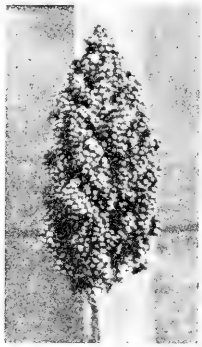
Cutting can be done by hand or by a harvester. When harvested by hand, the individual canes are cut about 6 or 8 inches above ground and laid across the rows with the heads all in the same direction. With a harvester and binder the cutting and binding in bundles forms one operation, and the seed heads are all at one end of the bundle. It is customary among some makers to leave the hand-cut cane in the field for a day or two to wilt the leaves, which is said to improve the quality of the sirup. The seed heads are removed and left in the field to be collected after the harvest. In making a good grade of sorgum sirup, it is necessary to remove all leaves and seed heads from the cane, as these on passing through the mill give the juice and the resulting sirup a bad flavor and also make clarification more difficult. In removing the seed heads, about 6 to 18 inches of the upper cane should be cut off, as this part contains little sucrose and many impurities; suckers should also be discarded for the same reason.

The harvesting should progress in proportion to the mill work, no more being cut at one time than can be worked in two days. When the weather is cold the cane may be cut and shocked. Some makers have kept it in stock for four weeks with no appreciable loss in sirup-making properties. Like other sugar-producing plants, however, a freeze does not hurt the crop, provided the cane can be worked up just as soon as it thaws. On freezing, the cells of the cane are broken; and on thawing, decomposition quickly sets in. A frost will not hurt a ripe cane materially, but if the cane is immature it will be spoiled. Frosted cane, like frozen cane, should be worked up as soon as possible. In Lousiana the sugar cane is "windrowed" when a frost or freeze is expected—that is, the cane is cut and laid on the ground between the rows, the leaves serving as a protection. In the case of sorghum, under such conditions, if the weather is warm during the middle of the day, the leaves on the stalk soon produce a "heating" of the pile and decomposition sets in. "Heated cane" and frosted cane do not affect the flavor of the sirup. One of the large makers states that by shocking the cane with leaves and heads on, he has kept it in good condition for many weeks. This, of course, was during cool weather, for even when standing in shocks the cane is liable to "heat."

As stated before, for sirup making the best stage for cutting is just before hardening of the seed. Earlier than this the cane is too green and the resulting sirup will have an unripe taste. If cut when the seeds are very hard the juice is said to be difficult to clarify, and the flavor of the sirup is not good.

MILO AS A DRY-LAND GRAIN CROP

CARLETON R. BALL and ARTHUR H. LEIDIGH.



Milo is one of the durra group of sorghums, closely related to white durra ("Jerusalem corn") and brown durra. It is probably of African, perhaps Egyptian, origin and was introduced into the United States between 1880 and 1886.

Milo is recommended as a short and suitable name for this crop. It is commonly known as a dwarf milo, yellow milo, and milo "maize." The last name confuses it with corn.

There is only one variety handled by the seed trade. What is sold as "dwarf" milo is ordinary milo grown on the drier plains, where for lack of moisture it is low in stature. There is a true dwarf milo, but it is not yet generally sold on the market.

Ordinary milo stools freely at the base and branches freely above, is tall and rather stout, and is not uniform in height or in time of ripening. The heads are mostly pendent. As a crop it is difficult to handle rapidly and satisfactorily.

Improved or selected milo has to a large extent been prevented from suckering and branching, is low and rather slender, is uniform in height and ripening, and has its heads mostly erect. It may be handled easily by machinery and is fitted for harvesting with headers.

Milo is widely grown in western Texas and adjacent parts of New Mexico, Oklahoma and Kansas. It is well suited to the entire southern half of the Plains region below 4,500 feet elevation. It can probably be profitably grown as far north as South Dakota and westward in Colorado and New Mexico to elevations of about 6,000 feet; likewise in the Great Basin region.

The soil requirements of milo are much the same as those of corn. The land should preferably be fall plowed and well prepared in spring to hold moisture and destroy weeds.

In general, milo should be sown about three weeks later than corn and after all danger from frost is past. Milo may be listed or sown at the surface as local conditions require. The seed is sown by means of special sorghum plates used in either the corn planter or the lister planter.

The best rate of planting for highest grain yields lies probably between 4 and 6 pounds to the acre, depending somewhat on the character of the soil, the average rainfall, the length of the season, and the cultivation given. Four pounds to the acre has given the best results in the Texas Panhandle. The rows should be about 3½ feet apart and the stalks 6 to 8 inches apart in the row.

The cultivation of milo is essentially the same as that for corn.

Farmers should carefully select their own seed of milo, especially where it is not yet a staple crop. Selection is usually made for (1) earliness, (2) drought resistence, (3) higher yields, (4) uniformity, (5) freedom from suckers and branches, and (6) erect heads. The yield and value of the crop can be greatly increased by such means. Select enough for a small seed plat if time lacks for more extensive work. Interest the farm boys in this work.

Harvesting is usually done with a corn binder or by cutting the heads by hand. Ordinary milo can not be headed by machinery because of the pendent heads. Our improved milo with erect heads may be cut with a grain header or with a row header. A good adjustable kind of row header is much needed.

Thrashing is done with a grain separator. Slowing the cylinder and removing the concaves or part of the concave and cylinder teeth will prevent cracking the seed.

Yields vary from 25 to 55 bushels of seed to the acre. The yields in the Panhandle of Texas average about 40 bushels to the acre. As tillage methods and the crop itself are improved the yields should be increased.

Milo is used mostly as a feeding grain on the farms. It may be fed as thrashed grain, in the head or in the bundle. The grain is preferably cracked or ground before feeding, except for poultry. The heads may also be ground. Milo is entering more and more into the production of chops and poultry foods.

Milo, like other sorghums, may become poisonous in the green state, especially when checked or stunted in growth.

The principal insect enemies are the chinch bugs, aphides or plant lice, fall army worm, and sorghum midge. The last may totally prevent seed production in the Gulf region.

Milo is entirely free from the kernel smut and the head smut of sorghum.

RICE CULTURE

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PREPARING THE GROUND.

Time to plow.—The time of plowing differs with different lands and circumstances, but in general it may be said that for wet culture plowing is done in the spring shortly before planting time. In the South Atlantic States, however, the land is often plowed or dug over with a hoe early in the winter. In some parts of southern Louisiana the land is so low and wet and the soil so stiff as to necessitate plowing in the water.

Deep plowing.—Some planters advocate shallow plowing for rice, because it appears to thrive best in compact earth. Even if this be granted, it does not prove the superiority of shallow over deep plowing. It has been demonstrated that the better the soil and the more thoroughly it is pulverized that the better the crop. The roots of annual cultivated plants do not feed much below the plow line; it is therefore evident that deep cultivation places more food within the reach of the plant. If pulverizing the earth deeply is a disadvantage, by reason of the too great porosity of the soil at seeding time, it can be easily remedied by the subsequent use of a heavy roller. If the soil is well drained deep plowing will be found profitable. Deep plowing just before planting sometimes brings too much alkali to the surface. The remedy for this is to plow a little deeper than the previous plowings just after harvest. The alkali will then be washed out before the spring plowing. The plow should be followed in a short time by the disk harrow and then by the smoothing harrow.

If the land is allowed to remain in furrows for any considerable time it will bake and can not be brought into that fine tilth so necessary to the best seed conditions. This is particularly true of rice land. If the best results are desired it will be advisable to follow the harrow with a heavy roller. The roller will crush the lumps, make the soil more compact, and conserve the moisture for germinating the grain, rendering it unnecessary to flood for "sprouting."

For dry culture the land is prepared very much as it is for a crop of oats.

DRAINAGE.

Perfect drainage is one of the most important considerations in rice farming, because upon it depends the proper condition of the soil for planting. It may appear unimportant that a water plant like rice should have aerated and finely pulverized soil for the seed bed, but such in the case. Thorough cultivation seems to be as beneficial to rice as to wheat. Complete and rapid drainage at harvest time allows the crop to be reaped under the best conditions and reduces the expense of the harvest.

Thorough drainage is even more essential for rice than for wheat, because irrigation brings the alkali to the surface to an extent that finally becomes detrimental to the rice plant. Alkali cometimes accumulates in the soil just below the depth of the usual furrow to such an extent that any plowing is dangerous to the crop. Experience has shown that there is but one effective way of disposing of these salts, and that is by thorough drainage and deep plowing. As the water drains away the excess of soluble salts is carried off. Now if the ditches are no deeper than the ordinary furrow it is evident that only the surface of the soil can be cleared. Either tiling must be employed or there must be plenty of open ditches, the main ones at least 3 feet deep.

Where the lands can not be thoroughly drained after the crop has matured there is liable to be an encroachment of water grasses which will grow so rapidly during the winter that they almost fully possess the field. If the soil can be drained sufficiently to enable the planter to put in a winter cover crop, it will be found exceedingly profitable, in addition to preventing the establishment of these injurious grasses.

SOWING.

Selecting the seed.—Too great care can not be exercised in selecting rice for seed. It is indispensable that the seed should be free from red rice, grass, and weed seed, uniform in quality and size of kernel, well filled, flinty, and free from sun cracks. Uniformity of kernel is more essential in rice than in other cereals, because of the polishing process.

Time to sow.—The best time to sow rice differs in different sections and varies somewhat with varying conditions in the same section. It may be sown between the middle of March and the middle of May, but in most cases it should be sown by April 20 for best results. Sowing should take place as soon as possible after spring plowing. Care must be taken to plant the several fields at different periods, so that harvest will not be too crowded.

Amount to sow.—The amount of rice sown per acre varies in different sections and with different methods of sowing, from 1 to 3 bushels per acre being used.

Germination.—Three different methods of treating the seed are followed. Some let on just enough water to saturate the ground immediately after sowing and harrowing and at once draw off any surplus water. This insures the germination of the seed. Others sow and trust to their being sufficient moisture in the land to germinate the seed. This is sometimes uncertain and rarely produces the best

results. A few sprout the seed before planting by placing bags of rice in water. This is sure to be a failure if the soil is very dry when the seed is sown. In case of planting in dry soil without following with water saturation, rolling the land after seeding and harrowing has been found beneficial.

Drilling.—The rice should be planted with a drill. It will be more equally distributed and the quantity used to the acre will be exact. The seeds will be planted at a uniform depth and the earth packed over them by the drill roller. It also prevents the birds from taking the seeds. The roller should precede the drill. If it follows the drill the feet of the horses, mules or oxen drawing the roller will press some of the planted rice 4 or 5 inches deeper into the earth than the general average. Furthermore, the lumps of earth will prevent the uniform operation of the drill. In rice farming too much emphasis cannot be placed upon the importance of thoroughly pulverizing the soil to a considerable depth; leveling with a harrow as perfectly as possible; crushing all the lumps and packing the surface to conserve the moisture; and planting the seed at a uniform depth.

Broadcast sowing.—Broadcast sowing of rice is the method most in vogue in many localities, but it should be discontinued; the seed is never scattered with uniformity; some grains remain upon the surface and the remainder is buried by the harrow and the tramp of the teams to depths varying from 1 to 6 inches. Rice sown broadcast does not germinate with any uniformity. Some seeds are taken by the birds, some are too near the surface and lack moisture to germinate, while others are buried too deep. In some instances the variation in the germination of the rice in the same field has been as much as eight weeks. Then at the harvest when the main portion is ready for the reaper a good deal of the rice is still immature. The product commands a very low price in the market, because the merchantable grain must sell at the price of the low grade. It requires much more care to produce a strictly first-class quality of rice than is found necessary in the production of any other cereal, and nearly every fall prime offerings are the exception.

The South Carolina method.—Seeding in South Carolina commences in April and continues nearly to the middle of May. Just prior to seeding the land is thoroughly harrowed, all clods pulverized, and the surface smoothed. Trenches 12 inches apart and 2 to 3 inches deep are made with 4-inch trenching hoes at right angles to the drains, and the seed is dropped in these. This is usually covered, but occasionally a planter, to save labor, stirs the seed in clayed water, enough clay adhering to the kernels to prevent their floating away when the water is admitted. Great attention is paid to the selection of good seed.

FLOODING.

Flooding is the most important distinctive feature of rice culture as compared with the culture of cereals generally. When it is considered that rice can be grown successfully without any irrigation whatever, or with continuous irrigation from the time of sowing till nearly ripe, the wide scope there is for variation in practice will be realized.

General directions.—Except where the water is necessary for germinating the seed, flooding is not practiced until the rice is 6 or 8 inches high. If showers are abundant enough to keep the soil moist it is better to delay flooding till the rice is 8 inches high, as there is considerable danger of scalding the rice when very young. At 8 inches high a sufficient depth of water can be allowed on the field to prevent scalding. The depth of water that should be maintained from the first flooding until it is withdrawn for the harvest depends upon other conditions. If the growing crop thoroughly shades the land, just enough water to keep the soil saturated will answer. To be safe, however, for all portions of the field, it should stand 3 to 6 inches

deep, and, to avoid stagnation, it should be renewed by a continuous inflow and outflow. In case the stand of rice is thin the water should be deeper. A flow of water through the field aids in keeping the body of the water cool and in preventing the growth of injurious plants that thrive in the stagnant water. The water should stand at uniform depth all over the field. Unequal depths of water will cause the crop to ripen at different times.

Where the lands are sufficiently level and have excellent drainage the tillering of the rice can be greatly facilitated by keeping the soil saturated with water but not allowing enough to cover the surface. In this way the crop is frequently nearly double what it would be if allowed to grow dry until tall enough to flood or if flooded before fully tillered.

The practice in South Carolina.—Under the usual method the water is let on as soon as the seed is covered, and remains on four to six days, till the grain is well sprouted. It is then withdrawn. As soon as the blade is up a few inches the water is sometimes put on for a few days and again withdrawn. The first water is locally called the "sprout water." After the rice has two leaves the so-called "stretch water," or "long-point flow" is put on. At first it is allowed to be deep enough to cover the rice completely—generally from 10 to 12 inches—then it is gradually drawn down to about 6 inches, where it is held twenty to thirty days. It is then withdrawn and the field allowed to dry. When the field is sufficiently dry the rice is hoed thoroughly, all grass and "volunteer" rice being carefully removed. After hoeing, it remains without irrigation until jointing commences, when it is slightly hoed, care being used to prevent injury to the plants, and the water is then turned on again. During the time water is held on the rice it is changed at least every week to avoid its becoming stagnant. When this occurs rice is liable to be troubled with water weevil. This "lay-by flow," or final irrigation, continues until about eight days before the harvest, when the water is drawn off for the field to dry.

UNIFORM RIPENING.

The planter should particularly note the importance of not making the fields too large. It impedes complete drainage. It is inconvenient to have large ditches intersecting the fields. The simultaneous maturity of all portions of the field is desirable if it is to be cut wth a twine binder. This can be secured by uniform and good drainage, by plowing, harrowing, planting, and rolling the same day, and by planting the seed equally deep and distributing it evenly. No field should be so large that the work of planting can not be completed within three or four days. The flooding water must stand in all portions of the field at equal depth and temperature.

Rice should be cut when the straw has barely commenced to yellow. If cutting is delayed till the straw shows yellow to the top the grain is reduced in quality and quantity and the straw is less valuable. There is also a considerable increase in the loss by shelling and handling in the field.

FERTILIZING.

Rice is not a great impoverisher of the soil, especially if the straw and chaff are regularly returned to it.

It has been claimed that the flooding of rice fields restore to the soil as much nutritive material as the rice crop removes. Where lands are flooded from rivers like the Mississippi or the Nile, which carry a large amount of silt, this may be true. It is not the case where flooding is done with pure water. The continued fertility of the rice field can only be maintained by restoring to the soil annually a portion of what the crop removes. Whether this can be more economically done by the use of commercial fertilizers and plowing under the rice straw, or by fallowing occasionally and using some

renovating crop as a green manure is an economic question to be determined by each planter according to the conditions presented. Repeated trials of commercial fertilizers have almost invariably shown gains in the quality and quantity of the crop more than sufficient to cover the cost. Summer fallowing, where it can be practiced is, in addition to its renovating effect, a substantial aid in destroying noxious grasses and red rice.

HARVESTING.

Reaping machines are generally used in the prairie districts of Louisiana and Texas, but in the other rice-producing sections such machines can be used only to a limited extent, if at all. The principal obstacle to the use of large and heavy machinery is that the ground is not sufficiently dry and firm at harvest time. In some cases the smallness of the fields is also an obstacle.

Where the use of reaping machines is impracticable, the sickle is the implement commonly used in harvesting rice. The rice is cut at 6 to 12 inches from the ground, and the cut grain is laid upon the stubble to keep it off the wet soil and to allow the air to circulate about it. After a day's curing the grain is removed from the field, care being taken not to bind it while it is wet with dew or rain. The smaller the bundles the better will be the cure.

Care in shocking is also important. Thirty per cent of the crop may be lost by improper shocking. The following directions will aid: First, shock on dry ground; second, brace the bundles carefully against each other, so as to resist wind or storm; third, let the shock be longest east and west and cap carefully with bundles, allowing the heads of the capping bundles to fall on the north side of the shock to avoid the sun. Exposure of the heads to the sun and storm is a large factor in producing sun-cracked and chalky kernels, which reduce the milling value. Slow curing in the shade produces the toughness of kernel necessary to withstand the milling processes. In the shock every head should be shaded and sheltered from storm as much as possible. The rice should be left in the shock till the straw is cured and the kernel hard.

When the weather is dry, ten or twelve days after cutting is sufficient for completely curing the grain. If the weather is damp or rainy, the farmer must use his best judgment in determining the number of days necessary for the curing.

Whether stacking rice from the shock is a benefit depends upon the condition of the grain and straw at the time of stacking and how the stacking is done. If too much heat is generated, stacking is an injury. It is, moreover, of less importance with rice than with wheat. Judging from the practice in other countries, rice well cured in the shock and aired after threshing ought to keep in the bin without heating.

THRESHING.

The primitive methods of "flailing," "treading out," etc., have largely given place to the use of the steam thresher, though its use frequently involves considerable loss through breakage and waste of grain. Great care should be exercised to avoid this and preserve every part which has been won from the soil with such labor. At the commencement of threshing an examination should be made to see that there is no avoidable breakage of the grain. If the rice is damp when delivered from the machine, it should be spread upon the floor and dried before sacking, so as to be in the best condition for the market for color of grain effects the value. One great mistake made by many farmers is to sack the rice when it is really wet, without airing and drying. They claim that it will dry out in the sack. It will, but drying under such conditions promotes chalkiness and in extreme cases makes the rice almost worthless.

RED CLOVER

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SOILS ADAPTED TO RED CLOVER.

As a general rule throughout the clover belt any soil that will grow corn successfully will produce satisfactory crops of red clover. A deep soil is desirable for red clover in order that it may utilize fully its extensive root system, which may extend down as far as 5 or 6 feet. Red clover is a legume that will grow in soil relatively low in nitrogen so long as there is a sufficient supply of this element to start the plants, until they have opportunity to develop tubercles on the roots. Absence of sufficient humus, however, makes it very difficult if not impossible to secure a profitable stand of clover. Red clover will not succeed if the ground is poorly drained or if the land is in any way boggy. On such soils it is better to seed alsike instead of red clover. One effect of poor surface drainage, especially on uplands, is to induce heaving during the winter and early spring. The surface drainage of the field may often be facilitated by backfurrowing, leaving the dead furrows at intervals of 1 rod or less. These furrows furnish means for the storm waters to run off quickly in the event of heavy rains. The limestone areas of the country are usually very well adapted to the production of red clover. Where the soil is decidedly deficient in lime, as in many eastern States and in some portions of eastern Ohio, southern Indiana, and Illinois, this mineral must usually be supplied artificially.

PREPARATION OF THE SEED BED.

Clover is usually seeded in the spring on winter grain. In such cases no special preparation of the seed bed is necessary, as the frost has usually cracked the ground sufficiently to render natural covering a reasonable certainty. If seeded with a spring-sown nurse crop the preparation accorded the land for the grain crop is usually sufficiently thorough for successful results with red clover; but it is necessary to have the seed bed fine and reasonably firm if prompt germination and proper establishment of the young plants is to be accomplished.

When clover is seeded alone—a very desirable practice on poor, run-down farms—a firm, fine, well-settled seed bed is highly desirable. For this reason the clover should not be seeded on freshly plowed land which has been given no opportunity to settle. Several workings with soil packers or harrows are usually necessary unless a heavy rain intervenes to settle the ground to the proper condition. If the ground has been previously planted to an intertilled crop, such as corn, plowing is not always necessary, as a good disking will generally put the ground in proper condition for red clover. It should be remembered that red clover, especially in its early stages of development, is not drought resistant; in seasons of drought, or on land which drought affects badly, special care should be taken looking to the conservation of the moisture in the soil.

FERTILIZERS FOR RED CLOVER.

Under ordinary conditions the red clover is able to succeed by utilizing whatever fertilizer has been used in connection with the crops immediately preceding or with which the clover is sown; but on soils which are somewhat low in fertility profitable returns are made more certain by top-dressing with manure previous to the time of seeding. The soil may lack a sufficient quantity of one or more of the principal fertilizer elements essential to the production of red clover. This deficiency may be supplied in the form of commercial fertilizer if manure is not available in sufficient quantities. Clover soils in the clover belt generally appear to be somewhat deficient in phosphorus but usually have enough potash and nitrogen.

When barnyard manure is used as a top-dressing, from 6 to 10 tons per acre should be scattered, preferably with a manure spreader, as this insures a fine and even distribution. The manure may often be applied advantageously to the preceding crop, especially if it be a crop like corn, the cultivation of which kills the weeds. A sufficient residue will usually be left to produce a satisfactory growth of the young clover plants. Wood ashes when available may also be applied.

SEEDING RED CLOVER.

Red clover often fails to catch because it is not planted sufficiently deep to insure proper moisture conditions for the young seedlings. In light or sandy soils the seed should be covered 1½ to 2 inches deep, while in clay soils the covering should be about 1 inch. For prompt germination it is advisable on reasonably loose lands, especially sandy lands, to roll the ground after seeding. If a smooth roller is used, it should be followed by a light harrow to roughen the surface and thus prevent rapid evaporation of the soil moisture. Shallow seeding is especially disastrous in case of insufficient rainfall. Red clover may be seeded about six weeks before frost in the autumn or in the early spring while the ground is still freezing and thawing daily. It may also be seeded in the late spring after the ground has become warm. The late summer or early fall seeding is recommended in seasons where there is ample moisture or where spring seeding from any particular reason do not succeed.

TREATMENT THE FIRST SEASON.

When seeded with a grain nurse crop no special treatment is given the clover the first season. It develops in the stubble after the grain has been cut and occasionally may afford some pasture the same fall. If the late summer be especially favorable sufficient growth may be made for a cutting of hay, and in some cases a crop of seed has been secured. The stand, however, is apt to be injured by the cutting, and it is usually best to clip back the growth to check the development of the plants. When seeded in the fall in corn or with rape one or two crops may be expected the next season in addition to considerable pasture. A top-dressing of barnyard manure acts very favorably on red clover at any time. A light top-dressing of gypsum may also be of advantage if the clover appears to lack vigor. This can be applied on the young plants when about 6 inches high, and even in early spring the following year. It is not advisable to pasture spring seedings the same season with sheep or hogs, as they are likely to injure the young plants. Pasturing with cattle is less injurious.

TREATMENT THE SECOND SEASON.

Common red clover usually lives but two years. The second season the first crop is usually cut for hay and the second crop for seed. The aftermath or rowen is then pastured or plowed under. In sections where the season is not long enough to permit the clover to set seed after a full hay crop has been harvested it is necessary if seed is desired either to pasture back the first crop of clover or to cut it early when just coming into bloom, rather than to wait until it is in full bloom, as is usually recommended. When mixed with timothy the stand is often allowed to remain three or four years with the clover gradually decreasing. If it is desired to retain a stand of clover for more than two years seed must be allowed to mature during the late summer the second season. This may reseed the area naturally, but it is well to give the ground a good harrowing to cover the seed and properly scatter it. A top-dressing with clover straw or with manure made from clover hay will also tend to thicken up the stand by reason of the seeds which are present therein. Although no definite experimental evidence is at hand it is probable that by leaving occasional

uncut strips of red clover across the field when cutting the seed crop this will furnish sufficient seed to reseed the ground when harrowed across the narrow uncut strips.

THE SUGAR BEET

H. W. WILEY,
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SELECTION OF SOIL.

The sugar beet does not require a particular kind of soil for its proper production. In general, soils are described for practical purposes as clayey, sandy, loamy, or alluvial soils; all of these soils will produce beets. The black prairie soils also have been found, with proper cultivation, to produce excellent beets. Perhaps the best soil may be described as a sandy loam, a soil in which there is a happy equilibrium of organic matter, clay, and sand.

New land should not be selected to grow sugar beets, for the crop is not a good reclaimer of soils; and especially to be avoided is new land containing decaying vegetable matter, which produces only rank growth with low sugar content. Preferably the most productive land on the farm should be used, such a soil as will yield a good crop of Indian corn, wheat or potatoes. The soil should neither be so compact as to interfere with cultivation to a depth of 10 or 12 inches nor have a tendency to bake hard. It may contain some alkali, as sugar beets are not especially susceptible to injury from this constituent. The soil should be reasonably level, but it should also be well drained. Natural drainage on level soil being somewhat deficient, tile drainage may be practiced with advantage.

FERTILIZATION.

Happily, in most American soils there is still sufficient natural fertility to produce a good crop of suger beets; whereas in the soils of Europe, where sugar beets have been grown for years, the farmers must depend on fertilizers to insure a remunerative crop.

The principles of fertilization depend upon the fact that a soil should have returned to it all that the harvest has removed, and an unproductive soil be supplied with those elements in which it is deficient.

The soil ingredients most essential for the successful production of sugar beets are nitrogen, phosphoric acid, potash, and lime.

Most soils contain a sufficient quantity of lime, although there are some in which the supply of lime is naturally deficient; and such soils would be benefited by an application of land plaster, burned lime, phosphatic slags, or ground shells. Phosphoric acid and potash are supplied in the form of ordinary commercial fertilizers—the phosphorus as ground bone, superphosphate, or basic slag, and the potash may be supplied in the form of muriate or sulphate of potash or as kainit.

Nitrogen may be supplied in the form in which it exists in ground bone, or from the refuse of the slaughterhouses in the form of dried blood and tankage, or as cotton-seed meal or oil cake, or as nitrate of soda, sulphate of ammonia, etc.

Barnyard manure offers a ready means for fertilizing the soil, and one which every farmer can employ. By its use, humus is added to the soil as well as small percentages of potash, phosphoric acid, and nitrogen. There is a great difference of opinion as to the best time and method for applying it to beet land. In general, however, it should be applied, in a well-rotted condition, in the autumn before the ground is plowed. The quantity per acre depends, of course, on the fertility of the soil; but in any case it is not best to apply a very

heavy dressing. With poor soils it is best to apply the manure for several years in succession, rather than to apply enough at once to bring it up to the required state of fertility. Too copious an application of manure is apt to produce overgrowth in the beets, which makes them ill-suited to the manufacture of sugar. If the manure be applied in an unrotted condition it is apt to seriously injure the crop in case of dry weather.

CROP ROTATION.

Every farmer should understand that he can not continuously grow any crop on the same ground and secure maximum results. Many try to do his, but they do it to their own loss and to the depletion of the soil.

One of the great objects of crop rotation is to bring about and maintain an equilibrium of soil constituents and conditions. The best rotation is one in which the method of culture and action of the plant each year leave the soil in the best condition for the following crop. Beets do best after alfalfa, corn, or small grains.

A good scheme of rotation is, first wheat; then beets; then clover for two years, the last crop being plowed under; then potatoes, wheat, and beets in the order mentioned. If alfalfa can be grown, it should be included in the rotation of crops. Also in some sections potatoes do well in the rotation. By this method, and a judicious use of stable manure and commercial fertilizers, the fertility of the soil can be maintained and even increased. Beets do well after small grain crops, because these, being harvested early, leave the ground ready for late autumn plowing, an important point in successful beet culture.

PREPARATION OF THE LAND FOR PLANTING.

The field in which beets are to be planted should be selected and plowed in the late autumn to the depth of at least 9 inches. As a rule the plow in each furrow should be followed by a subsoiler, which will loosen the soil to the depth of 6 or 7 inches more. Each field to be planted in beets should thus have the soil prepared by thoroughly loosening it to the depth of from 15 to 18 inches. The land, being exposed through the winter, becomes quite mellowed, and in the spring can in many cases be prepared for planting by thoroughly cultivating the surface of the soil until it is reduced to perfect tilth, followed when necessary by harrow and roller. Too much can not be said of the importance of correct preparation of the ground before seeding, as on this condition the crop depends to a large extent. The seed bed should be uniformly well pulverized. It is desirable, however, that each portion of the field to be planted should be thoroughly prepared immediately before the planting takes place. For instance, if the planting is to be made on a given day, the soil should be thoroughly prepared on the previous day. Thus all weeds and grasses which have started to grow are killed, and the beets have an even chance with the weeds for growth. If, on the other hand, the soil be prepared a week or even a few days before planting, the weeds and grasses get a good start, and it is difficult to free the beets therefrom. In case the ground has to stand any time before seeding after being prepared, it should be constantly and thoroughly cultivated.

PLANTING THE SEED.

Hand planting of the seed may be practiced when a very small plat is to be put in beets, but where a field embracing an acre or more is to be planted it is not convenient. In such cases planting by drill is best. Almost every garden drill can be adapted to use with beet seed. Special drills for sugar-beet seed are made by many manufacturers of agricultural implements. In planting by drill it is necessary to use from 15 to 20 pounds of seed per acre; in planting by hand from 10 to 15 pounds will be found sufficient.

The beets should be covered to a depth of one-half inch to 2 inches, according to the state of the soil. If the soil be moist and in excellent condition, the beet seed should not be covered more than half an inch. If, on the other hand, the soil be very dry and early rains are not probable, the seed should be covered to a depth of 2 inches.

In the matter of space between rows there is considerable variation. In some cases the rows are made only 16 inches apart, and in others as wide as 28 inches. In recent years the tendency has been to increase rather than diminish the distance, though much depends on the soil and local conditions. It is argued by many that the greater ease and economy of culture with the wider rows outweigh the increased yield per acre which may be secured in the narrower rows.

When a considerable acreage is planted. it is important to be able to plant two or more rows at a time.

In planting by hand or by drills an effort should be made to drop the seeds singly and at equal distances apart.

Under irrigation planting can be accomplished at almost any time, as the ground can be irrigated, then cultivated, and the seed planted at once.

Beets should be planted as early in the spring as practicable, but the ground should have sufficient moisture and warmth to cause germination of the seed. Experience has shown that the early-planted beets almost uniformly produce a larger yield with a higher content of sugar than the late-planted. No exact date can be fixed which would be suitable to all localities. In most of the localities in the beet area of the United States it will not be found practicable to plant earlier than the first week in May. In exceptional seasons a part of the sowing can be accomplished in April. On the Pacific coast, especially in central and southern California, the sowing can take place at a much earlier date. In parts of California planting is done in December with favorable results. But if planted too early, some of the beets will go to seed before harvest time. When this happens the percentage of sugar is diminished.

Most factories, by way of inducement to early planting, offer free seed for replanting any beet field that may be injured by frost or other unfavorable conditions. This early planting makes it possible for the factory to begin its campaign earlier in the fall.

CULTIVATION.

To prevent the formation of a crust, and to keep the weeds and grass from getting a start, it is often necessary to cultivate the beet field with a spike harrow before the plants come up and to continue such cultivation until the beets are large enough for row cultivation to begin. Cultivation must not be postponed or neglected unless wet ground makes it impossible. The purpose of cultivation is two-fold: (1) To hold the moisture in the soil; (2) to destroy the weeds and grass, as in the early stages of the beet's growth these can spoil the stand by choking the plants. When the land becomes dry is the most important time for cultivation in order to prevent the escape of moisture from the soil. Cultivation should be continued until the beets have attained such a size that the leaves cover the ground.

When large fields are cultivated, the horse hoe may be used. For smaller fields a similar apparatus propelled by hand may be employed. This implement frees the spaces between the rows of beets and weeds, and guards are used to prevent the growing beets from being covered by the loose soil.

In growing beets with irrigation a cultivator which will prepare the furrow for conducting the water over the field is important.

In the cultivation of large areas an implement adapted to four rows of beets is desirable. Such an implement, however, can not be advantageously used, except in those cases where the beets have been sown with an implement planting four rows at a time.

BUNCHING AND THINNING.

When the beets show three or four leaves, they should be bunched and thinned. The bunching is best accomplished with a short-handled hoe. One stroke of this implement takes out all the beets in the row except small bunches from 8 to 10 inches apart, depending on the width between the rows and other circumstances. From these bunches should be removed by hand all the plants but one, the largest and healthiest. Great care should be exercised in this work, and by careful selection all of the inferior plants will be removed. On the proper thinning, the tonnage largely depends. This does not mean that less space should be left between the plants. If the rows be 18 to 24 inches apart, the space between plants can vary from 8 to 10 inches, depending on the nature of the soil. When thinning, it is a good plan to give the ground a thorough hand hoeing. This can be done at a little extra expense and will pay for itself in the long run. If the thinning is put off too long, the crop will suffer.

POSITION OF THE BEET IN THE SOIL.

It is important not only that a sugar beet should be of proper size and shape, but also that it be grown in such a manner as to secure the protection of the soil for all of its parts except the top with foliage It is for this reason that subsoiling in the preparation of a field for the growth of sugar beets is of such great importance. If the beet, in its growth, should meet a practically impervious subsoil at the depth of 8 or 10 inches, the taproot will be deflected from its natural course, lateral roots will be developed, the beet will become disfigured and distorted in shape, and the upper portion of it will be pushed out of the ground. Experience has shown that the content of sugar in that portion of a beet which is pushed above the soil is very greatly diminished.

HARVESTING AND DELIVERY OF BEETS.

The time for harvesting varies in different localities. In southern California the beets planted in December are ready for harvesting in the latter part of June or the first of July. In general it may be said that beets planted the first week in May will be ready for harvesting about the 1st of October. Harvesting should be postponed to as late a date as possible, provided the beets are in no danger of a second growth and are not exposed to a freezing temperature. The leaves of the ripened beet change from a rich to a yellowish green, droop and lie close to the earth, and many of them die.

REMOVING BEETS FROM THE GROUND.

The harvesting is easily accomplished by first loosening the beets in the soil and then removing them by hand. For loosening the beets a common turning plow is often used. The edge of the share cuts off the tap roots at the proper depth and the beets are lifted and thrown over by the moldboard. Better adapted to this work, however, are plows which have been specially constructed for beet harvesting.

Several more or less complicated devices have been invented which are designed not only to lift the beets but to cut off the tops and shake off the adhering dirt. Some ambitious inventors have attempted the construction of a harvester which will not only dig, top and clean the beets, but load them into a wagon. Such a harvester is much to be desired; but while some of these inventions have worked fairly well under favorable conditions, it must be said that none has yet proved satisfactory under all conditions. Hence the use of such harvesters has been very limited.

TOPPING.

The next operation consists in removing from each beet the top or neck bearing the leaves. This is done by a large knife. The object of removing this portion of the beet is to prevent the mineral salts, which have accumulated in large quantities therein, from entering the factory, as they exercise a very deleterious influence on the crystallization of the sugar. The tops and leaves are well fitted for feed or for fertilizing purposes.

The removal of the tops of the beets is a tedious process, which in Europe is performed by women and children. In this country sometimes the whole family goes to the beet field and performs the work. More commonly, however, it is done by laborers of various nationalities, who are brought in by the factory and with whom the farmer contracts to do this work as well as the hand work of growing the crop.

The topping of the beets can be a source of great waste for the farmer, as too much may be taken off and the tonnage decreased. Constant supervision is necessary in this work. Several attempts have been made to construct a mechanical device by which the beets can be topped, thus saving a large expense, and perhaps a successful device of this kind may some day be invented. So far as is known at the present time, however, this process has not been successfully accomplished by machinery, and the topping must still be done by hand.

When the beets are topped they are thrown into piles, and the leaves are thrown over them as a protection from the sun or frost until they can be delivered to the factory.

THE PEANUT

W. R. BEATTIE,
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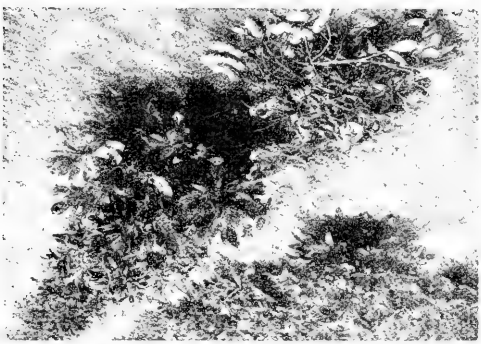

The soil best suited to the peanut is one of a sandy loamy nature, preferably light or grayish in color rather than dark. Soils that are dark and those carrying a considerable percentage of iron or other mineral are likely to stain the shells of the peanut, thus rendering them less desirable for the trade. For use on the farm, however, the staining of the shells is of little consequence, as it does not materially injure them for stock feeding. In fact, soils that contain considerable clay and lime or are loamy in character produce heavier nuts and sometimes greater yields than do lighter soils. As a rule the peanut does best on sandy loam with a well-drained clay subsoil, but the crop may be grown under a wide range of soil conditions.

Soils that become hard or compact are not adapted to peanut growing owing to the inability of the pod stems or "pegs" to penetrate the surface.

Soils that are poorly drained or sour are not suited to the peanut. The ideal soil consists of a sandy loam containing a reasonable amount of humus, or vegetable matter, together with an abundance of lime. A soil having a suitable mechanical consistency is the first essential. Soils lacking in fertility can be improved by a proper cropping system or by the judicious use of manures.

The cultivation of the peanut for commercial purposes has until recently been confined chiefly to areas in Virginia, Tennessee, the Carolinas, and Georgia. During recent years the industry has become established throughout the South Atlantic States and westward to and including California.

TIME AND METHODS OF PLANTING.

Time of planting.—The time for planting peanuts is in the spring after the soil has become thoroughly warm. In order to secure a good stand, the seed should not be put in the ground until there is sufficient warmth to germinate it quickly. As a rule peanuts should be planted a trifle earlier than corn and beans. The Spanish variety may be planted somewhat later than the Virginia type, as it requires less time to complete its growth.

The Spanish and similar varieties may in certain localities be planted after oats—that is, from the middle of June to the 10th of July. The Virginias or large sorts should, if possible, be planted before May 20 for the best results.

Distance to plant.—A common distance between rows is 36 inches, but this varies somewhat according to the soil and variety. For the Virginia Runner variety on good soil the distance between rows should be at least 36 inches, and 16 inches between the plants in the rows. Virginia Bunch peanuts may be in rows as close together as 30 inches, and 9 to 12 inches apart in the rows. The Spanish and Tennessee Red varieties are planted in rows from 28 to 36 inches apart and 9 to 12 inches apart in the rows, according to the fertility of the soil. On rich soils, where the spread of vine will be great, the maximum distance between rows as well as between plants in the row should be allowed.

Quantity of seed required.—The quantity of seed peanuts required to plant an acre will depend somewhat upon the distances of planting.

As a rule 1½ pecks of shelled Virginia peas will plant an acre. One peck of shelled Spanish peanuts, or 1¼ bushels in the pods, are required for an acre. The greater the care exercised in planting, the smaller will be the waste of seed, and economy is quite an object when planting specially selected or high-priced seed. By planting the Spanish variety in the pod two seeds will be placed together in a hill, but there can be no very great objection to this, as the two plants will generally give a better yield than where the plants grow singly.

Depth to cover the seed.—The depth to which the seed should be covered will depend somewhat upon the character of the soil. On heavy soils three-fourths inch to 1¼ inches will be sufficient, while on light sandy soils 1½ to 2 inches may not be too deep.

Tools and methods of planting.—Peanuts are generally planted in rows that are cultivated in one direction only. Some growers follow the practice of first marking the land with an implement similar to the ordinary corn marker. Others open the furrow with a one-horse plow, then after the fertilizer has been distributed in the furrow the plow is again used and a slight ridge thrown up. There is now on the market a tool which sows the fertilizer, throws up a slight ridge and at the same time indicates the position of the next row.

The greater portion of the peanut crop is planted with the one-horse planters. These machines are similar in many respects to a cotton planter and cost about $15 in most localities.

Where the Spanish and similar varieties are planted in the shell the usual method is to open a small furrow, drop the seed by hand, then cover it by means of a small harrow or cultivator with a notched board fastened across the back of the implement.

GENERAL CULTIVATION.

Method of cultivation.—Cultivation of the peanut crop should begin immediately after planting and continue until the vines occupy the ground. The work of cultivation should be pursued very much the same as for corn, beans, and all similar crops. Frequent shallow cultivation that will keep the soil loose and prevent the loss of moisture is essential. Shortly after rains the surface soil should be stirred and during dry weather a dust mulch maintained. During the later cultivations it will be desirable to work the soil toward the rows to provide a bed of loose earth in which the pods may form.

After the peanuts begin to "peg," or form pods, they should not be disturbed or given further cultivation. The old idea that the blossoms of the peanuts must be covered is erroneous, although growers frequently allow considerable soil to be thrown over the vines during the final cultivation. For the last cultivation it is a common practice to employ a tool that will both throw the soil toward the rows and leave a furrow in the middle of the alley to carry off water during heavy rains.

Common crab-grass is one of the most troublesome weeds of the peanut field, and it is often necessary to resort to hand hoeing in order to keep this and other weeds out of the rows. If the crop is kept well worked with horse tools, very little hand labor will be required.

Tools adapted to cultivating peanuts.—Most implements that are adapted to the cultivation of corn or cotton will be found suitable for handling the peanut crop. For the first two or three cultivations a one-horse weeder of special type may be used crosswise of the rows. After the plants are tall enough so the rows can be followed, a spring-tooth riding cultivator is desirable, while for the later workings the same implement can be used by changing the spring teeth for regular cultivator shovels. For one-horse cultivation the ordinary cotton sweep is frequently used.

Some growers follow the practice of running a light roller over the plants after the final cultivation, the object being to flatten the stems upon the ground in order that the little pods forming on the extremities of the stems may reach the soil. This practice may increase the yield, but it will also increase the percentage of "saps," or unfilled pods, and it is doubtful if anything is gained by the practice.

HARVESTING.

Proper time for digging the crop.—No fixed rule can be given by which to determine when to remove the peanut crop from the ground, and each grower must be his own judge in the matter. In general practice the growers aim to dig before the first frosts, in order that the peanut vines may have greater value for stock food. To the southward, where frosts do not appear until quite late, the vines assume a yellowish appearance during the latter part of the season, which indicate the ripening of the peas. If digging is deferred too long, the first-formed peas are liable to burst their shells and start growing; this is especially true if there is a period of rainy weather late in the season. The aim should be to dig at the time the vines have upon them the greatest number of mature peas. Where a large acreage is grown it will be necessary to begin harvesting as soon as the earliest peas are ready, in order to complete the work before unfavorable weather sets in.

CULTIVATION OF BUCKWHEAT

Buckwheat prefers a moist, cool climate, and matures in 8 to 10 weeks, and is thus well adapted to high altitudes and short seasons. It grows on many different kinds of soil and succeeds fairly well on soils too poor for other crops, but the largest yields are obtained on fertile, well-drained, sandy loams. The crop is not specially adapted to heavy clay or wet lands, and on very rich soils it lodges readily, and when once lodged does not rise again. Heavy applications of barnyard manure or of nitrogenous fertilizers are seldom profitable, as they increase the tendency to lodge, but the use of lime and phosphoric acid has been found very beneficial. In experiments conducted by the West Virginia Experiment Station a few years ago the use of 400 pounds of acid phosphate per acre apparently almost doubled the yield during two seasons, while the third season the increase in yield was small when this substance was used in excess of 150 pounds per acre. In this same series of experiments a plat having received 30 bushels of stone lime per acre in 1908 yielded 32.1 bushels of buckwheat per acre in 1910, as compared with 22.7 bushels on the check plat.

A good preparation of the seed bed aids very materially in securing profitable yields. Early plowing, to allow the ground to settle before the seed is put in, is recommended. Three pecks of seed per acre is sufficient on good soil, but on land of low fertility from 4 to 5 pecks is used. The seed is sown with the ordinary grain drill or broadcasted and covered with the harrow. In southern localities buckwheat is sown from May to September, while in the North the seeding period is much shorter, extending from June 15 to about July 10. Hot weather and frost are both injurious to the crop while the grain is forming, and hence it is desirable to sow as late as possible, provided sufficient time is allowed for the grain to mature before frosts occur. The plant blossoms for three weeks or more, and the kernels ripen unevenly. Harvesting is begun soon after the first seeds are ripe, but at this time the same plant often contains mature and immature grain and blossoms. The immature grain ripens in the swath, while if the crop is not harvested at this stage much of the mature grain will shell out in handling. Buckwheat is generally cut with the hand cradle or the dropper reaping machine, the self binder being rarely used. Cutting early in the morning or in damp, cloudy weather prevents the loss of the ripe grains. The crop is left to cure in the swath for a few days and is then set up in small shocks. If bound at all the sheaves must be small and loosely tied to facilitate drying. Threshing may be done as soon as the crop is cured. Buckwheat threshes easily, and in order to avoid cracking the grain and unnecessarily breaking the straw the spiked concave is removed from the machine and a smooth one put in its place.

The varieties generally grown are the Common Gray, Silver Hull, and Japanese. The seed of the Silver Hull is slightly smaller and lighter in color than the Common Gray, while that of the Japanese is larger than the Common Gray, darker in color, and the edges of the hull show a tendency to extend into a wing. The Japanese is generally regarded as the best yielding variety.

The buckwheat crop is quite free from interference from weeds, plant diseases, and insects. The crop is well adapted to green manuring, because it thrives on quite poor soil, grows rapidly, smothers out weeds, leaves hard soils in a mellow condition, and decays quickly when plowed under. The straw when spread out on the land also soon decays and makes a good fertilizer. Buckwheat has usually no definite place in the crop rotation, as it is largely grown as a substitute for meadow or spring-planted crops that have failed. It is stated that while buckwheat is not materially affected by the crop that precedes it, oats and corn are regarded as being less successful

after buckwheat than after other crops. A crop of buckwheat leaves the soil in a peculiarly mellow condition, and in many localities with rather heavy soils advantage is taken of this fact by following it with potatoes. The following rotation is given as sometimes recommended for heavy soils: Clover, buckwheat, potatoes, oats or wheat with clover. The clover is harvested early and immediately followed by buckwheat as a preparation for the potato crop.

THE CULTIVATION OF HEMP

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CLIMATE.

Hemp requires about 110 days for its growth. It should have a rainfall of at least 10 inches during this period. It has not been grown commercially under irrigation. If the level of free water in the soil is within 5 to 10 feet from the surface, as is often the case in alluvial river-bottom lands, and the character of the soil is such that there is good capillary action to bring the water up, hemp will not suffer from drought, even should there be very little rainfall. Hemp is uninjured by light frosts. It may therefore be sown earlier than oats and harvested later than corn.

SOIL.

Hemp requires for its best development a rich, alluvial, or loamy soil not subject to severe drought, yet not of a swampy condition. It is not to be recommended for a light sandy soil, unless it follows a crop of clover or beans which has left a plentiful supply of nitrogenous fertilizer. The soil should also be well supplied with lime. Hemp will not grow well in an acid soil or on gumbo soils. Excellent crops have been obtained in Indiana during the past two seasons on peaty soils over marl.

The best fertilizer for the hemp crop is barnyard manure, and this should be applied to the previous crop or, at the latest, in the fall before sowing the hemp. Hemp may be introduced in any crop rotation, but it is best to have it follow peas, beans, or clover. It may follow corn or grain, providing these crops are well fertilized. A dense growth of hemp destroys nearly all weeds, and as it is a rather deep rooting plant and shades the soil it leaves the land in excellent condition for any crop which may follow.

SOWING.

Hemp seed should be sown at the rate of approximately 1 bushel per acre at about the time of sowing oats or as early as possible after the period of severe frosts. If possible the land should be plowed during the previous fall. Fall plowing is essential for success if a heavy soil or much vegetation is to be turned under. The soil should be harrowed at least once before seeding in order to settle the furrows.

The seed is sown broadcast by hand or by any good broadcast seeder set for seeds smaller than average grains of wheat. Good results are obtained with an end-gate seeder, a roller-press grain drill, or an ordinary toothed grain drill with the teeth removed and replaced by a board dragging on the ground below the feeding tubes. The seed falling on this board will be spread out evenly over the surface, The ordinary teeth cover the seed too deeply and crowd them in drills from 6 to 8 inches apart, so that the hemp does not grow as evenly as when it is spread over the entire surface. The seed may be covered by means of a light straight-toothed harrow. Drills similar to grain drills are made especially for sowing hemp seed and are largely used

in Kentucky. These hemp-seed drills will be found most economical if large areas of hemp are to be sown or if hemp is to be raised year after year as a regular crop.

After seeding it is best to roll the land in order to have a smooth surface that will permit close cutting wih machinery. After seeding the crop requires no further attention until harvesting.

HARVESTING.

Most of the hemp is now cut with self-rake reapers made especially for harvesting this crop. These machines require 2 men, or a man and a boy, and 4 horses for their operation and 1 man to keep the knives sharp. They cut a swath of about 5 feet, or about 5 or 6 acres per day. They leave the hemp stalks in gavels. After lying in the gavel for two or three days the stalks are either spread for retting, set in shocks without binding, or tied in bundles and set in shocks. When the harvest is late, or in the North, where there is little danger of hot dry weather that would "sunburn" the stalks, labor may be saved by spreading the hemp for retting immediately after cutting. If there is danger of hot dry weather after harvest the hemp should be cured in shocks. If it is to be stacked it must be bound in bundles before shocking. Stacking is not regarded as a necessary step in the preparation of hemp, but a greater weight and also a better quality of fiber are obtained from stalks which have been stacked. If the stacks are properly made they may be left almost indefinitely before retting. Three men will put up two stacks a day of about 8 tons each.

In Nebraska the hemp is cut with a mowing machine with a special homemade attachment, bending the stalks over in the same direction that the machine is cutting. One man with one span of horses will cut from 7 to 9 acres per day. The ordinary price paid there for cutting hemp is 50 cents per acre, including team and machine. The hemp is left on the ground as it falls until retted, when it is raked up with a horserake and hauled to the machine brake to be made into long tow.

RETTING.

Practically all of the hemp produced in Kentucky is dew-retted. It is spread on the ground, either from the gavel, shock, or stack, in rows with the stalk side by side and not more than two, or at most three, stalks in thickness, the butts all even and in one direction. It is left in this manner for from four to twelve weeks, or sometimes even longer, until the bark, including the fiber, separates readily from the woody portion of the stalk. The stalks are then raked up and set up in shocks to dry. As soon as dried they are ready for breaking.

BREAKING.

Much of the hemp produced in Kentucky is still broken by the old-fashioned hand brake, but this method is not recommended for introduction into any new locality because it requires a degree of skill that would be difficult to secure in laborers not accustomed to the work. Even in Kentucky the newer generation of laborers do not learn to break hemp, and this is one of the principal reasons that the industry is not carried on there to a greater extent. At least six different kinds of machines for breaking hemp and preparing the fiber have been in use during the past three years, and some of these prepare the fiber very much better than the hand brake.

At Havelock, Nebr., and at Courtland, Cal., there are power machines consisting essentially of a series of fluted rollers, somewhat like a jute softener, followed by large beating wheels, and these machines make long tow. They will handle a greater variety of different sized hemp stalks in a satisfactory manner than the other machine brakes, but as the fiber is tangled instead of being straight it does not command as high a price as that produced by the hand brakes or by the other machine brakes mentioned.

YIELD.

The yield of hemp fiber ranges from 500 to 2,000 pounds to the acre. The general average yield under ordinary conditions is about 1,000 pounds to the acre. Yields are sometimes estimated at 150 pounds of fiber to each foot in height of the stalks, and also at 20 per cent of the weight of the dry, retted stalks, but estimates based on these factors alone may be misleading, for slender stalks yield much more fiber than coarse ones.

MARKET.

All of the hemp fiber produced in this country is used in American mills, and increasing quantities are being imported. It is used for making gray twines, "commercial twines," carpet warp, and ropes of small diameter.

Hemp can not be grown profitably in small isolated areas. Two hundred acres or more should be grown on one or more farms near together, so as to warrant the introduction of special machinery for drilling, harvesting, breaking, and baling, and also make it possible to ship the fiber in full car lots.

Before undertaking the cultivation of hemp on a commercial scale it is advisable to try some preliminary experiments with half an acre or less, to determine whether the local conditions are adapted to the crop.

GROWING AND CURING HOPS

By W. W. STOCKBERGER,
Bureau of Plant Industry.

The time at which planting is done depends very largely on the local conditions existing where the crop is grown, but in general the best results are obtained by planting as soon as the soil can be worked into a fine mellow condition. In California planting should be done in January or February, although in some seasons planting as late as the 1st of May has yielded good results. In Oregon and Washington hops are planted in March or April, and in New York successful plantings have been made in April in favorable seasons.

CULTIVATING.

Thorough cultivation is important and should begin early and continue until the plants are well armed out. This is necessary not only to keep down the weeds, but also to prevent the top soil from forming a crust and becoming hard, for when it is in this state the moisture of the undersoil rises to the surface and evaporates quickly. The frequent stirring of the topsoil to a depth of 2 or 3 inches will produce a layer of finely divided soil which conserves the moisture near the surface, where it is more readily reached by the young feeding roots which develop at about the time the hops go into the burr. If these small feeding roots are destroyed or seriously injured by late cultivation, growth will be checked and early ripening favored. Careful growers agree that the young buds do not set so well if the feeding roots are seriously disturbed, and that the crop is shorter in consequence. Nevertheless, if the soil is becoming hard and the moisture is readily evaporating, it may be best, at least in dry sections, to cultivate and depend upon a second growth of the feeding roots for the proper maturing of the crop. The existing soil conditions must determine the advisability of cultivating after the appearance of the feeding roots.

PRUNING.

By the process of pruning, the excess shoots from the rootstock are removed and the formation of fewer but at the same time stronger

vines is favored. The rootstock itself also is reduced to an acceptable form and suitable depth below the surface of the soil, and the formation of undesirable runners is retarded or suppressed. The working over of the ground incident to pruning also is an important part of cultivation.

Within certain limits determined by local conditions, the length of the growing period and the time of ripening may be influenced by the earliness or lateness of pruning. The general practice is to prune early in the spring, the exact time being determined by the season and the locality.

A common practice is to draw four or five furrows with a small plow on each side of the row, turning the earth away from the hills. The yard is then cross-plowed in a similar manner, leaving each hill a small undisturbed square. The earth is then hoed and grubbed away from the roots, and the superfluous roots and runners, together with an inch or two of the top of the root crown, are cut off with a sharp knife. After pruning, the hoe is used to pull the soil back upon the hill, covering the rootstock to a depth of 2 or 3 inches. Too much pruning by this method causes disease, and frequently uneven pruning causes the late coming out of the overpruned vines.

Another method which offers several advantages over the former is to prepare the ground by plowing as before, using a coulter on the plow in drawing the last two furrows. The hill is not dug into, but instead a sharp spade is used, with which each side of the hill is cut down on a slant from top to bottom, leaving the hill about 4 inches square at the top and 12 to 14 inches square at the bottom. With this method baking of the soil over the hill is avoided and the new shoots come through much more easily. The pruning is more even and the rootstock suffers less from wounds and bruises than by the former method.

TRELLISES.

Except in the hop-growing regions of New York, the use of hop poles has been largely discontinued in those regions where there is a scarcity of available timber, and even in heavily wooded sections many growers have dispensed with them. This is not due to the labor and expense of handling alone, but experience has proved that the advantages of growing hops on strings so far surpass the growth on poles that it is only a question of time when poles will be almost entirely abandoned. The hops are healthier on strings, more successfully sprayed, mature earlier, are usually richer and brighter, arm out lower, and are not so leafy; they do not wind-whip so readily, can be picked cleaner, and are much more easily torn down for picking. Also the hops can be picked without cutting the vine, a practice which is harmful, since it prevents the return of materials from the vine to the root of the hop, and by causing a loss of food reserves to the stock, produces a weakening effect on the succeeding crop.

Training.—When the young vines are about 2 feet long training is begun. Usually the four runners most closely approaching in length the average of the field are selected from each hill and the remainder are cut off. In case of an uneven stand it may be well to cut off the whole field and wait for the second set of runners. However, vines which may be inferior at first sometimes develop a vigorous growth after they have reached a length of 4 or 5 feet. As a general rule, in all light producing sections it is advisable to train the first runners; in heavy producing sections the second runners should be chosen. Two runners are usually trained to each string, care being taken to twine them from left to right about the string.

In the New York yards many farmers train seven vines up each pole, three for the long string and two each for the other string and the pole.

PICKING.

Time to Pick.—The time when hops should be picked varies with the locality, the season, and the variety cultivated. When the acreage is large there is a tendency to start picking before the crop is fully mature, as otherwise a portion may be lost through becoming overripe. Also a great consideration with many growers is the early securing of pickers. To this end it is customary in some sections to plant an early-bearing variety, e. g., Fuggles, which ripens from a week to ten days earlier than the other standard varieties and enables the grower to begin picking so much earlier.

A second consideration is the capacity of the drying plant to handle the crop as fast as harvested. If the acreage is large and the crop heavy, the facilities for handling and drying the hops will be taxed to their utmost, and if more hops are picked than can be put upon the kilns and dried without delay, they undergo heating and are thereby seriously damaged in quality or lost entirely. Because of inadequate facilities, therefore, growers frequently begin picking before the hops are ripe and continue picking after they have passed what is recognized as the most suitable stage for harvesting.

A third consideration, which is recognized by all progressive growers, is the effect of the picking time upon the quality of the product. The development of the essential oil, the desirable soft resins, and other valuable constituents reaches its height about the time the hops become fully ripe, in which condition they are generally regarded as possessing the finest flavor.

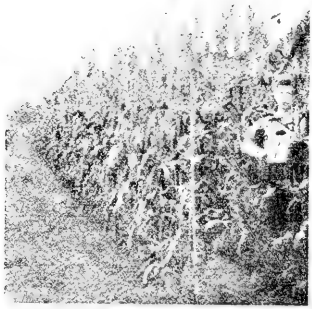
From the standpoint of the consumer the time of picking is a matter of great interest, and it should be also to every grower, as a much higher quality of hops would result from picking at the proper time. However, for reasons previously mentioned it is often very difficult to secure pickers when the crop is just ripe. In addition to the difficulties just mentioned, the several parts of the field rarely ripen exactly together; often when a field is practically level slight variation in quality of soil or moisture content will result in unevenness in ripening, and while it is customary in picking to work around and through the field, choosing first the ripe portions, it is rarely possible to pick all of the crop at the most desirable degree of ripeness.

While growers recognize in a general way the importance of a proper picking time, the disadvantages arising from a disregard of this time are not appreciated by all. There are several important objections to improperly picked hops which reduce their market value.

CURING.

The Object of Curing.—The primary object of curing hops is to reduce rapidly their moisture content to such a degree that they may be safely stored and their properties preserved. Hops must be dried soon after their removal from the vines, as otherwise they undergo a process of oxidation or heating which seriously injures their appearance as well as their aroma and other valuable qualities. According to the variety and the degree of ripeness when gathered, freshly picked hops contain 65 to 75 per cent of moisture, but when in a dry state fit for storage or marketing they should contain only from 10 to 14 per cent of moisture. Increased knowledge of the constituents and properties of hops has extended the idea of curing to include the production of a hop which not only has a fine physical appearance, but which also contains the maximum amount of the desirable principles upon which its intrinsic value is based. The most important of these principles are the tannin, found mostly in the bracts of the cone, the soft resins, the volatile oil, and the bitter principles which occur chiefly in the lupulin. Curing is all too frequently conducted with regard to the physical appearance alone, and the methods employed often injure the quality of the hop through their harmful effects on the oil, lupulin, etc.

CULTIVATION OF SUGAR CANE



In the opinion of many of our best planters there are numerous advantages to be had in planting cane during the fall. In the first place, better weather conditions are generally to be found in the fall than in the spring months; in the second place, the necessity of windrowing is avoided, and there are other minor advantages.

PREPARATION OF LAND.

For fall planting the land should be broken and put in good tilth sufficiently early. Better crops will result if cane is planted on land which has the year previously been planted to cowpeas, velvet beans, or such crops as will add to the store of organic matter and nitrogen in the soil. The breaking of land and the turning under of these green manuring crops can be very successfully accomplished by means of the disc plow, but in the majority of cases the ordinary mould board plow is employed. In three to five weeks after the turning under of these crops the land can be bedded for planting. Ridged rows five feet apart are probably productive of the best results, although six-foot rows are more generally used.

PLANTING CANE.

The rows are opened by means of the double mould board plow, and the cane stalks are laid their length in single or double rows. This cane should be covered with earth to a depth of from three to four inches in order to protect it from the cold during winter. In localities farther north than the sugar belt proper heavier coverings to a depth of six inches are advisable. This can be successfully accomplished by the one-horse plow. The cane thus covered, the middle between the rows should be run out with the double mould board plow and all quarter drains and ditches should be put in shape to handle any excessive rainfall that may occur.

DRAINAGE.

Drainage is a prime necessity for successful cane culture, and its importance is difficult to exaggerate. The depth and number of ditches for a cane field vary greatly with its topography, and one must be guided by this in planning his drainage system.

OFF-BARRING.

After the severe weather of winter has passed the heavy covering of earth must be removed from the cane in order to give it the benefit of the early spring warmth. This is accomplished by throwing the earth from the sides of the cane rows toward the middle, a process termed "off-barring." This is done by the two-mule plow. The

earth is then removed from over the cane until a layer of only an inch, or a little more, remains.

THE SCRAPER.

There is an implement especially designed for this and is far more economical than hoes, although it performs the work no better. The cane thus left upon a narrow, well-drained ridge germinates earlier than it otherwise would.

The earth between the rows should be thoroughly worked so as to be kept in good tilth.

FERTILIZATION.

The next step in order is the application of fertilizers. They should not be applied until the cane has reached a stand.

It is sometimes the practice to apply the fertilizer to cane at the time of planting in the fall or in the spring by placing the fertilizing materials in the furrow of the cane. There is a difference of opinion as to the merits of this method as compared with the other.

If the off-bar furrows have been filled from the washing of heavy rains they should be reopened and the fertilizer applied along these and over the row.

CULTIVATION.

The earth is then returned to the cane by means of plows. The middles between the cane rows are opened with a double mould board plow and the cultivation from this stage should be performed with a disc cultivator which straddles the row at each working, throwing more earth toward the cane, building the row higher and higher. Each time the disc cultivator is used the middles should be cultivated by means of an implement especially designed for the purpose. These are termed "middle cultivators." Only a limited amount of hand-hoeing should be necessary when these implements are used, and then only to remove the grass which is immediately around the stalks of cane.

Cultivation should be continued until the cane has reached such a height that the mules and implements can no longer pass through without causing material injury.

KINDS AND AMOUNTS OF FERTILIZERS.

The matter of fertilizing sugar cane is an extensive subject and admits of much discussion, but it shall only be briefly dealt with here. In the first place, sugar cane is a crop that requires, as all other crops do, the essential plant food ingredients—nitrogen, phosphoric acid and potash. Among these nitrogen is foremost and deserving of the greatest consideration. There is hardly a crop that is so exhaustive upon soil nitrogen as sugar cane. In the first place, the tonnage that is removed is greater than is generally taken from the land, and in addition the green leaves and tops are usually burned in the field and the nitrogen they contain is thereby lost.

Phosphoric acid is required by nearly all of our cane soils, and is second in importance to nitrogen.

Although sugar cane makes heavy drains upon soil potash, most Louisiana soils—and this is to a large extent true of most of our Southern soils—are very rich in potash and there is very little, if any, advantage from the application of potash fertilizers.

Nitrogenous fertilizers are divided into two distinct classes. Those of an organic nature, such as cotton seed meal, tankage, dried blood, etc., and the mineral form, such as nitrate of soda, sulphate of ammonia, etc.

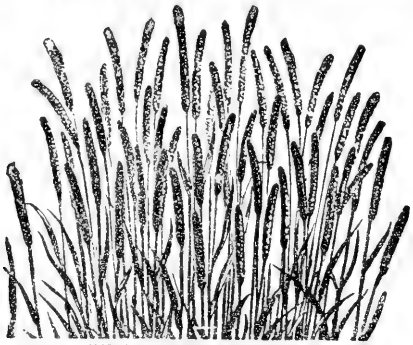
A decision as to which one of these to use is dependent upon rainfall and other conditions. In a soil that is subjected to heavy

bleaching rains the mineral forms, being more soluble, will be to a certain extent washed away, and the organic forms are therefore preferred by many in Southern Louisiana on this account. If quick results from the application of fertilizers are needed, or if the crop needs to be stimulated, the mineral or readily available forms are the ones desired.

One of the most popular fertilizers in the cane belt of Louisiana is slaughter-house tankage, and this is applied in quantities ranging from 400 to 800 or 1,000 pounds per acre. In addition to containing from 8 per cent to 11 per cent organic ammonia, it contains good quantities of phosphoric acid. It is, however, sometimes supplemented with acid phosphate in quantities ranging from 100 to 300 pounds per acre.

The companies which manufacture ready mixed fertilizers also put out a number of brands which are desirable in the fertilization of cane.

TIMOTHY (Phleum Pratense)



TIMOTHY (Phleum Pratense.)

The most popular of all grasses for hay and the standard to which all other hay is compared. It is a perennial, doing best on a moist, tenacious, rich soil. On light soils the yield is generally scant. The best results are had by sowing timothy with a mixture of red top and clover. Timothy does not make a desirable pasture as there is little growth after being cut and tramping of stock soon destroys it. Hay should be cut just when it has stopped flowering. Quantity of seed per acre varies with the character of the soil. On heavy soils sow one-third to one-half bushel per acre, on light soils less.

KENTUCKY BLUE GRASS

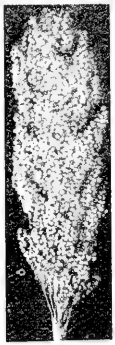
Agriculturally this is well called the King of all Pasture Grasses. However, it is not such a general purpose grass as is red top. Wher-

ever this grass does well, generally on lime soil, land there at once commands a high price, as it becomes the animal breeder's ideal location. This grass requires some time to establish itself. For a couple of years should only be lightly grazed. Time for sowing depends on the locality. There are three principal times of sowing, in the fall, in the early spring and again in June. Sow three bushels (14 lbs. to the bushel) per acre. This seed should never be covered, but only rolled after sowing, as the seen germinates better in the light than in the dark.

THE NON-SACCHARINE SORGHUMS

(1) Kafir corn and (2) the duras.

By C. W. WARBURTON,
Bureau of Plant Industry.



The non-saccharine sorghums are important as grain and forage crops in regions of slight or moderate rainfall and high summer temperatures. As they are of tropical origin they cannot be grown in the extreme north or at high altitudes. Although some progress has been made in securing early strains, at the present time they can hardly be depended on to mature seed very far north of the southern boundry of Nebraska. Some of the varieties are of value as forage crops, however, for a considerable distance farther north. In all the middle and southern portion of the Great Plains, in the semi-arid Southwest, and in the central valleys of California these sorghums make the most acceptable substitutes for corn which can be grown. They are especially valuable for growing on "new land." Kafir corn is most useful in Kansas, especially the western two-thirds of the state, and in Oklahoma and Texas.

QUANTITY OF SEED NECESSARY.

The quantity of Kafir corn seed to plant to the acre varies according to the method of planting, the use to be made of the crop, and the conditions under which it is grown. When grown in rows for the maximum yield of both fodder and grain, 6 or 8 pounds to the acre in 3½-foot rows are desirable, although this quantity is frequently reduced to 3 or 4 pounds. Thin planting, however, produces coarse stalks which are not readily eaten by stock and a small number of large heads which yield less grain than the many small ones resulting from thicker seeding. When the stalks are a considerable distance apart, the heads frequently do not grow entirely out of the "boot," or sheath, and the inclosed part of the head rots or fails to mature seed. Where the crop is to be harvested by hand, thin planting is desirable. For hay and pasture it should be much thicker—one-half to 1 bushel of seed to the acre in rows or drills and 1 to 2 bushels in broadcast seeding. On account of the larger seed of the

dura group, heavier planting is necessary—9 to 12 pounds per acre in rows or 1 to 1½ bushels in drills. As thin planting tends to produce goosenecked heads in this class of sorghums, it is never desirable. The largest yields of grain from all varieties may be secured from 3 to 3½ foot rows, with the stalks 2½ to 4 inches apart in the row. In very dry localities, or where the crop receives little cultivation, the stalks should be thinner than where conditions are more favorable.

METHODS OF PLANTING.

Listing.—In the sections of Kansas, Oklahoma and Texas where the non-saccharine sorghums are largely grown, the common method of planting all the cultivated crops is with the lister. With this implement the seed is planted in the bottom of a furrow, and is thus placed several inches below the general level of the field. This furrow is filled by the first two cultivations. Listed crops are said to be better able to resist drought than are the surface-planted ones because their main root system is farther below the surface of the soil. Corn and the sorghums, however, throw out many feeding roots from the portion of the stalk covered by cultivation, so that there is really little difference in the depth of the main roots of listed and shallow-planted crops.

The principal advantage from listing comes in the protection afforded the young plants from the strong winds often prevailing in the spring, and from the sand carried by these winds, which sometimes cuts the plants off close to the ground. Listing the crop delays its maturity several days, as the young plants in the bottom of the furrow are checked by lack of heat and light, and it is therefore not to be recommended in sections where the growing season is short or when the seed is planted late. In wet seasons listing is a disadvantage, as the furrow fills with water and the young crop is washed out or covered with sand and mud. If the plants are not yet up, the bottom of the furrow sometimes bakes so hard that they are not able to break through the crust. In listing it is customary to use a planter with special sorghum plates. The most common implement is the combined lister and planter.

Surface planting.—Recent tests have shown that in many sections where the lister is largely used fully as good yields may be secured from surface planting. In surface planting, the ordinary two-row corn planter may be used when provided with sorghum plates, or enough of the holes in a grain drill may be stopped to give the desired distance between the rows. The grain drill distributes the seed rather more evenly along the row than the planter. If the corn planter is used and the drills are desired closer than 3½ feet, the rows may be straddled.

Drilling and broadcasting.—When the crop is desired for hay or pasture, good results can be secured by sowing the seed with a grain drill with all the holes open, or by broadcasting. If the seed is sown broadcast it may be covered by harrowing or disking.

CULTIVATION.

When the crop has been listed, the first cultivation is usually given by running a harrow lengthwise of the rows. The young sorghum plants grow very slowly at first, so that frequent and shallow cultivation is necessary to keep the weeds in check. Harrowing in the direction of the rows throws only a small quantity of earth into the lister furrows, and does not cover the young plants. The harrow may be used until the plants reach the top of the lister furrow, or what is known as the "sled," or lister cultivator, may be substituted. In styles of this machine the knives are replaced by disks. After the plants get above the general level of the field any ordinary type of cultivator can be used to advantage. While the plants are small

and before the roots spread into the space between the rows, one cultivation 3½ to 4 inches deep should be given. Later cultivation should be frequent and shallow, to maintain an earth mulch and check evaporation.

When the crop is surface planted the harrow is the best tool for early cultivation, running the same way as the rows. Later tillage should be the same as for the listed crop, using any of the ordinary types of walking or riding cultivators. Frequent cultivation is essential when the plants are small, especially on fields that have been cropped for some years. On sod land good crops are usually grown with only one or two cultivations, or with none at all. In California, where irrigation is practiced, the common method is to grow the crop without cultivation, but one or two workings greatly increase the yield.

Where the crop is drilled, harrowing when the plants are from 3 inches to a foot high is frequently of benefit.

HARVESTING.

When the crop is cut for fodder the grain should be fairly mature; if the heads only are removed they should be fully ripe. For hay the crop may be cut at any period of growth from the time the plant comes into bloom until the seed is in the hard dough stage. For silage it should be harvested when the grain is in the dough stage. If used as a soiling crop, the stalks may be cut at any time after they are large enough to handle conveniently, but can be fed with most profit from the time the plant comes into bloom until it approaches maturity.

When grown in rows the crop is ordinarily harvested with a corn binder and put in large shocks to cure. It can later be threshed for grain or fed as fodder. The stalks may also be cut with the "sled-cutter" commonly used in the corn belt before the row harvester was introduced, or by hand with a corn knife. Where a large area is to be harvested the saving effected by the use of the most improved machinery fully justifies any additional expense in its purchase.

Ordinarily, when the crop is to be fed without threshing, the fodder is allowed to stand in the shock until wanted. As the loss from handling in this way is slight, owing to the dry climate, the method is quite practical; but it is advisable to stack a portion of the crop near the feed lot for feeding in stormy weather or when the shocks are covered with snow. When the fodder is to be hauled a considerable distance before feeding and it is not too tall and coarse it is sometimes baled for convenience in handling. The bundles are not opened in baling, but are simply compressed and bound together. For this purpose a hop baler is the most practical machine, as the ordinary hay presses are too small for compressing the bundles.

Where the fodder is not desired the heads may be removed by hand, using an ordinary pocket or butcher knife, or by a special header attached to the wagon box and driven by a sprocket on the rear wheel of the wagon. When the crop is harvested in this way the heads should not be thrown in piles unless they are thoroughly dry, as they heat quickly if at all damp or green. If the heads are not dry when harvested they should be spread in thin layers to cure.

If the crop is drilled or sown broadcast it may be cut with an ordinary grain harvester. For this purpose it is customary to use an open-end elevator. When the crop is sown in this way the heads can be removed with a grain header. The stalks may then be cut and stacked for stover or they may be pastured. When cut for hay a mower is generally used; the hay is allowed to cure partially in the swath, then raked into windrows, where the curing is completed, and stacked with a sweep rake and swinging stacker. Under favorable conditions the hay will cure in three or four days.

If the grain is to be fed alone, the fodder may be run through an ordinary thresher with the concaves removed and boards substituted, or the heads only may be inserted, the grain threshed out, and the stalks then removed. Both these operations involve much heavy labor, however. A better way is to remove the heads from the stalks and run only the heads through the machine. If the crop is cut for fodder the heads may be removed by hand, using an ordinary knife, or by laying the bundle on a block and cutting them off with a broad-ax or corn knife. The seed should be thoroughly dry when threshed; if it is not, it should be spread in thin layers to dry, as it heats quickly if stored in bins when damp. The grain also absorbs moisture readily, so that in damp weather it is necessary to shovel it over occasionally.

BUTTER MAKING ON THE FARM

EDWIN H. WEBSTER, M. S.,
Bureau of Animal Industry.

MILK UTENSILS AND THEIR CARE.

Good tin is the only practicable material for milk vessels, and this must be kept shining and bright. All milk should be rinsed from the surface of the tin before it comes in contact with boiling water, as the heat will cook the milk onto the surface, forming a coating very difficult to remove. After rinsing the vessel free from milk, it may then be washed in hot water. There should be added to the water some good cleansing compound. Powders can be procured that are guaranteed to contain no grease, and they are usually excellent cleansers. If these are not obtainable, the best thing to use is ordinary commercial sal soda and a little borax, which are cheap and effective.

The final rinsing of dairy vessels should be in boiling hot water. After the rinsing in boiling water, the surface will quickly dry and should be allowed to do so naturally. It is an excellent practice to stand the pails and other milk vessels in the sun so that the rays will reach every part of the inside.

HANDLING OF MILK AFTER IT IS DRAWN.

Milk is often spoiled by allowing it to stand in the barn too long after it is drawn. The milk should be quickly removed to a place free from odors.

This building need not be very large, but must be constructed so that it can be easily kept clean and cool. A cement floor should be laid, as it is the easiest to clean, is cool, and does not rot from moisture.

The water supply.—Provision must be made for an abundance of water and the pumping arrangement must be such that the fresh water from the well or spring will flow through the dairy house.

Cooling arrangements.—If the dairyman has ice, the problem of cooling is very simple. Broken ice can be placed in the tank about the cans.

Use of steam.—In a moderate-sized dairy there should be added to the equipment a small steam boiler which should be in a room separate from the dairy. There is always need of steam, and the additional cost involved is but little compared with the benefits obtained. If steam cannot be provided, a small hot water heater of some kind should be used. It is essential to have plenty of boiling water for purposes of washing and scalding milk vessels and the floors and walls of the building.

THE CREAM SEPARATOR AND ITS OPERATION.

The dairyman cannot afford to be without a separator. It removes practically all of the butter fat from the milk, while the old method of gravity skimming will leave from one-eighth to one-fourth of the butter fat in the milk. The cream from the centrifugal machine is of finer quality, and a much better product can be made from it. The skim milk is fresh and sweet for feeding and is far superior to that from the gravity system.

There are numerous kinds of mechanical separators on the market, but they differ in details of construction rather than in the principles on which they work. The dairyman should thoroughly understand these principles. In selecting a separator one should first determine its value for good work, and then examine its mechanical construction to see if it will stand long use.

The principles of separation.—The force that is used to separate the milk is known as centrifugal force. This force may be described as the pull that is felt when a weight attached to a string is whirled about the hand. It is the pull outward, and the faster the weight is whirled the stronger the pull becomes. In the old system of creaming, the separation is caused by the action of gravity. The fat globules, being lighter than the other portions of the milk, are forced to the top; that is, gravity acts stronger or pulls harder on the heavier portions than it does on the lighter, and the milk is gradually arranged in layers, the lighter portion at the top and the heavier portion at the bottom. The force acting in the separator has precisely the same action on the milk, but acts outward from the center of the bowl the same as gravity acts downward from the surface, only many thousand times stronger, accomplishing in a few moments and far more completely what it takes gravity several hours to do.

As the milk goes into the bowl it is at once thrown to the outermost parts and fills the bowl completely until an opening is reached where it will flow out again. The surface of the milk is on a line parallel with the center, or axis, of the bowl, and is exactly in line with the cream outlet. A cross section through the bowl from this surface to the outside presents much the same appearance as would a pan of milk after the cream has raised by gravity. The cream is on the surface, which might be called the top, and the heavier portions of the milk at the point farthest from the center, which would represent the bottom.

With this understanding of the arrangement of the milk in the bowl there are a number of things to be observed which influence the separation.

First. The speed of the separator must be uniform and up to the standard required by the makers of that particular machine.

Second. The temperature of the milk should be such as will make it flow readily; the warmer it is the more perfect will be the separation.

Third. The amount of milk that is run through the machine should remain constant, and should not be increased over that which is intended for the machine.

Fourth. The machine should be set on a solid base or foundation, so that there will be no jar or shaking about as it is turned, such as would tend to interfere with the even flow of the milk through the bowl and thus destroy its efficiency in skimming.

Fifth. The separator must be kept thoroughly and scrupulously clean, particular care being taken that none of the tubes through which the milk flows become obstructed in any way.

Sixth. The test of the cream can be readily changed by changing either the cream outlet or the skim-milk outlet.

In the mechanical operation of a machine none but the best oil

should be used, and this should not be allowed to gum or become dirty on the bearings. It is good practice to flush the bearings with kerosene occasionally by making a run with kerosene in the oil cups. This will serve to cut out any gum or dust that has accumulated in the bearings and will make the machine run much freer and easier, thus greatly increasing the length of time that it will last and do perfect work.

SEPARATING THE MILK.

The milk should be separated as soon as possible after milking, while it still contains the animal heat. If milk has been handled in a cleanly way during milking it can be poured directly into the supply can of the separator without straining.

In the winter time when the separator bowl and parts are cold it is best to pour a pint or so of hot water through the machine just as it is started. This warms up the surfaces and prevents the milk from sticking as it would if cold. It also makes the cleaning of the separator much easier and prevents its clogging up at the start.

Bring the machine gradually up to its normal speed and then turn the milk in slowly until the valve is wide open. Keep a constantly uniform motion of the handle during the entire run. When all of the milk has passed from the supply can a quart or so of the skim milk should be caught and poured through to flush out the cream that will remain in the bowl. Unless this is done some of the butter fat will adhere to the surfaces and a small amount remain in the center of the bowl, not being able to get out of the machine because there is no more milk flowing in to force it through. Pouring in the skim milk forces it all out.

Care of Cream After Separation—The first work on completion of the separation should be the care of the cream. The cream must be cooled at once to check the growth of bacteria. The best method of doing this is to place it in a deep, narrow pail immersed in cold water just pumped from the well, and then stir it gently until it is brought down to nearly the temperature of the water. A good dairy thermometer must be a part of the equipment of every dairy, and all temperatures should be taken with it—not by guess. It will take but a few minutes to cool the cream down in the manner described. As soon as it is cooled cover the pail in such a way that it can be entirely submerged in the water. The ordinary shotgun can, as it is commonly called, having a cover that fits over the outside coming down about 2 inches, with catches to hold it in place, is the best kind of a vessel for cooling and holding cream. When a can is entirely submerged it is protected from the heat of summer, the cold of winter, and the contaminating odors that may be in the air; and the surface is effectually kept from drying, leaving the cream in as fine physical condition as when separated.

Warm cream should never be mixed with cold. The result of mixing is always quick souring.

In using the tank for keeping cream cool, it must not be forgotten that water must be kept fresh. If a constant stream is not running through the tank the water should be changed at least twice or three times during the day. The frequency should depend upon the coolness of the room in which the tank is kept.

Cleaning the separator.—Very soon after the separation has been completed the separator should be cleaned. It is imperative that it be washed ever time after it is used, and the sooner it is washed the easier will be the operation.

RIPENING THE CREAM.

The starter and its use.—The dairyman may think, if it is necessary to sour the cream, why is all this pains taken up to this point to keep it sweet. The trouble with ordinary souring is, it may not

be the desirable kind. It must be handled in such a way that desirable flavors will be developed and the undesirable ones kept in check. This can only be done by starting with a perfectly sweet cream and afterwards controlling the souring process. This control is secured by introducing into the cream what is known as a starter. A starter is nothing more nor less than nicely soured milk, either whole or skimmed. It will contain those kinds of bacteria that will develop the good flavors wanted and not those that cause putrefaction, gassy fermentations, and similar undesirable changes. As has already been stated, the greater number of bacteria present are the favorable kinds, and when milk is handled in a cleanly manner practically all that find entrance are of these kinds. To secure a starter containing desirable bacteria, the dairyman has simply to set away a portion of skim milk as it comes from the separator and await developments. If the milk is kept at a temperature between 70 and 80 degrees F., it should sour inside of twenty-four hours and form a solid curd. A test of this curd shows whether or not the dairyman has kept his milk clean. If the taste is found pleasant and mildly acid and the curd readily breaks up when poured from one vessel to another, becoming creamy, showing no hard lumps that will not break down, he has a good starter. On the other hand, if the curd is stringy or will not break with a square, sharp cleavage, but seems to be granular, or if a clear whey is formed on the surface, it shows that bacteria of a harmful species are present. The formation of this curd is caused by the development of acid in the milk. If the souring continues too long and too much acid is formed, the starter becomes sharp and unfit for use. After a certain amount of acid is formed its further development is checked, but this does not occur until the milk is too sour for a good starter.

The starter is at its best just as the curd becomes firm, and the butter maker should plan to have this occur at the time he wants it to put in the cream. A glass jar is the best vessel in which to make a starter. The glass surface, being smooth, is easily cleaned, and the butter maker can see what action is taking place while the milk is souring. If there are gas-producing germs in the milk, little bubbles of gas will form in the bottom and along the sides of the jar. If these are formed the starter should not be used, as gas fermentations always indicate impurity, and the effects of the starter will not be good.

The amount of starter that should be used in the cream will vary under different conditions. Ordinarily, if one is churning every day, about 1 to 1½ gallons of starter in 10 gallons of cream is the right proportion. If it is necessary to hurry the process of souring, more starter can be used, and vice versa. The temperature at which the cream is set will influence the amount of starter to be used. If the cream is cooled to about 60 degrees F., it will require more starter than if it is set at 70 degrees F. Unless the butter maker has means of controlling the temperatures quickly, either by very cold water or by means of ice, it is best to have the cream as cold as well water will make it (which will usually be about 60 degrees F.) when the starter is added. If the cream is to be held for the next eighteen or twenty hours at this temperature, the amount of starter to be added can be determined by the butter maker after two or three trials. Attempts should be made to add just enough starter to have the cream soured properly at churning time. No absolute rule can be given that can be depended upon for this work. The butter maker must use his intelligence and decrease or increase the amount of starter and raise or lower the temperature of the cream in such a way that it will be ripened and ready for the churning at the right time.

If the cream is not to be churned every day, but must be held from two to four days before enough is secured for a churning, either of two ways may be followed: A very small amount of starter may be added to the first batch of cream, which will cause the gradual development of the acidity, or the cream may be held sweet from two to four milkings and then the starter added in a little larger quantity, with a view

to have the ripening completed about twelve to eighteen hours after the last batch of cream is added. Here again the butter maker must use his judgment and experiment until he finds just the right quantities and the right time to add the starter.

During the process of ripening, the cream should be stirred occasionally to obtain best results. Just what is the result of stirring is not entirely known or why it is necesssary, but it is known that cream when frequently stirred ripens with a more uniform and finer flavor than cream which is ripened without stirring.

THE ACID TEST.

The only standard that has been applied in measuring the ripening of cream is the determination of the acid present. The acid test, as it is called, gives a fair idea of the quality and stage of ripeness. It is true, however, that two lots of cream may have exactly the same amount of acid and one of them be good and the other bad; so, after all, the acid test is not infallible. There is no step in the whole process of making butter where the judgment of the maker is so much needed as in ripening the cream. He must cultivate his taste for the desirable flavors and must know when the point is reached where further ripening must be checked. Neither the butter maker who depends entirely upon the sense of taste and smell, nor the one who depends entirely upon the acid test, will get the best results.

Methods of learning to taste and smell, or judgment in their use, can not be given in a book. The ability must be developed through experience. The acid test, however, is a mathematical calculation capable of exact determination.

The principle and its application.—As already stated the measure of ripeness of cream can be determined in a general way by the amount of acid it contains. For the purpose of determining the amount of acid, different methods have been devised, but all are based on the principle that an alkaline substance in solution will neutralize an acid solution. The manipulation of the different tests is practically the same although the apparatus differs somewhat in character. In every instance an alkaline solution of known strength is used. This is added to a definite quantity of cream until it exactly neutralizes the acid in the cream. The amount of alkali necessary to do this measures the quantity of acid present. In order to tell just when the right point is reached and all of the acid is neutralized, a coloring matter, called an indicator, is added, which is pink in an alkaline solution and colorless in an acid solution. Sometimes this coloring matter is added to the alkaline substance used to make the test, as in the case of certain alkaline tablets. As the solution containing the indicator is added to the sour cream, it shows no color until the point of neutrality is reached. At this point color gradually appears and becomes permanent. In other forms of the test it is necessary to add the coloring matter or indicator to the cream before beginning the test, three or four drops being sufficient to give the proper color when the cream becomes alkaline.

THE CHURN.

The barrel churn is by far the best. Practically all factory churns in this country are modifications of it. This form has stood the test of time, and, until some genius gets up an entirely new method of making the butter it will be used to the exclusion of all the claptrap quick-churning machines ever invented.

Barrel churn the best.—Taking the barrel churn as best for the farm butter maker, he should know how to get the most out of it. In this form of churn the concussion of the cream necessary to do the churning is secured by the fall of the cream as the churn is revolved. The faster the churn is revolved the greater number of concussions per minute will be secured. But if the churn is whirled so fast that the centrifugal force created holds the cream from falling no churning will take place.

Cleaning the churn.—Churns are usually made of wood, and their care is an important factor. When ready to clean, the churn should be rinsed out with cold water to remove all buttermilk, salt, etc.; it should then be partially filled with boiling water, the lid put on and fastened loosely, so steam can escape, the draining plug withdrawn, and the churn whirled. The pressure on the inside caused by the creation of steam from the hot water will force water into every nook and crevice of the churn. After a few revoutions the water should be drawn off and another lot, boiling hot, added, and the whirling repeated. Empty this out and let the churn stand so it will drain a few minutes, and then turn the opening up and let it dry. The heat in the wood will dry it out rapidly, and there will be no chance for mold to grow. An occasional rinsing out with lime water will help to keep a churn sweet.

All other wooden dairy utensils should be rinsed, scalded and dried with the same care.

CHURNING.

The process of churning is the gathering into a mass of the butter fat in the cream. The butter fat exists in the cream in minute globules, each independent of the others, and any agitation tends to bring them together, the force of the impact causing them to adhere to each other. As the agitation is continued these small particles of butter grow larger by addition of other particles until a stage is reached where they become visible to the eye, and if the churning is continued long enough all will be united in one lump of butter in the churn.

Temperature.—The time that it takes to churn depends largely on the temperature of the cream at the beginning. If the cream is quite warm, the butter will come quickly; if it is too cold, the churning may have to be prolonged, in some instances for hours, before the butter granules will become large enough to free themselves from the buttermilk. The temperature at the beginning should be regulated accordingy. It is usually considered that about thirty to thirty-five minutes' churning should bring the butter. With different seasons of the year the temperatures will have to be varied somewhat in order to have the butter come in this length of time.

Washing and salting the butter.—It is important to know at just what point to stop churning. For best results in freeing the granules from the buttermilk and incorporating the salt it is considered that the butter granules should be about the size of beans or grains of corn, possibly a little larger. The churn is then stopped, and the buttermilk allowed to drain. After the buttermilk is well drained from the butter granules an amount of water about equal in volume and of the same temperature as the buttermilk should be added, and the churn given four or five revolutions, slowly, so that the water will come in contact with every particle of butter and wash out the remaining buttermilk.

As soon as the wash water has drained well from the butter granules, salt should be added The amount of salt used will depend entirely on the demands of the consumer. Usually about 1 ounce of salt for each pound of butter will be necessary. If the ordinary barrel churn is used, which is perhaps the best form made, the salt may be added in the churn. By giving the churn a few revolutions the salt will be quite thoroughly incorporated with the butter. It should stand in this condition for a few minutes, until the salt becomes more or less dissolved, before the working of the butter is begun.

WORKING THE BUTTER.

Table workers.—For working the butter some form of table worker is best to use. The butter bowl and paddle never give as good results because the butter will almost invariably be greasy, owing to the sliding motion of the paddle over the butter. The table workers commonly used are of two kinds—one having a stationary bed and a roller, either corrugated or smooth, arranged so that it can be passed back

and forth over the surface of the butter; the other having a movable bed, revolving on a center, usually under two corrugated rollers. Both of these forms will do good work if the operator understands their use.

Suggestions as to working.—If the salt and butter have been mixed in the churn the butter can be placed on the working table and the working begun at once. After the butter has been pressed out with the roller it should be divided in the center, one part being laid over onto the other and the rollers passed over again. The process should be repeated until the butter assumes what is termed a waxy condition. If the working is continued for too long a time the butter will become salvy, having the appearance of lard, and will lose its granular structure, becoming weak-bodied. The firmness of the butter must be taken into account in determining how long it should be worked. Usually the firmer the butter the more working it will stand and the more time it will need to thoroughly incorporate the salt and bring out the waxy condition.

Testing saltiness while working.—During the process of working, the butter should be tested frequently to determine its saltiness, and if by mistake too much salt has been added it can readily be removed from the butter by pouring a little cold water over it as the working continues. The water washes out the excess of salt. If the butter should contain too little salt, more can readily be added during the process of working. It is best practice to about half finish the working and then let the butter stand for about twenty minutes or half an hour before completing. This gives the salt an additional chance to dissolve, and there is less liability of mottles in the finished product.

NUMBER OF SHRUBS OR PLANTS FOR AN ACRE.

Distance Apart	No. Plants	Distance Apart	No. Plants	Distance Apart	No. Plts.
3 x3 inches ...	696,960	4 x4 feet	2,722	13 x13 feet	257
4 x4 inches ...	392,040	4½x4½ feet	2,151	14 x14 feet	222
6 x6 inches ...	174,240	5 x1 feet	3,712	15 x15 feet	193
9 x9 inches ...	77,440	5 x2 feet	4,356	16 x16 feet	170
1 x1 foot.....	43,560	5 x3 feet	2,904	16½x16½ feet	160
1½x1½ feet....	19,360	5 x4 feet	2,178	17 x17 feet	150
2 x1 foot.....	21,780	5 x5 feet	1,742	18 x18 feet	134
2 x2 feet.....	10,890	5½x5½ feet	1,417	19 x19 feet	120
2½x2½ feet....	6,960	6 x6 feet	1,210	20 x20 feet	108
3 x1 foot.....	14,620	6½x6½ feet	1,031	25 x25 feet	69
3 x2 feet.....	7,260	7 x7 feet	881	30 x30 feet	48
3 x3 feet.....	4,840	8 x8 feet	680	33 x33 feet	40
3½x3½ feet....	3,555	9 x9 feet	537	40 x40 feet	27
4 x1 feet.....	10,890	10 x10 feet	435	50 x50 feet	17
4 x2 feet.....	5,445	11 x11 feet	360	60 x60 feet	12
4 x3 feet.....	3,630	12 x12 feet	302	66 x66 feet	10

THE DEHORNING OF CATTLE

(RICHARD W. HICKMAN, Bureau of Animal Industry)

The dehorning of cattle can be very satisfactorily performed without other apparatus or instruments than a good strong clothesline and a clean sharp meat saw, or a miter saw with a rigid back. The same simple means for controlling the animal is just as applicable when dehorning clippers are to be used as when the horns are to be removed with the saw. The head of the animal is secured to the horizontal rail or stringer which holds the upper ends of the stanchion boards. The animal is put in the stanchion in the usual manner; then one end of a heavy clothesline is passed around the upper part of the neck and tied in a knot that will not slip, otherwise it will

choke the animal. The free end of the rope is now carried between the horns, through the stanchion to the front, up and over the horizontal stanchion rail, then down underneath the neck and up and over the top of the stanchion rail to an assistant, who should hold it firmly. Now open the stanchion, allowing the animal to withdraw its head; then, keeping the rope tight, pass it once around the muzzle, up and over the stanchion rail, and through to the front again to the hands of the assistant, who should stand 3 or 4 feet in front of the animal and hold the rope firmly, but prepared to release it when told to do so by the operator. The animal is now ready for the dehorning operation.

It is necessary that the rope be held by an assistant, as in the event of the animal struggling during the operation so as to throw itself off its feet, or if there appears to be danger of choking, the rope may be slackened promptly at the word of its operator and the animal partly released. This, however, is rarely necessary, for as soon as the head is secured the operator should be ready, standing at the right shoulder of the animal with his saw, and proceed to saw off first the right and then the left horn.

WHERE TO CUT THE HORNS.

The horns should be severed from a quarter to a half inch below where the skin joins the base of the horn, cutting from the back toward the front.

If the cut is made too high an irregular, gnarly growth of horn is very apt to follow. It will be seen that the point of union of the skin and horn varies in different cattle; hence there can be no rule of measurement, except as the eye becomes trained to see the point or line at which the cut should be made. In the beef breeds fully one-half inch of skin, all around, is usually taken off with the horn.

TREATMENT AFTER DEHORNING.

It is not usual to apply any preparation after the operation of dehorning to prevent bleeding, as the loss of blood is not sufficient, as a rule, to be of consequence. Care should be taken, however, to prevent substances from getting into the openings left after the horns are removed.

Occasionally animals after being dehorned and turned out of the stable will rub their heads against a dirt or gravel bank or the rough bark of a tree, and foreign material may thus get into the cavities, though usually the soreness of the parts is sufficient to prevent this.

If the animals are dehorned in warm weather, it is well to apply some pine tar with a view to keeping flies from the wounds. Some operators do this in nearly all cases, thinking that it facilitates healing. The dehorning operation should always, when possible, be performed in cool weather, and upon animals which have at least attained the age of two years.

HOG CHOLERA

The symptoms observed in particular cases will be influenced by the virulence of the germ which is responsible for the attack, and also by the resisting power of the hogs in the herd. If this resisting power is low, or if the germ which is the cause of a particular outbreak is of high virulence, we may have in such a herd a typical manifestation of the acute type of hog cholera. In this acute type, the chief symptoms observed are sluggishness, disinclination to move, weakness, loss of appetite, a high fever, inflammation of the eyes with gumming of the lids, and there may be diarrhoea. If the sick animals are examined carefully, red or purplish blotches may be seen on the skin, espe-

cially over the surface of the abdomen, on the inside of the legs, and around the ears and neck. As a rule the progress of the infection is so rapid that the hog is not greatly emaciated before death; it is, in fact, usual in acute outbreaks for hogs to die after being sick only a few days.

In the chronic type of the disease the symptoms are quite similar to those seen in acute cases. The sick hogs are sluggish and disinclined to move when disturbed, and coughing is frequently heard when they are suddenly roused. They may eat very little and usually lose flesh rapidly, finally becoming so emaciated and weak that they stagger or walk with an uncertain gait, the hind legs particularly appearing to be very weak. The eyes become inflamed and the lids may be gummed together. After the first few days of illness there is apt to be a profuse diarrhoea, and in these chronic cases the hog may, and usually does, linger for several weeks, sometimes months, before it finally dies. It is extremely rare for such an animal to recover its health and vigor sufficiently to become of value to the owner.

It will thus be seen that before death the appearance of hogs affected with hog cholera is not particularly characteristic, for the symptoms, especially in acute cases, are only such as might be expected in a severe disease of any kind. But if these symptoms are noticed in a herd of hogs, and if the disease is seen to be contagious, showing a tendency to spread from the sick to the healthy animals, it is likely that hog cholera is present.

In Farmers' Bulletin 24, Dr. D. E. Salmon gave the following formula for a medicine which was used many years ago as a preventive and cure for hog cholera:

	Pound
Wood Charcoal	1
Sulphur	1
Sodium chlorid	2
Sodium bicarbonate	2
Sodium hyposulphite	2
Sodium phosphate	1
Antimony sulphid (black antimony)	1

Experience has shown, however, that this medicine is not to be regarded as a cure or preventive in the true sense of the words, but it is nevertheless a very good condition powder. This powder is mixed with the feed in the proportion of a large tablespoonful to each 200 pounds weight of hogs to be treated, and should not be given oftener than once a day. This medicine can not be relied upon to prevent the occurrence of disease, except in so far as it improves the general health of the hogs. Therefore, even though this remedy be used, strict attention must be given to quarantine and sanitary measures if the disease is to be warded off when in the neighborhood.

THE CARE OF MILK IN THE HOME

If the milk producer and the milk dealer have done their duty there is daily left at the consumer's door a bottle of clean, cold, unadulterated milk. By improper treatment in the home the milk may then become unfit for food, especially for babies. This bad treatment consists (1) in placing it in unclean vessels; (2) in exposing it unnecessarily to the air; (3) in failing to keep it cool up to the time of using it; and (4) in exposing it to flies.

Milk absorbs impurities—collects bacteria—whenever it is exposed to the air or placed in unclean vessels. Some of these may be the bacteria of certain contagious diseases; others may cause digestive troubles which in the case of babies may prove fatal. Much of the

cholera infantum and summer bowel troubles of infants is due to impure milk. The amount of the contamination depends largely on the condition of the utensils and the air with which the milk comes in contact; the air of even a so-called clean room contains many impurities. The science of bacteriology is raising the standard of cleanliness of utensils. Bacteria which get into the milk from the air or from the vessels multiply rapidly so long as the milk remains warm; that is, at 50 degrees F. or above. At lower temperatures the bacteria either are dormant or increase slowly. Cleanliness and cold are imperative if one would have good milk, although if it is consumed so quickly after production that the bacteria in it do not have time to increase much—say within two or three hours—the importance of cold is lessened. Milk from the grocery store or bakery which is kept in a can, open much of the time, possibly without refrigeration, is dangerous and should be avoided.

The suggestions given here regarding milk apply also to cream.

RECEIVING THE MILK.

The best way of buying milk is in bottles. Dipping milk from large cans and pouring it into customers' receptacles on the street, with all the incident exposure to dusty air not always the cleanest, is a bad practice. Drawing milk from the faucet of a retailer's can is almost as bad as dipping, because, although the milk may be exposed to the street air a little less than by the dipping process, it is not kept thoroughly mixed, and some consumers will receive less than their proportion of cream. If situated so that it is impossible to get bottled milk, do not set out overnight an uncovered vessel to collect thousands of bacteria from street dust before milk is put into it. Have the milk delivered personally to some member of the family if possible; if not, set out a bowl covered with a plate, or better still, use a glass preserving jar in which nothing but milk is put. In the latter case use a jar with a glass top, but omit the rubber band. Paper tickets are often more or less soiled; hence if they are used do not put them in the can, bowl, or jar. For the same reason money should not be put in the can.

Take the milk into the house as soon as possible after delivery, particularly in hot weather. Never allow the sun to shine for any length of time on the milk. Sometimes milk delivered as early as 4 a. m. remains out of doors until 9 or 10 o'clock. This is wrong. If it is inconvenient to receive the milk soon after it is delivered, indicate to the driver a sheltered place, or provide a covered box in which the milk bottle or can may be left.

HANDLING AND KEEPING THE MILK.

On receiving the milk put it in the refrigerator at once and allow it to remain there when not using from it. Except in cold weather milk can not be properly kept without ice. Unless the milk bottle is in actual contact with the ice it will be colder at the bottom of the refrigerator than in the ice compartment, as the cold air settles rapidly.

Keep milk in the original bottle till needed for immediate consumption; do not pour it into a bowl or pitcher for storage. Carefully wipe or rinse the bottle, especially the mouth, before pouring any milk from it, so that dust or dirt which may have gathered thereon or on the cap will not get into the milk. Do not pour back into the bottle milk which has been exposed to the air by being placed in other vessels. Keep the bottle covered with a paper cap as long as milk is in it and when not actually pouring from it. If the paper cap has been punctured, cover the bottle with an inverted tumbler.

Milk deteriorates by exposure to the air of pantry, kitchen or

nursery. Do not expose uncovered milk in a refrigerator containing food of any kind, not to mention strong-smelling foods like fish, cabbage, or onions. An excellent way of serving milk on the table, from the sanitary standpoint, is in the original bottle; at all events pour out only what will be consumed at one meal.

When milk is received in a bowl or pitcher instead of in a bottle, observe the spirit of the foregoing remarks: Keep the vessel covered; expose uncovered milk to the air of any room as little as possible; do not expose it at all in a refrigerator.

Remember that exposure of milk to the open air invites contamination not only from odors and bacteria-laden dust, but also from flies. These scavengers may convey germs of typhoid fever or other contagious diseases from the sick room or from excreta to the milk.

Records show typhoid epidemics from such a cause, and 100,000 fecal bacteria have been found on a single fly. Flies also frequently convey to milk large numbers of the bacteria that cause intestinal disorders in infants; an examination of 414 flies showed an average of 1,250,000 bacteria per fly.

THE REFRIGERATOR.

Keep the refrigerator clean and sweet. Personally inspect it at least once a week. See that the outlet for water formed by the melting ice is kept open and that the space under the ice rack is clean. The place where food is kept should be scalded every week; a single drop of spilled milk or a small particle of other neglected food will contaminate a refrigerator in a few days.

CLEANING EMPTY BOTTLES AND UTENSILS.

As soon as a milk bottle is empty rinse it in lukewarm water until it appears clear, then set it bottom up to drain. Do not use it for any other purpose than for milk. There is no objection to the consumer's washing and scalding the milk bottle, but this is unnecessary, as the dealer will wash it again when it reaches his plant. He can not, however, do this properly if he receives the bottle in a filthy condition, and if you return such a bottle your negligence may result in the subsequent delivery of contaminated milk to some consumer, possibly yourself.

All utensils with which milk comes in contact should be rinsed, washed and scalded every time they are used. Use fresh water; do not wash them in dishwater which has been used for washing other utensils or wipe them with an ordinary dish towel—it is better to boil in clean water and set them away unwiped.

When a baby is bottle-fed, every time the feeding bottle and nipple are used they should be rinsed in lukewarm water, washed in hot water, to which a small amount of washing soda has been added, and then scalded. Never use a rubber tube between bottle and nipple, or a bottle with corners.

CONTAGIOUS DISEASES.

If a case of typhoid fever, scarlet fever, diphtheria, or other contagious disease breaks out in the family, do not return any bottles to the milkman except with the knowledge of the attending physician and under conditions prescribed by him.

PASTEURIZATION.

While efficient pasteurization destroys disease germs and affords a safeguard against certain dangers, it should not be regarded as an insurance against future contamination of milk, and the foregoing suggestions should be observed in the case of pasteurized milk as

well as with ordinary milk can. Do not keep milk over twenty-four hours, even if it seems to be sweet, as milk may become unfit for human food before it sours.

TANKAGE, OR MEAT MEAL, FOR PIGS

In view of the increasing use of tankage as a food for pigs and the beneficial results reported by feeders as attending this use, the Indiana Station has carried out experiments which show that, "as a feeding material for pigs, tankage offers certain advantages. It contains a high percentage of protein and an amount of phosphoric acid that materially excels that found in any grain or by-product of mills. The phosphoric acid for pigs is useful in building up bone structure, an important feature with our pigs of to-day, while the protein has a value universally recognized by feeders." These experiments also "strongly emphasize the weakness of using corn meal as a single ration in feeding growing, fattening pigs, and indicates the great value of adding a food rich in protein (such as tankage) to the corn, thus producing a better-balanced ration and securing more desirable results in both health and growth."

The Iowa station has also reported experiments with pigs which indicate that in fattening pigs a ration containing more protein and ash than a pure corn ration gives better results than the latter. In these experiments a ration consisting of 5 parts of corn to 1 of tankage of beef meal, and containing much larger percentages of ash and protein than one consisting of corn alone, gave from 7 to 34 per cent greater net profits than corn alone.

The results reported strikingly demonstrate the value of tankage and similar animal products as food for pigs and indicate that a trial of this material is worthy of the attention of swine raisers generally, especially those so situated that they can readily obtain it. Reports from various sources indicate that the use not only of tankage but also of dried blood as feed for all kinds of farm animals is increasing. In addition to being a nutritious food, dried blood has been found by the Kansas Station to be an excellent remedy for scours in calves.

CULTIVATION OF COTTON

J. F. Duggar, Department of Agriculture.

Disposal of Litter.—Where cotton is the preceding crop, the first step in preparing the field for another crop of cotton consists in reducing the old stalks to fragments fine enough to be plowed under. This is most economically done by driving a stalk cutter along each row, the blades on the cutter chopping the stalks into short pieces. A more common method consists in beating the old brittle stalks with a heavy stick; this is best done during dry weather or on a frosty morning in late winter. Sometimes the stalks are lifted by a plow or by hand and then raked and burned. This latter course should be avoided except when it may be made necessary by the presence of the cotton boll-weevil.

Methods of plowing.—The greatest part of the area intended for cotton receives only one plowing before the seed are planted. This usually consists in forming ridges or beds. More thorough preparation may be given by first plowing the land level or flush, afterwards forming the beds by a subsequent plowing. The conditions under which this double amount of preparation, namely, first broadcast plowing and then bedding is especially advisable, are the following:

1.—When the soil is a stiff loam or clay inclined to form clods.

2.—When the land has not been cultivated the preceding year, or when the preceding crop is one that has left much vegetation on the surface.

The practice of plowing land twice for cotton, first fallowing it, and then throwing it into beds, is on the increase among the best farmers.

Time for plowing or breaking.—February and March are the months in which the greater part of the plowing of cotton land is performed. The time of plowing is largely a matter of convenience. The general rule should be that the larger the proportion of clay in the soil, the earlier may plowing be done to advantage, provided the surface be freshened later. The larger the amount of trash to be buried and rotted, the earlier should be the date of plowing. Some farmers begin plowing for cotton in December or even in November. This permits freezes to aid in pulverizing the ground and killing some kinds of cotton insects that spend the winter in the ground.

Early plowing may cause land to become too compact before the time for planting. In this case it is desirable, shortly before planting, either to replow the land or to loosen the surface with a disk-harrow. Too early plowing of sandy land increases the loss due to the leaching out of plant-food in the water that drains through the soil. Hence, sandy land, as a rule, is not plowed in the fall. However, it is good practice to plow any soils except the sandiest in the fall, provided some winter-growing crop, such as the small grains, or clovers, or vetches, are sown. The roots of the growing plants largely prevent leaching by appropriating the plant-food that becomes available as the vegetable matter decays. These green crops can be plowed under in the late winter or early spring, or grazed, or otherwise utilized. Plowed soil should be kept covered during winter with growing plants. Fields covered with cowpeas or other dead leguminous plants should not be plowed very early, since early fall plowing would induce rotting and leaching before the cotton plants would be ready to utilize the nitrogen made available by the decay of the legumes.

A small proportion of the area in cotton is plowed only a few days before planting. This incurs the danger that some of the seed may fail to come up in the loose soil, which quickly dries.

Depth of plowing.—A large proportion of the cotton fields are plowed only 3 or 4 inches deep. It is generally advisable to plow deeper than this, so as to afford a larger amount of available soil-moisture for the benefit of the plants in periods of dry weather, and to increase the feeding area for the roots. However, extreme depth, as well as extreme shallowness, is to be avoided. Plowing too deep may bring to the surface much of the subsoil, where, for a year or two, it remains infertile and subject to baking or clod-forming. Moreover, the cost of very deep plowing is excessive. A depth of 6 to 8 inches may be regarded as unusually good preparation; this depth should be attained only gradually, that is, by plowing each year only about an inch deeper that the year before. By a gradual and judicious increase in depth, a few farmers have advantageously stirred their soil to even a greater depth than 6 to 8 inches. For very deep plowing the disk plow is a favorite implement.

When plowing is several months before the time of planting the seed, the depth may well be greater than in late plowing. This is because the earlier plowing permits the upturned subsoil to be improved by the action of freezes and of the air, and because the deeper layer of stirred soil requires a longer time to settle to that degree of compactness most favorable to the germination of seeds and the growth of plant roots. The aim of the cotton grower should be gradually to deepen the layer of plowed soil.

Subsoiling.—Is usually accomplished by first employing an ordinary turn-plow, and then in its furrow running a special subsoil plow.

Subsoiling is a means of suddenly increasing the depth of loosened soil. The benefits of subsoiling, when done under the most favorable conditions, are the same as those that result from any form of deep plowing.

Forming the ridge or bed.—Most cotton fields are prepared by throwing together at least four furrow slices turned up by a moldboard plow. This forms a ridge or bed which is usually 3 or 4 feet wide, and several inches high.

In regions where commercial fertilizers are used, there is first run a furrow in which the fertilizer is placed, and over which the bed is subsequently formed. This center furrow may be either (1) along the line of old cotton stalks, or (2) in the middle or water-furrow of the year before, or (3) it may be run in land already plowed broadcast.

A saving of labor may be effected by forming the beds with a disk-harrow on a field previously plowed broadcast.

Planting cotton level.—Practically all the cotton of the United States is planted, on ridges or beds. However, a few farmers, on well-drained sandy soil, plant late cotton on land that is not bedded, but merely "flushed," or "plowed broadcast." This requires very shallow planting, and also requires very careful early cultivation to prevent covering the plants. The object in planting on a level is to enable the plants better to endure drouth.

A method that is generally an improvement on the last named consists in forming low beds; before being planted thay are pulled down almost level, by harrowing or dragging them whenever a crust forms or whenever young weeds appear.

Distribution of fertilizers.—The rows having been marked off, usually with a shovel plow, the fertilizer (if any is to be used) is drilled in this furrow. It is most convieniently put in place by means of a one-horse fertilizer distributor, which also draws earth over the fertilizer. Immediately a "list" is formed. The bed may be completed at once, or more frequently not until the entire area intended for cotton has been thus fertilized and listed. On some farms the fertilizer is distributed by hand, either through a "guano horn" or without this inexpensive device.

Time of planting.—The usual date for the beginning of cotton planting is two to three weeks after the average date of the last killing frost in that locality. Planting begins in March near the Gulf of Mexico; it begins about April 1 in the central part of the Gulf States and in the extreme northern part of the cotton-belt it may be delayed until May. In the central part of the cotton-belt most of the crop is planted before May, but an occasional field is not planted until about the first of June. Extremely early planting increases the risk of injury by frost in spring and increases the labor of cultivation. Rather early planting is advisable in regions where the cotton boll-weevil is present. Extremely late planting reduces the labor of cultivation and usually also reduces the yield, many of the immature bolls being destroyed by frost in the fall.

Cotton planters. There are numerous forms of planters for cotton. Most of them plant a single row at a time, opening the furrow, dropping the seed, and covering the seed, at one trip. Probably the most important features about a planter are: (1) provision for constantly agitating the mass of seed, so that the feed may be uniform, and (2) provision for rolling or otherwise pressing the soil around the seed.

If the earth above the seed be rolled, or otherwise compacted, the depth of planting may be as shallow as one inch. The usual depth is from one to three inches.

Quantity of seed.—A bushel of cotton seed usually contains between 120,000 and 150,000 seeds, or enough, if each one developed into a mature plant, to suffice for fully fifteen acres. However, it is customary to plant 1 to 1½ bushels of seed per acre. An ideal planter that places the seed in a narrow drill or in hills requires less; and still less is required when planting is done by dropping the seed by hand in separate hills.

On stiff land, it is regarded as advantageous to have a thick stand of plants, so that the combined strength of the young plants may

be exerted to break through the surface crust, which might be too strong for a single plantlet. On the other hand, the presence of only one seed in a place greatly reduces the labor of chopping or thinning cotton.

Broadcast tillage.—One change which should be made in cotton culture is the introduction of broadcast tillage; that is, of cultivation or tillage across the rows by means of weeders or of light, spike-tooth, adjustable harrows. This kind of tillage permits a larger area to be covered in a day's work of man and team than does any other kind of cultivation. It has the double object of breaking the surface crust before this has become very thick and hard, and of destroying weeds and grass while they are extremely small or merely sprouting. One horse drawing a weeder, or a double team drawing a light, spike-tooth harrow, may cultivate ten or more acres in a day.

As soon as a crust begins to form, there is need for the use of a weeder or light harrow at the following stages in the cultivation of cotton:

(1)—A few days or weeks before planting, in order to break the crust and save the moisture for the germination of the seed soon to be planted.

(2)—Following a rain occurring soon after planting, which otherwise would leave too dense a crust to be easily broken by the young plants.

(3)—Between the time when the young plants first take on their green color and the time when chopping or thinning is done.

However, it may be impracticable to use either weeder or harrow (1) on stony land, (2) on a field where there is much trash, and (3) where the stand is thin or very irregular.

The judicious use of the weeder or light harrow before chopping cotton permits this operation to be postponed longer and to be effected with less labor.

First tillage by separate rows.—As soon as practicable after all the young plants have appeared above ground and have taken on a green color, the first tillage is given with some form of cultivator. The principal objects of this operation are the following:

(1)—To reduce the width of the strip that is subsequently to be thinned by the hoe;

(2)—To destroy vegetation;

(3)—To put the soil into the best condition for retaining moisture in dry weather and for the growth of the roots of the young cotton plant.

Chopping or thinning.—As soon as possible after the operation of scraping or barring off, the plants should be thinned by means of a hoe. This first hoeing is called "chopping." Usually either one or two plants are left at the desired distance apart. Much subsequent hoe work is saved if, at the time of chopping, the plants can be safely thinned to a single one at the required distance apart. However, it may be wise to leave two or more plants in a place, or twice as many hills as will finally remain, if chopping is done when the plants are extremely small, or if many of the young plants are expected to die as the result of disease or of unfavorable weather.

Second cultivation or "siding."—The objects in "siding" cotton are as follows:

(1)—To throw close about the plant, for its firmer support, earth that may have been removed from it in the first cultivation or in hoeing.

(2)—To form a mulch that will retain the moisture in the soil layer just below it.

(3)—To destroy weeds.

Since one purpose is to throw a little earth towards the plants,

the scrape or sweep now used may be wider than that used at the first cultivation. To prevent the small plants being covered, it may still be necessary to use a fender attached to the stock or cultivator.

This second tillage or cultivation is done by running the cultivating implement close on both sides of each row of plants. Hence, for scraping, two furrows per row usually suffice, where a single scrape or sweep is used.

Siding should sometimes be done as soon as practicable after chopping. But in order to give time for grass to be smothered by the earth thrown on it in "barring off," siding may be delayed.

Third tillage or cultivation, or "cleaning middles."—If the "siding" just described has been performed with only two scrape furrows per row, there is usually left a low ridge of soil, called a "balk or middle." halfway between each two lines of plants. If this strip becomes compact or weedy, the next step is to cultivate it. This is usually done by a single furrow of a rather large sweep or scrape, which splits the "middle," lapping part of it on each of the adjacent rows. When a double cultivator is employed it cultivates the plants on both sides and throws out the "middles" at the same time. Even when a single scrape is used in "siding," farmers often prefer to throw out the "middle" immediately.

Subsequent tillage.—The operation of "siding" is repeated as often as necessary to destroy all young weeds and grass and to prevent the formation after each rain of a crust on the soil, which would hasten the loss of water by evaporation. Likewise, the middles are cleaned or thrown out as often as necessary for the same purpose. The larger the plant becomes, the wider, as a rule, are the scrapes or sweeps employed.

It should constantly be borne in mind that one of the principal objects of tillage is to form a mulch of loose dry soil through which the moisture from the lower layers cannot rise and be evaporated.

Subsequent hoeing.—The hoeings subsequent to chopping are necessary only when vegetation grows along the line of plants in spite of the earth thrown upon the young weeds in siding. Hoeing is a cleaning rather than a true tillage or mulching process. Next to picking, it is the most expensive operation in cotton culture; hence, as far as practicable, the horse implements should be made to lessen the necessity of hoeing.

Amount and frequency of tilling.—There can be no fixed rule as to how often cotton should be cultivated. The general rule is to cultivate it before the formation of a crust following each rain. Four "plowings" may be considered the minimum and six or more are often advisable. The total number of furrows per row required in good tillage is usually between twelve and sixteen. In addition to this, two or more hoeings are usually given.

Depth of cultivation.—The same principle applies here as in the tillage of any other crop. At the first cultivation, the depth may well be shallow, medium, or deep, as the judgment of the farmer dictates. But in the subsequent tillings, the depth should be shallow; that is, just deep enough to check evaporation.

Usually a depth of 1½ to 2 inches meets these requirements. The finer the soil particles forming the mulch, that is, the more complete the pulverization effected by the tilling implement, the less the thickness of soil-mulch required to check evaporation. A three-inch mulch of small clods is less effective than an inch mulch of well pulverized soil.

Sowing seed among growing cotton plants.—When it is desired to improve the soil by growing during the cooler months, some soil-improving plant, such as crimson clover or hairy vetch, the time selected for sowing the seed is usually immediately after the first picking. By choosing this time, no cotton is knocked from the plants by

the one-horse cultivator used in covering these seed. On some farms fall-sown oats are sown among the growing cotton plants and covered as just indicated. To permit the use of harvesting machinery in the oats, the cotton plants, if large, are loosened in winter by means of a narrow plow, or by the use of a sub-soil plow, and then pulled and removed.

Distance between rows.—In deciding on the space between rows and between plants of cotton, the general rule is as follows: The richer the land, the wider must be the rows and the greater the distance between plants in the row. This rule is exactly the opposite of the practice in spacing Indian corn. The reason for planting cotton farther apart on rich land is the fact that cotton is a branching or spreading plant, and hence on rich land requires much space for the outward growth of its long branches. On the other hand, corn has no branches and may be crowded as closely together as is permitted by the supply of plant-food and of moisture, both of which are of course more abundant on rich land.

The usual distance between rows of cotton on upland, where a crop of one-half bale or less per acre is expected, is 3½ feet. On highly fertilized upland, the distance may well be increased to 4 feet. On bottom land and other very rich land, a distance of 5 feet is advisable, and occasionally even wider rows are preferable.

The wider the rows can be made without reducing the yield, the cheaper is the cost of cultivation, since work with cultivators is cheaper than work along the rows with the hoe.

Distance between plants in the row.—Much of the cotton grown in the United States is unduly crowded in the row. A distance of 12 inches may be regarded as the minimum even for very poor land. With almost any character of medium or fair soil, capable of producing one-half bale of cotton or more per acre, it is usually better to space the plant at least 18 inches apart.

Results of distance experiments with cotton.—Most of the experiment stations in the Southern States have conducted experiments on this subject. Naturally the results have varied greatly as influenced by differences in soil, in fertilizer, in rainfall, and in the variety of cotton under observation. In a series of experiments at the Georgia Station, where the yield was a little more than a bale per acre, slightly higher yields were made where the plants stood 1 foot apart than where they were 2 feet apart; a distance of 3 feet between plants afforded a slight reduction in yield; and where the space between plants was increased to 4 feet, the yield was notably decreased.

SUPPLIES FOR REPAIR OF HARNESS, CARRIAGE TOPS, ETC.

Every farmer should have on hand supplies for the repair of harness, and many will find it an advantage to have also some materials for making the simpler repairs on carriage and buggy tops. Ready-made harness and bridle parts of all kinds can be secured from many of the larger establishments.

In deciding what tools and materials to purchase, always give preference to those most frequently and urgently needed, passing over those that will be rarely used.

Keeping a machine or vehicle in good repair and well oiled not only increases its efficiency, but lessens the power required in using it.

The proper maintenance of farm machines not only saves money but avoids danger to those who operate them. Keeping the harness and vehicles in repair may prevent a dangerous runaway.

So far as practicable let the repair work be done when regular farm work is not pressing, as on rainy days and during the winter season. Pursue the repair work as a kind of recreation or rest from the regular farm operations.

Do not have several places for the storage of repair tools and supplies. Have one place, and see that all tools are kept there when not in use.

Tools and materials should be kept in their proper places. Do not keep all sizes of bolts or screws mixed together in a single receptacle, but fit up suitable boxes or bins, so that the supplies may be accessible on short notice.

Keep all tools clean and free from rust, and all edge tools sharp.

CHEESE MAKING ON THE FARM

HENRY E. ALVORD, Bureau of Animal Industry.

The ordinary process by which our American cheese is made in factories is not applicable to the farm dairy, because it takes too much time, and is so complicated that it requires years of practice to become sufficiently familiar with the varying conditions in which milk comes to the vat. The various changes that take place in milk and which are troublesome in making cheese nearly all develop in the night's milk kept over until the following morning. So, if milk is made into cheese immediately after it is drawn, no difficulty need be experienced. By employing a simple and short method of manufacture, anyone at all accustomed to handling milk can, with the appliances found in any well-regulated farm home, make uniformly a good cheese.

DETAILS OF MANUFACTURE.

Aeration and Cooling.—The best time to make farm dairy cheese is immediately after milking. First pour the milk from one vessel to another in some locality where the air is pure and fresh, raising the vessel well so that the air can pass through the milk as it is poured out and carry off the animal heat and odor. Then pour the milk into the vat, or, if no regular vat is at hand, use a large wash boiler.

COLORING.—If it is desired to have more than the natural color, so that the cheese will look rich, add about a teaspoonful of cheese color to 16 gallons of milk. To do this properly take a large dipper half full of milk, mix in the color thoroughly, and stir the whole into the vat of milk.

Rennet.—Now add rennet extract at the rate of 1 ounce to 100 pounds, or 12 gallons, of milk. Mix the extract with half a dipper of cold water and then pour into the milk. Rennet tablets may be used instead of the extract, one small tablet for every 5 gallons of milk, or one large tablet for 25 gallons. Small tablets are about the size of a dime; large tablets are about as large as a silver quarter of a dollar. Dissolve the tablets required in a small quantity of cold water, then pour into the milk. The rennet extract or the tablets may be procured from any dairy supply house and at many drug stores.

Temperature.—Great care should be taken not to have the milk at a temperature below 86 degrees F. nor above 90 degrees when the rennet is put in.

Curdling.—After the rennet is put into the milk, stir gently two or three minutes, then let stand until the curd is firm enough to cut. The milk should begin to curdle in from ten to twelve minutes. To ascertain when the curd is ready for cutting, push the forefinger into the milk at an angle of 45 degrees until the thumb touches the milk; make a slight notch in the curd with the thumb, then gently raise the finger; if the curd breaks clean across the finger without any flakes remaining on it, the curd is ready for cutting. A little practice will soon enable the operator to tell the best time to cut.

Cutting.—For cutting, regular cheese knives are best, one with horizontal blades and one with perpendicular blades. In case it is intended to make only a few cheeses, a wire toaster may be used, the wires only about a half an inch apart. First cut lengthwise, then

crosswise of the vat or boiler, until the curd is cut into cubes about the size of small kernels of corn.

Cooking.—After cutting, stir the curd gently for about three minutes, then heat slowly to 98 degrees or 100 degrees F., constantly stirring gently while the curd is being heated. Keep the curd at this temperature for about forty minutes. To tell when the curd is sufficiently cooked, take a handful and press it gently, hold for a moment, then open the hand, and if the curd falls apart it is firm enough. As soon as the curd is sufficiently cooked, draw off the whey. Then the curd is ready to put into the cheese mold, or hoop.

Molding.—Fill the mold by taking a double handful of curd at a time and pressing in gently until the mold is full and well rounded up. Regular Gouda molds are best, but any tin or wooden receptacle will answer if small holes are made in it to allow the whey to escape. The cheese should be from 8 to 10 inches in diameter and about 3 inches thick. Then take the cheese out of the mold and turn it upside down and replace it. Put on the cover and put the cheese to press.

Pressing.—The press may be a simple lever and weight described as follows: The lever should be about 12 feet long; a broken wagon tongue answers the purpose very well. Set a strong box, on which the mold may be placed, about 3 feet from a wall, post, or tree; on the latter nail a slat and under it put one end of the lever. Put a circular board about 6 inches in diameter upon the mold and on this rest the stick or lever. A pail containing a few cobblestones will answer for the weight. Do not apply full pressure at first, but let the weight hang about halfway between the mold and outer end of the stick. Let the cheese remain a few hours in the press; then take out and dress.

Dressing.—To dress a cheese, first put it in warm water for a few moments and then wipe dry and rub smooth. Take a piece of linen cloth about 6 inches wide and long enough to go around the cheese and lap over a few inches. Wrap the cloth smoothly around the cheese, folding the edges down carefully over the sides; then put a circular cap of cloth of suitable size on each side. Replace the cheese in the mold, with the bandage or dress all smooth, and put it under the press, moving the pail to the end of the stick. Leave the cheese in the press for about twenty hours; then take it out and salt it.

Salting.—The cheese may be either dry salted or brine salted. Brine salting is the better way. Make a solution of salt and water as strong as it can possibly be made; put the cheese into this brine and sprinkle some salt on the surface which is exposed as it floats. Leave the cheese in the brine for two and a half days, turning it over every twelve hours. For dry salting rub salt onto the cheese, and all over it, twice a day for three or four days.

Curing.—Next, put the cheese on a shelf in the cellar for curing. It must be turned and rubbed with the palm of the hand every day for a week or two; after that twice a week will suffice. While curing, cheese should occasionally be wiped with a cloth dampened in warm water, and if it gets a rough rind smooth it by using a brush and warm water. The temperature best adapted for curing is from 55 degrees to 65 degrees F., and the air should be as moist as possible. A cellar with a suitable and even temperature and not too dry is therefore a good place for curing. The cheese will be ready for use in from two to four months. The lighter the cheese is salted the sooner it will be ready for use, and the more the curd is cooked the slower it will be in ripening and the longer it will keep.

Cheese made as here described is more like the Dutch Gouda than any other of the standard varieties. (From a circular issued from the Minnesota Dairy School by Prof. T. L. Haecker).

CASSAVA

S. M. TRACY, M. S.

Cassava is cultivated for its starchy roots, which are used extensively for human food, especially in the Tropics, as food for live

stock, and for the manufacture of starch. It belongs to the milkweed family (Euphorbiaceae) and is a native of Brazil, whence it has been carried to nearly all the warmer parts of the world.

So far as is known, the sweet or nonpoisonous form is the only one found in the United States.

USE IN FEEDING STOCK.

The value of cassava for feeding stock attracted no special attention until within a few years, and little regular feeding was done with it. The freezes of 1894-95, which destroyed so large a part of the Florida orange groves, forced the planters to undertake new lines of work and to consider the cultivation of new crops, and, very wisely, increased attention was given to the raising of live stock. Corn, oats, and other grains do not produce so well on the light, sandy soil common to Florida as on heavier soils farther north, and some less expensive substitute for them had to be found before stock growing could be made profitable. Cassava, being already fairly well known as a garden crop, was planted in field areas and soon proved itself an important factor in solving the problem of producing meat at a low cost for feed.

TIME OF PLANTING.

Planting is done as early in the spring as is safe, not later than February in Middle and Southern Florida, and not later than the first of April in any part of the cassava-growing region. Some growers prefer planting in December or January, and that practice is often very successful, but should never be followed where the soil is liable to remain water soaked for any great length of time during the winter. On well-drained, light, sandy soils this very early planting is often the better method, as it enables the seed canes to take advantage of every warm day to form roots and so be ready for active growth a little earlier in the spring, but it is not a safe method on any but the driest of soils.

CUTTINGS USED AS SEED.

The crop is not grown from seeds but from the canes or stalks grown the previous season and kept through the winter. When the field is ready for planting the seed canes are cut in pieces from 4 to 6 inches in length.

CONDITION OF SEED CANES.

Whatever may be the size of the pieces planted, care should be taken to see that they are alive and in good condition. One can usually tell the difference between live and dead seed canes by their general appearance, the live canes being plump, with fresh-looking bark, sound pith, and full eyes, while the dead canes usually show their condition by their shrunken appearance, bleached or darkened color, discolored or dried pith, and shrunken eyes.

DROPPING AND COVERING THE CANES.

The pieces of seed cane are dropped, one at each cross row, and covered with a plow or hoe as Irish potatoes are covered, the covering being from 2 to 4 inches in depth, the deeper covering being given on the lighter soil.

CULTIVATION.

Cassava requires no special cultivation beyond that needed to keep the ground free from weeds and the surface loose and friable. The first cultivation is often given with a smoothing harrow before the young sprouts reach the surface of the ground. Some growers give this cultivation by plowing deeply between the rows and cleaning the

remainder of the surface with a hoe, while others prefer a five-toothed cultivator for the work. It really makes little difference what implement is used in this first cultivation, provided it is one which will kill all the young weeds, and little is gained by deep plowing between the rows except on soils which are too heavy to be well suited to the growth of the crop. All the later cultivations, however, must be as shallow as possible, for the cassava roots lie very near the surface of the ground. Some growers use a single section of a smoothing harrow for all the later cultivations, and find it very satisfactory when used with sufficient frequency to prevent any grass or weeds from becoming firmly rooted. Others prefer a 24-inch sweep run very shallow, while still others prefer a five-toothed cultivator. Whatever implement may be preferred should be used so frequently that the surface of the ground will at all times be covered with a dust mulch to prevent the sandy soil from becoming too dry, and the cultivation should be continued until the plants become of sufficient size to shade the ground. Two cultivations are often sufficient on land which is fairly free from weeds, as the cassava plants soon form a dense shade.

The surface of the ground should always be kept as nearly level and smooth as possible, and no hilling up should be given, as many of the roots reach nearly or quite across the spaces between the rows. Hoeing will not be needed when the ground is not filled with weed seeds and when the first cultivation is given with a smoothing harrow, but the rows should be kept free from weeds, even if they have to be hoed twice. Ordinarily the crop requires about the same amount of cultivation which is given to cotton, and there is little difference between the two in the expense per acre for making the crop.

VETCH (Vicia villosa)

One of the most valuable plants for forage and fertilizing purposes. It succeeds and produces good crops on poor, sandy soils as well as on good land; it is perfectly hardy throughout the United States, remaining green all winter. The root growth is very extensive, and makes quantities of nitrogen tubercles, thus giving it very valuable fertilizing properties, and improving the condition and productiveness of land for crops to follow.

Common vetch (Vicia sativa) is a great nitrogen gatherer and is used as a farm crop in many different ways. In some localities it has proved valuable as a catch crop and also as a cover crop in orchards. In France it has been grown to furnish honey-making material for bees. In the eastern United States the common vetch has not proved to be so valuable as other legumes, but in Western Oregon it has become a standard stock feed and is used as hay, silage, pasture, and as a soiling crop. It makes a very palatable hay and dairy cattle prefer vetch silage to that made of red clover. On some farms vetch is replacing clover in the regular rotation.

Vetches can be sown from July to November, and should be sown broadcast, at the rate of 20 to 30 lbs. per acre with one bushel of oats or rye. The oats or rye help to hold the vetches off the ground, enabling them to make a better growth, and making it more easy to harvest and cure properly. For a hay crop, vetches should be cut just after the oats or rye with which it may be sown has headed out, before the grain matures.

Under Western Oregon conditions of soil and climate it yields from 2 to 4 tons of hay to the acre. The seed crop yields from 15 to 30 bushels per acre.

CANADIAN FIELD PEAS

THOMAS SHAW.

No other grain crop, except prehaps oats, can be devoted to so great a variety of uses. The grain is possessed of a relatively high

feeding value, and the same is true of the straw, as will be readily apparent by reference to the chemical analysis of each. As a pasture for certain kinds of live stock, peas may be made to serve an excellent purpose. The value of the crop for soiling and fodder uses is very great, and as a fertilizing crop peas are probably excelled only by clover.

There is no kind of live stock on the farm to which peas cannot be fed with positive advantage, when they are to be had at prices not too high. They are not commonly fed to horses, since they can seldom be spared for such a use, but they make a good food for horses at work, and for colts during the period of development, if given as a part of the grain food. As a food for fattening cattle, peas are probably unexcelled. Much of the success which Canadian feeders have achieved in preparing cattle for the block has arisen from the free use of peas in the diet.

PREPARING THE LAND.

In climates where peas can be grown at their best, namely, climates with low winter temperatures, the land for peas, as for nearly all grain crops, should be plowed in the autumn; but peas will do better than the other small cereals, relatively, on spring plowed land. A fine pulverization of the soil is advantageous, but it is not so necessary for peas as for other grain crops, since the pea is a hardy and vigorous grower.

SOWING THE SEED.

Some writers advocate sowing the seed broadcast and then plowing it under. On heavy soils this method would bury the seed too deeply. On prairie soils it promotes the rapid evaporation of soil moisture. On fall-plowed lands the better plan is to prepare the seed bed by pulverizing it, and then to sow the seed with a grain drill. When broadcasted and covered with the harrow only and rain follows, much of the seed will be exposed; but the writer has grown excellent crops on spring-plowed stiff clays from hand sowing without any previous pulverization. When such lands are carefully plowed, the peas fall in the depression between the furrow slices, and the subsequent harrowing covers them. Peas should be buried less deeply on stiff clays and more deeply on the soils of the prairie. The depth may be varied from 2 to 5 inches. The pea crop should be sown as soon as the soil can be worked freely; but it will suffer less, relatively, than the other grain crops if the sowing has to be deferred.

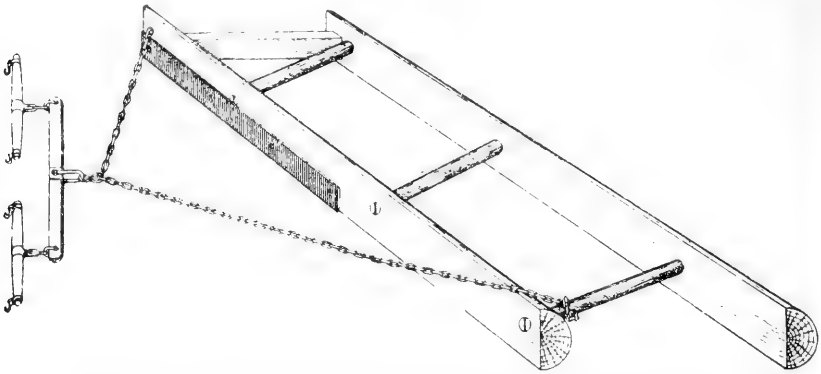
The quantity of seed required will vary with the character and condition of the soil and with the variety of seed sown. Rich and moist soils do not require so much seed as where the opposite conditions prevail. The amount of the seed sown should usually increase with the size of the pea. The quantities to sow per acre will vary from two bushels with the smaller varieties to 3½ bushels of the larger sorts. One great difficulty to be encountered in growing peas on prairie soils is the usual luxuriance of weed life, but this may be held in check by harrowing the crop before it appears above the surface. Harrows with teeth which may be set aslant are the most suitable for the work.

HARVESTING THE CROP.

Until recent years the pea crop was harvested with the scythe or with the old-fashioned revolving hay rake. The first method is slow; the second shells out many of the peas, and it so covers the vines with soil as to render the straw practically unfit for use. Happily, a pea harvester has been introduced, by the aid of which the crop may be harvested speedily and in excellent condition on level soils. It is simply an attachment to an ordinary field mower.

GOOD ROADS AND THE SPLIT LOG DRAG

D. Ward King, Expert in the Office of Public Roads, Department of Agriculture.



The author has experimented with a great variety of devices for road dragging, but has found the two-slab log or plank drag with liberal "set back" the most satisfactory. Double drags for working both sides of the roadway simultaneously have been tried with only limited success. The reason for this lies in the fact that both sides of any earth road are never exactly alike. This causes the two parts of the drag to work unevenly and to interfere with each other. It is also impossible for one man to operate both parts successfully, as will be shown later on.

Two mistakes are commonly made in constructing a drag. The first lies in making it too heavy. It should be so light that one man can easily lift it. Besides, a light drag responds more readily to various methods of hitching and to the shifting of the position and weight of the operator, both of which are essential considerations and are discussed more fully under the head "How to Use a Drag." A drag can be made heavier at any time by proper weighting.

The other mistake is in the use of squared timbers, instead of those with sharp edges, whereby the cutting effect of sharp edges is lost; the drag is permitted to glide over instead of to equalize the irregularities in the surface of the road. These mistakes are due partly to badly drawn illustrations and plans of drags which have occasionally appeared in newspapers and partly to the erroneous idea that it is necessary that a large amount of earth shall be moved at one time.

A dry red cedar log is the best material for a drag. Red elm and walnut, when thoroughly dried, are excellent, and box elder, soft maple, or even willow are preferable to oak, hickory or ash.

The log should be 7 or 8 feet long and from 10 to 12 inches in diameter, and carefully split down the middle. The heaviest and best slab should be selected for the front. At a point on this front slab 4 inches from the end that is to be at the middle of the road locate the center of the hole to receive a cross stake and 22 inches from the other end of the front slab locate the center for another cross stake. The hole for the middle stake will lie on a line connecting and half way between the other two. The back slab should now be placed in position behind the other. From the end which is to be at the middle of the road measure 20 inches for the center of the cross stake, and 6 inches from the other end locate the center of the outside stake. Find the center of the middle hole as before. When these holes are brought opposite each other, one end of the back slab will lie 16 inches nearer the center of the roadway than the front one, giving what is known as "set back." The holes should be

2 inches in diameter. Care must be taken to hold the auger plumb in boring these holes in order that the stakes shall fit properly. The hole to receive the forward end of the chain should be bored at the same time.

The two slabs should be held 30 inches apart by the stakes. Straight-grained timber should be selected for the stakes, so that each stake shall fit snugly into the 2-inch hole when the two slabs are in the proper position. The stakes should taper gradually towards the ends. There should be no shoulder at the point where the stakes enter the slab. The stakes should be fastened in place by wedges only.

When the stakes have been placed in position and tightly wedged, a brace 2 inches thick and 4 inches wide should be placed diagonally to them at the ditch end. The brace should be dropped on the front slab, so that its lower edge shall lie within an inch of the ground, while the other end should rest in the angle between the slab and the end stake.

A strip of iron about 3½ feet long, 3 or 4 inches wide and ¼ of an inch thick may be used for the blade. This should be attached to the front slab, so that it will be one-half inch below the lower edge of the slab at the ditch end, while the end of the iron toward the middle of the road should be flush with the edge of the slab. The bolts holding the blade in place should have flat heads and the holes to receive them should be countersunk.

If the face of the log stands plumb it is well to wedge out the lower edge of the blade with a three-cornered strip of wood to give it a set back like the bit of a plane.

A platform of inch boards held together by three cleats should be placed on the stakes between the slabs. These boards should be spaced at least an inch apart to allow any earth that may heap up and fall over the front slab to sift through upon the road again. The end cleats should be placed so that they will not rest upon the cross stakes, but drop inside them, while the middle cleat can be shifted to either side of the middle stake. These cleats should extend about an inch beyond the finished width of the platform. An ordinary trace chain is strong enough to draw the implement, provided the clevis is not fastened through a link. The chain should be wrapped around the rear stake, then passed over the front slab. Raising the chain at this end of the slab allows the earth to drift past the face of the drag. The other end of the chain should be passed through the hole in the end of the slab and is held by a pin passed through a link. One and one-half trace chains are sufficient.

In many logs the grain runs around the tree in such a way that when split the slabs will be in a "wind." If this wind is not more than 4 inches in 8 feet, the timber can be used to good advantage by setting it so that the blade end of the log shall slant forward when the other end is perpendicular. The construction of the drag in this case is the same as given above, but care must be taken that the holes bored to receive the stakes are plumb. No wedging under the lower edge of the blade is necessary in using such a log.

Drags are often constructed of planks instead of logs. There is nothing in the construction of a plank drag that calls for particular mention except the strengthening of the planks along their middle line by a 2 by 6-inch strip. A triangular strip may be used under the lower edge of the blade to give it the proper cutting slope.

HOW TO USE A DRAG.

The successful operation of a drag involves two principles, which when thoroughly understood and intelligently applied, make road working with this implement very simple. The first concerns the length and position of the hitch, while the second deals with the position of the driver on the drag. Each influences the other to a

large extent, and successful manipulation of the drag is dependent upon an understanding of both of them.

For ordinary purposes the snatch link or clevis should be fastened far enough toward the blade end of the chain to force the unloaded drag to follow the team at an angle of 45 degrees. This will cause the earth to move along the face of the drag smoothly and will give comparatively light draft to the team, provided the driver rides in the line of draft. Sometimes, however, conditions are met which require special treatment, and in a rolling country such conditions are not infrequent. Often a flat place several rods in length or a seepy spot needs special attention.

The distance from the drag at which the team is hitched affects the depth of the cutting. Shortening the chain tends to lift the front slab from the ground; a longer hitch causes the blade to cut more deeply. The length of hitch may be regulated by lengthening and shortening the chain at the end which runs through the hole in the blade end of the drag.

If small weeds are to be cut or a furrow of earth is to be removed, the doubletree should be attached rather close to the ditch end of the drag. The drag will now move nearly ditch end foremost, and the driver should stand with one foot on the extreme forward end of the front slab. This will swing the drag back to the proper angle and will cause the blade to plow. This hitch requires slow and careful driving in order to prevent the drag from tipping forward. If the blade should plow too deeply, as it may do in a wet spot, the driver should shift his weight toward the back slab.

If straw and weeds clog the blade, they can usually be removed if the driver shifts his weight to a point as far as possible from the ditch or blade end. Similarly, if he steps quickly away from the ditch end, the load of earth may be dropped into a low place or mudhole.

Some attention should be given to the edge of the blade. In the beginning, the average earth road requires no steel plate on the drag, though the drag will be better preserved if the steel is applied at first. At the end of a year's work, if the dragging has been faithfully done, a steel plate will be needed. If the twist of the log is properly used, or the three-cornered strip of wood is placed under the blade, a flat piece of steel will answer. In case the blade stands perpendicularly it should be slightly cupped when sharpened.

Usually two horses are enough to pull a drag over an ordinary earth road. When four horses are used, they should be hitched to the drag by means of a four-horse evener. The team should be driven with one horse on either side of the right-hand wheel track or rut the full length of the portion to be dragged, and the return made over the other half of the roadway.

The object of such treatment is to move earth toward the center of the roadway and to raise it gradually above the surrounding level. While this is being accomplished, all mudholes and ruts will be filled, into which traffic will pack the fresh earth.

WHEN TO USE A DRAG.

The drag does the best work when the soil is moist, but not sticky. The earth then moves freely along the faces of the slabs. If the roadway is very badly rutted and full of holes, it may be well to use the drag once when the ground is slushy. This treatment is particularly applicable before a cold spell in winter when it is possible to have a roadway freeze smooth.

A smooth road surface is secured by this method. Clay, when mixed with water and thoroughly worked, becomes remarkably tough and impervious to water. If compacted in this condition if becomes extremely hard.

Another valuable result of dragging is the reduction of dust, for the particles of clay cohere so tenaciously that there is but little

wear when the surface is smooth. Dust on an earth road is due to the breaking up under traffic of the frayed and upturned edges of ruts and hoof prints. If the surface is smoothed after each rain and the road dries hard and even, no edges are exposed to crushing and the only dust which forms is that due to actual wear of the road surface.

There are so many influences at work and conditions are so varied in different localities that it is quite impossible to lay down a general rule for the number of treatments needed to keep a road in good condition. A tough clay or a stiff sandy clay will resist the action of wheels and hoofs for a longer period than a loam, other things being equal. Certain sections of a roadway will require more attention than others because of steep grades, seepage, exposure to hillside wash, etc. The best guide in meeting these conditions is the knowledge and experience gained while dragging the roadway.

There is one condition, however, in which special treatment should be given to a road. Clay hills under persistent dragging frequently become too nigh in the center. To correct this it is best to drag the earth toward the center of the road twice and away from it once.

USE OF A DRAG ON ROCKY OR GRAVELLY ROAD.

In soils full of loose stones or even small bowlders the drag has done good service. The loose stones are drawn into a windrow down the center of the road while the earth is deposited around the bowlders in such a way that the surface is leveled. The loose stones in the center of the road should, of course, be removed. Where there is a large proportion of small stones or gravel the drag will keep down the inequalities in the surface.

CONSTRUCTION AND USE OF A DITCH CLEANER

The ditcher, or ditch cleaner, is a convenient device for clearing ditches. It consists of a guide plank 2 inches by 12 inches by 12 feet, and a mold board, 2 inches by 12 inches by 8 feet. These are braced with a crosspiece 3 feet long. The mold board should be shod with an iron plate ¼ inch by 4 inches by 3 feet, held in position with 3-8 inch bolts countersunk. The cross brace should be hollowed 3 inches on each side at the middle, the hollowing to begin not less than 4 inches from each end, in order that its bearing against the guide and mold board planks shall not be shortened, nor the nailing space decreased. This is done to prevent earth from heaping up in front of the brace. A light platform is needed to make the use of the ditcher safe.

The hitch is made as follows: The short side of the chain being about 2 feet 3 inches in length, and the long side 8 feet 3 inches. The chain is made to pass over the mold board, so that it may clear itself more readily. Two or three horses, according to the difficulty of the particular condition, are necessary to clear a ditch.

To secure the best service from the ditcher, a weight of about 200 pounds should be placed over the front end. The essential thing to be gained is to have the ditcher maintain a smooth, even surface on the bottom of the ditch. There is then no obstruction to the flow of water. This requires that soft, muddy holes is obtained if the driver shifts his weight forward or backward as a high point of a mudhole is approached. If the driver shifts his weight forward, the point of the ditcher is driven into the ground. If he moves back, the pressure on the forward end is relieved and the pull on the chain tends to raise it.

CAPACITY OF CORN CRIBS

(Height 10 Feet)

WIDTH	Lth.	½	1	12	14	16	18	20	22	24	28	32	36	48	64
	5	13	27	320	373	427	480	533	587	640	747	853	960	1280	1707
	6¼	13	28	333	389	444	500	556	611	667	778	889	1000	1333	1777
	6½	14	29	347	404	462	520	578	636	693	809	924	1040	1387	1849
	6¾	15	30	360	420	480	540	600	660	720	840	960	1080	1440	1920
	7	16	31	373	436	498	560	622	684	747	871	996	1120	1493	1991
	7¼	16	32	387	451	516	580	644	709	773	902	1031	1160	1547	2062
	7½	17	33	400	467	533	600	667	733	800	933	1067	1200	1600	2133
	7¾	17	34	413	482	551	620	689	758	827	964	1102	1240	1653	2204
	8	18	36	427	498	569	640	711	782	853	996	1138	1280	1707	2276
	8½	19	38	453	529	604	680	756	831	907	1058	1209	1360	1813	2418
	9	20	40	480	560	640	720	800	880	960	1120	1280	1440	1920	2560
	10	22	44	533	622	711	800	889	978	1067	1244	1422	1600	2133	2844

The length is found in top line, the width in left-hand column—the height being taken at 10 feet. Thus a crib 24 feet long, 7½ feet wide and 10 feet high, will hold 800 bushels of ear corn, reckoning 2¼ cubic feet to hold a bushel. If not ten feet high, multiply by the given height and cut off right-hand figure. If above crib were only 7 feet high, it would hold 800 x 7 equals 650 (0 bushels, etc.). The same space will hold 1 4-5 times as much grain as ear corn. Thus a crib that holds 800 bushels of ear corn, will hold 800 x 1 4-5 equals 1,440 bushels of grain.

BEES

E. F. PHILLIPS, Ph. D.,
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Bee keeping requires hard work and work at just the proper time, otherwise the surplus of honey may be diminished or lost. Few lines of work require more study to insure success. In years when the available nectar is limited, surplus honey is secured only by judicious manipulations and it is only through considerable experience and often by expensive reverses that the bee keeper is able to manipulate properly to save his crop. Anyone can produce honey in seasons of plenty, but these do not come every year in most locations and it takes a good bee keeper to make the most of poor years. When the crop is a failure through lack of nectar, the bees must be fed to keep them from starvation.

The average annual honey yield per colony for the entire country, under good management, will probably be 25 to 30 pounds of comb honey or 40 to 50 pounds of extracted honey. The money return to be obtained from the crop depends entirely on the market and the method of selling the honey. If sold direct to the consumer, extracted honey brings from 10 to 20 cents per pound, and comb honey from 15 to 25 cents per section. If sold to dealers, the price varies from 6 to 10 cents for extracted honey and from 10 to 15 cents for comb honey. All of these estimates depend largely on the quality and neatness of the product. From the gross return must be deducted from 50c to $1 per colony for expenses other than labor, including foundation, sections, occasional new frames and hives, and other incidentals—not, however, providing for increase.

Above all it should be emphasized that the only way to make bee keeping a profitable business is to produce only a first-class article. We cannot control what the bees bring to the hive to any great extent, but by proper manipulations we can get them to produce fancy

comb honey, or if extracted honey is produced it can be carefully cared for and neatly packed to appeal to the fancy trade. Too many bee keepers, in fact the majority, pay too little attention to making their goods attractive.

LOCATION OF THE APIARY.

The location of the hives is a matter of considerable importance. As a rule it is better for hives to face away from the prevailing wind and to be protected from high winds. In the North a south slope is desirable. Place hives so the sun will strike them early in the morning, as the bees will be active early securing the first supply of nectar. Have the hives shaded during the heat of the day. Place hives so the bees will not disturb passers by or livestock. Keep the ground, especially around entrances free from weeds, and hives some distance apart. Bees may be kept in many places, back part of city lots, in the woods etc. Careful attention to location is necessary if kept for profit. Don't keep over 100 colonies in one apiary, and the apiaries two miles at least apart.

EQUIPMENT IN APPARATUS.

It must be insisted that the only profitable way to keep bees is in hives with movable frames. The bees build their combs in these frames, which can then be manipulated by the bee keeper as necessary. The keeping of bees in boxes, hollow logs, or straw "skeps" is not profitable, is often a menace to progressive bee keepers, and should be strongly condemned. Bees in box hives (plain boxes with no frames and with combs built at the will of the bees) are too often seen in all parts of the country. The owners may obtain from them a few pounds of inferior honey a year and carelessly continue in the antiquated practice. In some cases this type of bee keeping does little harm to others, but where disease of the brood is present the box hive is a serious nuisance and should be abolished.

HIVES.

Whatever hive is chosen, the materials should be the best, parts accurately made, and all frames and hives in the apiary interchangeable. All hives should be as simple as possible to facilitate operation.

HIVE STANDS.

Have each hive on a separate stand, and entrance lower than other part of hive. Any convenient material as wood, concrete etc., will answer to keep the hives from the ground, and a few inches will answer. If ants are a nuisance special stands may be necessary.

OTHER APPARATUS.

A tin or copper receptacle for burning rotten wood or other material with a bellows attached, is necessary for a smoker. A veil of black material should be used, in case bees are cross. Cloth or leather gloves are sometimes used. Division boards, drone bee escapes, feeders, foundation fasteners, wax extracters, bee brushes, queen-rearing outfits, and apparatus for producing comb or extracted honey will be found described in catalogues of supplies.

EQUIPMENT IN BEES.

It is desirable to begin bee keeping with a small number of colonies. In purchasing these, it is usually best to obtain them near at home rather than to send to a distance, for there is considerable liability of loss in shipment. Whenever possible, it will be better to get bees already domiciled in the particular hive chosen by the bee keeper as the best, but if this is not practicable then bees in any hives or in box hives may be purchased and transferred. It is a matter of

small importance what race of bees is purchased, for queens of any race may be obtained and introduced in place of the original queen, and in a short time the workers will all be of the same race as the introduced queen. This is due to the fact that during the season worker bees die rapidly, and after requeening they are replaced by the offspring of the new queen.

A most important consideration in purchasing colonies of bees is to see to it that they are free from disease. The best time of the year to begin bee keeping is in the spring, for during the first few months of ownership the bee keeper can study the subject and learn what to do, so that he is not likely to make a mistake which will end in loss of bees. It is usually best to buy good strong colonies with plenty of brood for that season of the year, but smaller colonies may be purchased and built up during the season. No surplus honey can be expected if all honey gathered goes into making additional bees. Get as little drone comb as possible and a good supply of honey in the colonies purchased.

The Italian bees are the most popular race among the bee keepers in this country, and with good reason. They are vigorous workers and good honey gatherers, defend their hives well, and above all have been more carefully selected by American breeders than any other race. Especially for the last reason it is usually desirable to keep this race.

BEE BEHAVIOR AND HANDLING.

The successful manipulation of bees depends entirely on a knowledge of their habits. They should be handled to be little disturbed in their work. Stings should be avoided if possible, they are painful and the odor serves to irritate the other bees. Wear a black veil and a wide hat and carry a good smoker. Rubber bands around the sleeves keep the bees out. Gloves are usually a nuisance. Avoid black clothing. Don't exhibit fear as quick nervous movements irritate the bees, Remain quiet even if a bee flies toward you and don't jar the hive more than necessary when working around it. The best time to handle bees is in the middle of warm days during a honey flow. Don't handle at night or cold wet days. Keep gentle bees if you are a beginner. Put on the veil and light the smoker before opening the hive, and direct a few puffs of smoke into the entrance. This will cause the bees to fill themselves with honey and will drive back the guards. The hive cover should be raised gently, if necessary being pried loose with a screw-driver or special hive tool. As soon as a small opening is made, more smoke should be blown in on the tops of the frames, or if a mat covering for the frames is used, the cover should be entirely removed and one corner of the mat lifted to admit smoke. It is not desirable to use any more smoke than just enough to subdue the bees and keep them down on the frames. At any time during manipulation, if they become excited, more smoke may be used. Do not stand in front of the entrance, but at one side or the back.

After the frames are exposed they may be loosened by prying with the hive tool and crowded together a little so as to give room for the removal of one frame. In cool weather the propolis (bee glue) may be brittle. Care should be exercised not to loosen this with a jar. The first frame removed can be leaned against the hive, so that inside there will be more room for handling the others. During all manipulations bees must not be mashed or crowded, for that irritates the colony greatly and may make it necessary to discontinue operations. Undue crowding may also mash the queen. If bees crawl on the hands, they may be gently brushed off.

In examining a frame always hold it over the hive, so that any bees or queen which fall may drop into it. Freshly gathered honey also often drops from the frame, and if it falls in the hive the bees can quickly clean it up, whereas if it drops outside it is untidy and may cause robbing. If a frame is temporarily leaned against a hive, it

should be placed in a nearly upright position to prevent breakage and leaking of honey. The frame on which the queen is located should not be placed on the ground, for fear she may crawl away and be lost. It is best to lean the frame on the side of the hive away from the operator, so that bees will not crawl up the legs.

TRANSFERRING.

The box hive should be moved a few feet from its stand and in its place should be put a hive containing either full sheets of foundation or empty combs. The box hive should be turned upside down and a small, empty box fitted on it. By drumming continuously on the box hive for a considerable time the bees will be made to desert their combs and go to the upper box, and when most of them are clustered above the box may be carried to the new hive and the bees dumped in front the entrance. The queen will usually be seen as the bees enter the hive, but, in case she has not left the old comb, more drumming will induce her to leave. It is necessary that the queen be in the hive before this manipulation is finished. The old box hive containing brood may now be placed right side up in a new location and in twenty-one days all of the worker brood will have emerged and probably some new queens will have been reared. These bees may then be drummed out and united with their former hive mates by smoking the colony and the drummed bees vigorously and allowing the latter to enter the hive through a perforated zinc to keep out the young queens. The wax in the hive may then be melted up and any honey which it may contain used as the bee keeper sees fit. By this method good straight combs are obtained. If little honey is being gathered, the colony in the hive must be provided with food.

PREVENTING ROBBING IN THE APIARY.

When there is no honey flow bees are inclined to rob the other colonies, and every precaution must be taken to prevent this. Feeding often attracts the other bees, and, if there are indications of robbing, the sirup or honey should be given late in the day.

FEEDING.

During spring manipulations, in preparing bees for winter, and at other times it may be necessary to feed bees for stimulation or to provide stores. Honey from an unknown source should never be used for fear of introducing disease, and sirup made of granulated sugar is cheapest and best for this purpose. The cheaper grades of sugar or molasses should never be used for winter stores. The proportion of sugar to water depends on the season and the purpose of the feeding. For stimulation a proportion of one-fourth to one-third sugar by volume is enough, and for fall feeding, especially if rather late, a solution containing as much sugar as it will hold when cold is best. There seems to be little advantage in boiling the sirup. Tartaric acid in small quantity may be added for the purpose of changing part of the cane sugar to invert sugar, thus retarding granulation. The medication of sirup as a preventive or cure of brood disease is often practiced, but it has not been shown that such a procedure is of any value. If honey is fed, it should be diluted somewhat, the amount of dilution depending on the season. If robbing is likely to occur, feeding should be done in the evening.

A simple feeder can be made of a tin pan filled with excelsior or shavings. This is filled with sirup and placed on top of the frames in a super or hive body. It is advisable to lean pieces of wood on the pan as runways for the bees, and to attract them first to the sirup, either by mixing in a little honey or by spilling a little syrup over the frames and sticks.

The bees which come through the winter, reared the previous autumn, are old and incapable of much work. As the season opens

they go out to collect the early nectar and pollen, and also care for the brood which hatches from the eggs laid by the queen. This amount of brood is at first small, and as the new workers emerge they assist in the brood rearing so that the extent of the brood can be gradually increased until it reaches the maximum at the beginning of the summer. The old bees die off rapidly.

Queens sometimes die during the winter and early spring, and since there is no brood from which the bees can replace them, the queenless colonies are "hopelessly queenless." Such colonies are usually restless and are not active in pollen gathering. If, on opening a colony, it is found to be without a queen and reduced in numbers, it should be united with another colony by smoking both vigorously and caging the queen in the queen-right colony for a day or two to prevent her being killed. A frame or two of brood may be added to a queenless colony, not only to increase its strength, but to provide young brood from which they can rear a queen.

SWARM MANAGEMENT AND INCREASE.

When a swarm issues, it usually first settles on a limb of a tree or bush near the apiary. It was formerly common to make a noise by beating pans or ringing bells in the belief that this causes the swarm to settle. There is no foundation for such action on the part of the bee keeper. If the bees light on a small limb that can be spared it may simply be sawed off and the bees carried to the hive and thrown on a sheet or hive cover in front of the entrance. If the limb can not be cut, the swarm can be shaken off into a box or basket on a pole and hived. If the bees light on the trunk of a tree or in some inaccessible place, they can first be attracted away by a comb, preferably containing unsealed brood. In these manipulations it is not necessary to get all the bees, but if the queen is not with those which are put in the hive the bees will go into the air again and join the cluster.

To curb the swarming impulse frequent examinations of the colonies (about every week or ten days during the swarming season) for the purpose of cutting out queen cells is a help, but this requires considerable work, and since some cells may be overlooked, and particularly since it frequently fails in spite of the greatest care, it is not usually practiced. Requeening with young queens early in the season, when possible, generally prevents swarming.

PREPARATION FOR THE HARVEST.

An essential in honey production is to have the hive overflowing with bees at the beginning of the honey flow, so that the field force will be large enough to gather more honey than the bees need for their own use. To accomplish this, the bee keeper must see to it that brood rearing is heavy some time before the harvest, and he must know accurately when the honey flows come, so that he may time his manipulations properly. Brood rearing during the honey flow usually produces bees which consume stores, while brood reared before the flow furnishes the surplus gatherers.

A colony of bees consists normally of one queen bee, the mother of the colony, and thousands of sexually undeveloped females called workers, which normally lay no eggs, but gather the stores, keep the hive clean, feed the young, and do the other work of the hive. During part of the year there are also present some hundreds of males or drones (often removed or restricted in numbers by the bee keeper) whose only service is to mate with young queens. These three types are easily recognized, even by a novice. In nature the colony lives in a hollow tree or other cavity, but under manipulation thrives in the artificial hives provided. The combs which form their abode are composed of wax secreted by the workers. The hexagonal cells of the two vertical layers constituting each comb have interplaced ends on a common septum. In the cells of these combs are reared the developing bees, and here are stored honey and pollen for food.

The cells built naturally are not all of the same size, those used in rearing worker bees being about one-fifth of an inch across, and those used in rearing drones and in storing honey about one-fourth of an inch across. The storage cells are more irregular, and generally curve upward at the outer end. Under manipulation, the size of the cells is controlled by the bee keeper by the use of comb foundation—sheets of pure beeswax on which are impressed the bases of cells and on which the bees build the side walls.

In the North, when the activity of the spring begins, the normal colony consists of the queen and some thousands of workers. As the workers bring in early pollen and honey, the queen begins to lay eggs in the worker cells. These in time develop into white larvae, which grow to fill the cells. They are then capped over and transform gradually into adult worker bees. As the weather grows warmer, and the colony increases in size by the emergence of the developing bees, the quantity of brood is increased. The workers continue to bring in pollen, and nectar to be made into honey. After a time the queen begins to lay eggs in the larger cells, and these develop into drones or males.

Continued increase of the colony would result in the formation of enormous colonies, and unless some division takes place no increase in the number of colonies will result. Finally, however, the workers begin to build queen cells. These are larger than any other cells in the hive and hang on the comb vertically. In size and shape they may be likened to a peanut, and are also rough on the outside. In preparing for swarming the queen sometimes lays eggs in partly constructed queen cells, but when a colony becomes queenless the cells are built around female larvae. The larvae in these cells receives special food, and when they have grown to full size they, too, are sealed up and the colony is then ready for swarming. The issuance of the first swarm from a colony consists of the departure of the original queen with part of the workers. They leave behind the honey stores, except such as they can carry in their honey stomachs, the brood, some workers, drones, several queen cells, from which will later emerge young queens, but no adult queen. By this interesting process the original colony is divided into two. The swarm finds a new location in some place, such as a hollow tree, or if cared for by the keeper, a hive. The workers build new combs, the queen begins laying, and in a short time the swarm becomes a normal colony.

The colony on the old stand (parent colony) is increased by the bees emerging from the brood. After a time (usually about seven or eight days) the queens in their cells are ready to emerge. If the colony is only moderately strong the first queen to emerge is allowed by the workers to tear down the other queen cells and kill the queens not yet emerged, but if a "second swarm" is to be given off the queen cells are protected.

If the weather permits, when from 5 to 8 days old, the young queen flies from the hive to mate with a drone. Mating usually occurs but once during the life of the queen and always takes place on the wing. In mating she receives enough spermatozoa (male sex cells) to last throughout her life. She returns to the hive after mating, and in about two days begins egg laying. The queen never leaves the hive except at mating time or with a swarm, and her sole duty in the colony is to lay eggs to keep up the population.

When the flowers which furnish most nectar are in bloom, the bees usually gather more honey than they need for their own use, and this the bee keeper can safely remove. They continue the collection of honey and other activities until cold weather comes on in the fall, when brood rearing ceases; they then become relatively quiet, remaining in the hive all winter, except for short flights on warm days. When the main honey flow is over, the drones are usually driven from the hive. By that time the virgin queens have been mated and drones are of no

further use. They are not usually stung to death, but are merely carried or driven from the hive by the workers and starve. A colony of bees which for any reason is without a queen does not expel the drones.

Many abnormal conditions may arise in the activity of a colony, and it is therefore necessary for the bee keeper to understand most of these, so that when they occur he may overcome them. If a virgin queen is prevented from mating she generally dies, but occasionally begins to lay eggs after about four weeks. In this event, however, all of the eggs which develop become males. Such a queen is commonly called a "drone layer."

If the virgin queen is lost while on her flight, or the colony at any other time is left queenless without means of rearing additional queens, it sometimes happens that some of the workers begin to lay eggs. These eggs also develop only into drones.

It also happens at times that when a queen becomes old her supply of spermatozoa is exhausted, at which time her eggs also develop only into drones. These facts are the basis of the theory that the drone of the bee is developed from an unfertilized egg or is parthenogenetic. A full discussion of this point is impossible in this place.

The work of the hive is very nicely apportioned among the inmates, so that there is little lost effort. As has been stated, the rearing of young is accomplished by having one individual to lay eggs and numerous others (immature females or workers) to care for the larvae. In like manner all work of the colony is apportioned. In general, it may be stated that all inside work—wax building, care of brood, and cleaning—is done by the younger workers, those less than 17 days old, while the outside work of collecting pollen and nectar to be made into honey is done by the older workers. This plan may be changed by special conditions. For example, if the colony has been queenless for a time and a queen is then given, old workers may begin the inside work of feeding larvae, and these may also secrete wax. Or, if the old workers are all removed, the younger bees may begin outside work. As a rule, however, the general plan of division of labor according to age is probably followed rather closely.

THE PRODUCTION OF HONEY.

It is not profitable to cultivate any plant solely for the nectar which it will produce, but various plants, such as clovers, alfalfa, and buckwheat are excellent honey plants as well as valuable for other purposes; their cultivation is therefore a benefit to the bee keeper. It is often profitable to sow some plant on waste land; sweet clovers are often used in this way. The majority of honey-producing plants are wild, and the bee keeper must largely accept the locality as he finds it and manage his apiary so as to get the largest possible amount of the available nectar.

EXTRACTED HONEY.

Extracted honey is honey which has been removed by means of centrifugal force from the combs in which the bees stored it.

COMB HONEY.

Comb honey is honey as stored in the comb by the bees, the size and shape being determined by the small wooden sections provided by the bee keeper. Instead of having comb in large frames in which to store surplus honey, the bees are compelled to build comb in the sections and to store honey there. A full section weighs about 1 pound; larger ones are rarely used.

THE PRODUCTION OF WAX.

Beeswax, which is secreted by the bees and used by them for building their combs, is an important commercial product. There are times in almost every apiary when there are combs to be melted up, and it pays to take care of even scraps of comb and the cappings

taken off in extracting. A common method of taking out the wax is to melt the combs in a solar wax extractor. This is perhaps the most feasible method where little wax is produced, but considerable wax still remains in old brood combs after such heating. Various wax presses are on the market, or can be made at home. If much wax is produced, the bee keeper should make a careful study of the methods of wax extraction, as there is usually much wax wasted even after pressing.

PREPARATIONS FOR WINTERING.

After the main honey flow is over the management must depend on what may be expected later in the season from minor honey flows. If no crop is expected, the colony may well be kept only moderately strong, so that there will not be so many consumers in the hive.

In localities where winters are severe and breeding is suspended for several months great care should be taken that brood-rearing is rather active during the late summer, so that the colony may go into winter with plenty of young bees. In case any queens show lack of vitality they should be replaced early, so that the bees will not become queenless during the winter.

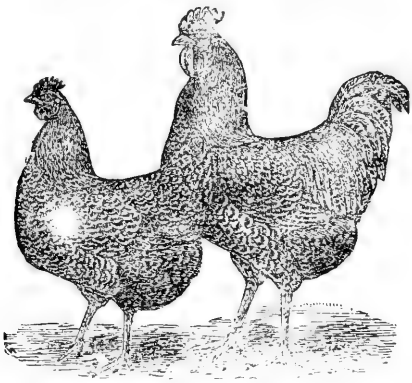
The important considerations in wintering are plenty of young bees, a good queen, plenty of stores of good quality, sound hives, and proper protection from cold and dampness.

If, as cold weather approaches, the bees do not have stores enough, they must be fed. Every colony should have from 25 to 50 pounds, depending on the length of winter and the methods of wintering.

DISEASES AND ENEMIES.

There are two infectious diseases of the brood of bees which cause great losses to the bee-keeping industry of the United States. These are known as American foul brood and European foul brood. Both of these diseases destroy colonies by killing the brood, so that there are not enough young bees emerging to take the place of the old adult bees as these die from natural causes. The adult bees are not attacked by either disease. In the hands of careful bee keepers both diseases may be controlled, and this requires careful study and constant watching. In view of the fact that these diseases are now widely distributed throughout the United States, every bee keeper should read the available literature on the subject, so that if disease enters his apiary he may be able to recognize it before it gets a start. The symptoms and the treatment recommended by the Agricultural Department are given in a publication which will be sent free on request.

POULTRY RAISING



Poultry raising is now one of the most profitable industries known and it is rapidly advancing every day.

Poultry culture has the confidence of the general public and while many will always fail from lack of application and proper regard for necessary conditions, it will be in no greater proportion than may be found in any industry that tempts the unworthy or unfit by its unusual profits. To anyone who is willing to give it his earnest attention and application it offers a pleasant and profitable occupation.

LOCATION OF THE POULTRY PLANT.

In selecting a site for your poultry plant you are not obliged to choose high priced land. If you can select well drained, well watered gravelly soil it will be desirable. If somewhat wooded it is also in its favor as shade is a valuable factor in poultry raising. Choose a plot sloping south or southeast if possible. Avoid a clay soil.

Face your house a little east of south if possible as in this manner you get all the sun possible during the winter months when especially needed. This position will shelter the front of the building from the west and northwest winds. If you have some good meadow land it will be of great value, for thereon you can grow clover, or it will produce corn and other cereals. It has been found that clover can be made the base of profitable feeding, and a poultry farm so situated that it may produce an abundance of green food is well selected.

Before you start to build, consider carefully the question of drainage. The surface water should run from the house—not towards it—and you must be careful that moisture cannot collect underneath the house to seep up through the floor. If water can collect under the house, you cannot well dry it, even with ventilation beneath. Cess pools under the house will endanger the health of the fowls.

BUILDINGS.

Various locations may require different kinds of buildings and conditions of climate should be properly considered. It is imposible to state which exact variety of house is the best for you, without knowing just how you are located and all the points which enter into the subject. A house should be selected with due regard to its natural suitability to the conditions.

The fowl consumes more oxygen from the air than any other breathing creature according to its size. It has no sweat glands, never sweats, and gives off all moisture by the breath. They must have plenty of pure, fresh air in order for them to obtain their natural, and necessary, amount of oxygen. We can understand that moisture coming from the breath, directly into the cooler air, without having a chance to slowly evaporate like it would in coming through a coat of hair or feathers, will condense very quickly; therefore there must be an unusual ventilation to carry off this moisture or the house will become damp and, in cold weather, a hoar frost will form on the inside walls.

The poultry house does not need to be in any way fancy, either in fittings or design, but there are a few certain rules which cannot be overlooked if you are to expect success.

DRAINAGE.

If circumstances compel you to build on land that is not naturally dry you should make it so by building up your ground. Carry your foundation walls up to a height of eighteen inches or more if necessary above the level of the ground and fill in a foot of this with small stones coarse gravel and cinders and the remaining six inches with sand. Then slope up the outside to the bottom of the sills and you will have an artificial drainage that will turn away the surface water and keep your floor dry.

SUNLIGHT.

The next important thing is plenty of sunlight. It not only makes the house cheerful but provides natural sanitation which tends to lessen disease, and aids in curing it and also gives light for the fowls in scratching.

Have about the right amount of glass surface as too much makes a house too warm in the day and too cold at night. Do not allow more than one square foot of glass to twelve square feet of floor space and see that the windows are placed correctly. Set the windows high and up and down so they will allow the sun to pass over all the floor space, drying and purifying same.

YARDS.

As you will have to plan for yards when you are planning for buildings, a word about them will not be out of place. Long and narrow yards promote more exercise than those wider and shorter. For a given number of square feet, the long and narrow yard is further around than the one nearer square, and it gives the fowl more range and better chance to exercise.

It is an excellent plan if you can provide a double yard for each house, as one set of yards can be plowed and planted, while the others are in use, and the fowls can have fresh yards in rotation. A run will become unsanitary if used constantly, no matter how much work may be expended upon it. Yards should be also provided with shade, either naturally or artificially, as it is an absolute necessity.

HEATING FOR POULTRY.

The only warmth needed in a poultry house is that given forth by the fowls' bodies; therefore the higher you build your house the colder it will be. A low house is much easier warmed than a high one. If you will make it as low as you can and still give you room so that you will not bump your head, you will have plenty of air space for as many fowls as the floor space of from five to six square feet per fowl will allow.

A house of dimensions 15x12x6 feet will give you 1,080 cubic feet of air space, or 36 cubic feet per fowl for 30 fowls, a little over seven cubic feet per pound—live weight—providing that they average five pounds each. That is six times more air space than would be necessary for horses, cows and sheep, and the fowls need it on account of the amount of oxygen they consume.

ROOF.

The cheapest form of house to build is the square one, and the nearer it is square the warmer it will be, but there is the valuable factor of sun radiation to be taken into consideration, and we would advise that the depth of the house be not more than fourteen feet and twelve would be better. The sanitary rays of the sun are of much more value than the slight difference in temperature and cost.

The cost of a poultry house is influenced by the shape of its roof. We would advise the single span, shed roof as the easiest to build and the most advantageous. It gives the highest point at the front, or south, and the best shelter at the back. It sheds all water at the back and keeps the front dry and cheery. It also allows the arrangement of the windows to be such as to throw the sunlight back into the house. As it slopes towards the north, a tarred paper, or prepared roofing, will last much longer as it is not exposed to the vertical rays of the sun, and it makes the house much cooler in summer for the same reason.

FLOOR SPACE.

From 5 to 6 square feet of floor space, and from 30 to 36 cubic

feet of air space, for each fowl, is about the right basis of measurement in planning a poultry house. A house 15x12x7 feet high in front, and five feet high at the back, with a single span roof, will have 180 square feet of floor space and 1,080 cubic feet of air space, which allows a flock of thirty fowls ample accommodation.

VENTILATION.

Look out for dampness, as it is fatal to profits. The warmer the air is in a house the more moisture it will hold and, when this comes in contact with a cooler surface it condenses in the form of hoar frost in winter, and makes the air soggy and damp in summer, and it is common to say that the house sweats. The remedies for these conditions are, first.

INTERIOR OF HOUSE.

Without regard for the particular kind of poultry house that you may select, there are features that should be followed as the results of the experience of others, and this experience is a capital in your business which costs you nothing, which you cannot afford to neglect.

FLOORS.

Have the floors of your house clear—that is have no fixtures on the floor level. Roosts, feeding troughs and drinking founts should be on platforms elevated from the floor, as it will be very much easier to keep the floor clean if it is free from fixtures of all kinds.

ROOSTS.

Roosts should be made of 2x3 stuff set edgeways with corners slightly rounded. Many patent roosts have oil cup attachments to prevent mites from crawling on the fowls at night but, while they are excellent, they are not absolutely necessary, as the poultryman can keep the houses entirely free from mites and other vermin by using the proper exterminators and attending to them frequently.

DROPPING BOARDS.

One of the greatest necessities is a droppings board under the roosts. It should be made easily removable for cleaning and is one of the best safeguards for sanitation known. The usual way of arranging the roosts is to have them close to the north wall, and at about half the height of the wall. Below the roosts is the movable droppings board and below the droppings board are the nests which are easily movable and set on the floor. Entrance to the nests should face toward the rear of the house, which will prevent the fowls from throwing material into the nests while scratching, and it will also help to keep the nests dark and prevent egg eating.

BOARD FLOORS.

In laying a board floor, allow for an eight inch space beneath it, with openings for ventilation and for the cat to get in and out to drive out rats and other marauders. Have floor tight and level.

CEMENT FLOORS AND FOUNDATIONS.

Concrete is not as expensive as stone, where the stone is laid in mortar and pointed up, and is much more satisfactory. It is equally as rat proof, less liable to heave by frost or moisture, and is easier to make.

SELECTION OF BREEDS.

This subject may well be considered the foundation to success or failure in the poultry business and it should receive your careful thought. You are going into the business for profit, so do not be content with scrub stock for it makes a poor investment.

The poultry business is no exception to the rule if you desire paying results, you must have a foundation for success, and no man can succeed who builds with poor stock. It costs no more to feed a standard fowl than a mongrel, and you cannot realize high class results from the latter. You would not attempt to conduct a dairy without obtaining the very best grade of stock, nor would you expect the best crops without planting the best seed obtainable. This is the point on which many poultrymen fail, so make it a point to start right. Select the breed that has made the best showing in your locality; see that your birds are of guaranteed strain, and from vigorous stock, and you will make no mistake. Care should be exercised and investigation made regarding the best stock for the climate and location, before going into the business blindly and with lack of ordinary precaution.

FEEDS.

If you are running a machine, the quality and quantity of your output must depend very much upon three points: the kind of machine you use, the quality of raw material which goes into the machine, and the kind of a man you have to run it. In this connection the domestic fowl may be compared to the machine. The feed is the raw material which goes into the machine and it must be balanced correctly to produce eggs or meat—whichever you are trying to obtain.

PROTEIDS.

Proteids the foods which renew the waste of the fowl. In any animal there is a continuous process of waste which must be as continuously renewed.

The following list of foods are very high in proteids and are, therefore, called protein foods: Cottonseed Meal, Flax Meal, Linseed Meal, Gluten Meal, Brewers' Dried Grains, Malt Sprouts, Wheat Middlings, Bran, etc.

CARBOHYDRATES.

These can be called the fuel of the body, as they furnish the heat. Carbohydrates furnish the steam to warm the egg factory and the strength with which to manufacture the proteids into eggs and new material. Carbohydrates also produce fat and make a fowl lazy and inactive unless the fowl can be made to exercise. Exercise consumes the carbohydrates in the blood, leaving the blood rich in protein to make the egg and to build up, and keep up, the wearing parts. Carbohydrates are the starchy foods, such as Corn, Cornmeal, Cob Meal, Hominy Meal, Ground Oats, Barley, Buckwheat, etc.

ANIMAL FOODS.

Animal foods are full of protein and take the place of bugs, worms, etc., that the fowl finds in her natural season for laying. They are Beef Scrap, Pork Scrap, Blood Meal, Green Bone, etc.

GREEN FOODS.

These take in all manner of fruit, vegetables and growing grasses and grain, Alfalfa Meal, Clover Meal,, and like the others help furnish the domestic fowl with its properly balanced food supply.

BALANCED RATIONS.

A balanced ration is one so made that it furnishes just what the fowl needs. Balanced rations are selected and compounded from the foregoing according to our knowledge of what is required, at various seasons, to produce eggs and meat and to maintain normal health and vigor. We must take into consideration that we demand vastly more from the fowl than nature ever did; that we twist the seasons so that the fowl will lay in winter, and that we have to supply food to meet these requirements over and above what nature would

provide when the fowl was idle. We are giving a few formulas for feeds and, while they are excellent in themselves, they should be constantly changed.

Growing feed.—Equal parts wheat, cracked corn, kafir corn and hulled oats. Use no oats with hulls nor barley or buckwheat until chicks are at least three months old.

Chick feed.—Mixture of 1 part each, by weight, of corn, wheat, hulled oats or pin head oat meal, and kaffir corn, cracked, screened and sized suitable for chicks. To this add one part of millet seed, half part grit (chick size), and a fourth part charcoal (chick size).

Mash feed.—Equal parts by weight bran, ground oats, corn meal, or substitute middlings for oats if of good quality, or where oats without hulls cannot be obtained. Cooked vegetables can also be used, steamed alfalfa or clover, for 25 per cent of the weight. Beef scrap should constitute 12 to 15 per cent or, if blood meal is used, about half of that amount.

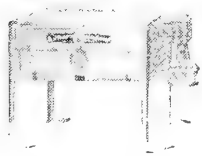
Scratching feed.—Mixture of wheat, oats, corn (whole or cracked), barley, kafir corn, buckwheat, and millet seed.

Sunflower seed can be added. Cut out buckwheat in summer.

Grit, oyster shell or mortar, charcoal, green cut bone (or other animal food) and pure fresh water, are the items which should never be forgotten. It is a wise idea always to have such food before the fowls.

Exercise is as necessary as food, and fowls cannot thrive without it. See that they are made to work for their living. Unless the fowls have free range, it is wise to feed all grain by scattering it in a six-inch litter of straw, cut alfalfa, leaves, or anything that will make them work by scratching. Remember that their food will do them but little good if they are troubled with lice. Lice will take away their vitality and their flesh faster than food can furnish them. Watch out for lice, and fight them at all times with the best lice killers that you can procure.

INCUBATORS AND BROODERS



The average farmer, his wife, his son, or his daughter, should not expect to learn all about the management of an incubator from the perusal of written pages. Experience comes from the work itself. This work is easy, interesting, and fascinating. It occupies the mind and leads to investigation. More than that, it leads to success and profit. But great results can not be expected in the beginning. The poultry business is a trade and must be learned. Many a person is idle today and looking for some sphere of usefulness who could learn how to operate an incubator to both mental and financial advantage. But the work, slight as it is, must be done properly and at the right time. The poultry business is honorable and profitable, but it requires study and experience. We serve a long and faithful apprenticeship to learn other more laborious and less remunerative trades, when the same amount of application would in less time make us experts with an incubator and give us a trade in a line not affected by strikes or lockouts, or liable to be overcrowded.

Nothing has played so important a part in elevating the poultry business, from a simple pastime to a great industry, as the incubator and brooder.

The requisites of a perfect incubator are first, a perfect radiation of heat, controlled by an active thermostat that will regulate the slightest change of temperature in the egg chamber; second, the necessary amount of ventilation.

Study your incubator.

Acquaint yourself with all its parts.

Read the manufacturer's directions for setting it up.

Set it up carefully and according to instructions.

Never try to run an incubator in a drafty place, nor near a stove, nor where the sun shines upon it.

Set fertile eggs only. Waste no effort upon those that are doubtful.

Learn how to trim and clean a lamp.

Keep the lamps full and the wick and tube clean.

Avoid smoke.

See that the eggs are clean and dry before setting them.

Balance all eggs, large end up, a few hours before placing them in the tray.

Do not overfill the tray.

Turn every egg the third day.

Cool the eggs every morning.

Be sure your hands are clean when handling eggs.

Test all eggs by the seventh day.

Test again by the eleventh day.

Test again by the fifteenth day.

If the air space is too large, supply moisture; if too small, put a saucer of dry lime in the room and run without moisture a day or two.

Do not expect to learn all about the air cell the first hatch. You will learn that later.

Do not disturb the eggs after the evening of the eighteenth day.

Have a regular hour for incubator work.

Do not tinker too much with the regulator.

Get the adjustment right and keep it so.

Heat your machine and make your adjustment before placing the eggs in the egg chamber.

INCUBATION.

After the selected eggs have been kept in your incubator for seven days, they should be tested by holding them in front of a strong light, concentrating the light so that it will pass through the shell. All eggs which appear perfectly clear are unfertile and should be discarded. These discarded eggs can be saved as they form an excellent food for the young chicks when hard boiled. A fertile egg at seven days in the incubator will show a dark spot from which as a center, blood vessels will radiate in different directions. If, however, you discover an egg containing a dark spot, around which is a dark circle, discard it also, as this is a dead germ, killed by the bursting of a blood vessel as a result of overheat. The air cell increases in size as the chick matures until, on the eighteenth day, it should occupy nearly one-third of the egg space.

Eggs should be tested on the seventh and twelfth days and all containing dead germs should be removed.

If conditions are right, chicks should break the shell on the nineteenth day and the entire hatch should be over by the twenty-first day. After the chicks begin to hatch, the machine should be kept closed until they are ready to remove to the brooder.

MATING.

No matter how well situated your poultry farm may be, or how good its buildings, or how excellent your incubators and brooders, success cannot be obtained unless you can produce, or secure, strong and fertile eggs. The first consideration must be the health of your stock. The male birds must be kept in vigorous health and the number of females with which they are permitted to run must be limited. With the American and English breeds, one male to each ten females, with the Mediterranean, one male to each fifteen females, and with the Asiatic, one male to six or eight females, are about the right proportions.

SELECTION OF EGGS.

Care should be exercised in selecting eggs for hatching. There is a great difference in eggs and, although it is not generally known, it is possible to arrive at some idea of their hatching qualities before they are placed in the incubator. An egg which will produce a fine, strong chicken will have a shell of even texture. If, by holding it between your eyes and a good, strong light, the shell appears to be porous or patchy, or if you detect a ridge or thickness encircling the egg, usually at the center, discard it. Again, the air cell in a fresh egg is always small. As the egg becomes older this air cell increases in size. A few practical tests will teach you the difference, so that you can surely and quickly make the proper selection.

Some people make the great mistake of buying a good incubator, expecting to make a brooder of their own, or to provide some scheme to get along without one. We advise most strongly against this error. It is a comparatively easy matter to hatch chicks, but to raise them is more difficult, and to accomplish this it is necessary to seek the aid of a high grade brooder.

The brooder is made in two patterns the indoor and the outdoor. Those arranged for indoor use are, as a rule, more successful although the outdoor brooders answer admirably.

Absolute cleanliness in brooders is a positive necessity, as filth and disease generally go together, resulting in the death of the chicks.

A brooder should be roomy, and well supplied with heat always from overhead, and provision should be made so that chicks do not crowd as they are apt to do if temperature is not right. If too cold they huddle together and smother. Fifty chicks in one compartment should be the limit and less is better.

FIRELESS BROODERS.

All the heat that is needed in a poultry house is obtained from the fowls' bodies if the house is correctly built, and the same principle is now utilized in the fireless brooder for little chicks, which is a well ventilated padded box that retains and evenly distributes the heat from the bodies of many little chicks together.

In mild weather fireless brooders can be used out doors, but the logical place for their use is in a room or brooder house where the temperature can be maintained steadily above freezing.

FEEDING YOUNG CHICKS.

Young chicks should be given no food whatever for the first 36 hours after hatching, as the last process of incubation is the absorption of the remaining portion of the yolk of the egg. This absorption is nature's way of feeding the chick and should not be interfered with by giving them other food.

Do not feed until chicks are removed to the brooder.

A little fine grit or coarse sand should be within their reach when

they are first placed in the brooder and this should be kept constantly before them. Also plenty of cool fresh water, given in founts so that the chicks cannot get into it and get wet and chilled.

Never feed chicks wet sloppy feed, even if you have to confine your feeding to small ground dry mixed grain and bran. After chicks are several weeks old wet feed will perhaps not hurt them, but dry feed is the surest plan. The dry feed should be made up of dry grains properly proportioned and ground or crushed to the right size. Give the little chicks a little at a time and five or six times a day. Make them scratch in litter for it. After the first week keep beef scrap or some form of animal food before the chicks, as this is necessary for their proper development.

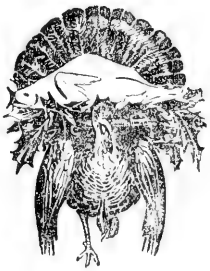
Irregular care of little chicks leads to failure, and an hour's chill may cause a set-back impossible to be overcome.

When the chicks are ten days old, begin to give them a little green food and increase gradually as they grow older. Onion tops, clover tips and leaves, cabbage chopped fine, potatoes baked, cooled and broken in two, grass cut into short lengths—less than ½ inch, are all excellent for the purpose. For the younger chicks, a light litter of cut clover, hay, or straw is excellent in the brooder; they will scratch for their food in it, and what little they may pick up will be good for them.

Correct feeding is the searching test of success in rearing chicks and should be attended to carefully and not wastefully. Keep the chicks just hungry enough to be willing to work for what they get. A careless feeder not only wastes the food, but will ruin the flock.

There are three enemies to your care of little chicks and they are lice. Watch out for them constantly. There are three distinct kinds. The first to bother will be the **head louse,** which kills more little chicks annually than die from all other causes put together. Next is the **body louse,** which lives on the chick and will not leave his body until you make him. The last is the **mite,** which attacks only at night and leaves the body in the morning to hide in the cracks and crevices of brooder or house. No one appliance or remedy will kill all three and they need different treatment with different lice killers.

TURKEYS



The common varieties of turkeys in this country are the Bronze, Narragansett, Buff, Slate, White, Holland, Black and Bourbon Red.

By far the most popular seems to be the Bronze, which is a cross of the Black (the English Norfolk turkey) with the original wild bird of this country. The Bronze turkey is now the largest and hardiest of all the varieties. Next to it in size, probably next to it in popularity also is the Narragansett—also a cross with the American wild turkey, but with some Mexican wild turkey blood added, giving the mixture of white in the bronze and black plumage.

Turkey raising is a profitable industry. It is something of a spe-

cialty and requires a little different system from that of raising ordinary domestic fowls, but the important differences are few and easily mastered. But the great thing is to actually do what's right. Knowing and doing are very different matters.

Turkeys adapt themselves easily to various climates and can be raised successfully whether you live far south in Texas or north in Canada, and thrive equally well under conditions so unlike as those found in New England and in California. Fact is you can raise them anywhere if you (1) start with the right stock and (2) give the right care.

The right stock is any stock that is itself individually strong and healthy. It must be kept so. Turkey stock quickly shows bad effects from inbreeding. The only way to keep up the constitutional vigor of the birds is to introduce new toms, selecting always vigorous medium sized males and mating each with about five mature hen birds, making sure always that the hens are also strong and vigorous. Some successful breeders consider eight to twelve hens a good proportion to each tom. Pullets do not lay eggs so large as those laid by yearling and two-year-old hens, and their poults are not so strong.

The right care means chiefly protecting the young poults from cold or damp, especially from wet grass and from insect vermin. Timbered land where there is not much underbrush is the finest for raising young poults, or pasture land where the grass is short and there are plenty of insects to be picked up. A flock of turkeys would benefit any farm by the amount of worms, grasshoppers, etc., thus destroyed. Right care includes also giving turkeys good, free range. These birds are still half wild and they will not thrive under the conditions that are ordinarily successful with domestic fowls. They grow very nervous and restless when too closely confined. If you are in the business for profit the right way is to give the turkeys plenty of good range, where they can get abundant natural food by foraging for themselves. But at the same time you must give them a nice grain feed every night as this will guarantee their return home to roost. Corn is the best grain, but you should add occasionally some wheat, oats or peas, as corn alone is too fattening. Since the turkeys will roost in the open air, however, they can stand this rich grain, as it keeps them warm while in the open. The rule is to feed a little at a time, but to feed often. A grain and insect diet suits them to a T. The young poults will begin to feed themselves just as soon as they are out of the shell. In the natural state they live almost entirely on the insects and berries they pick up.

Pretty nearly the whole problem in turkey raising is to start right with the poults. For while the grown birds are extremely hardy, the poults are the tenderest of all poultry to care for. Watch them carefully up to the time when they get their first plumage and "throw the red," that is show their combs. After that they are easy to manage with the two main cautions already stated.

The young poult should be fed the first two weeks a crumbly mixture of bread and milk and pot cheese, or curd—about one-fourth should be the cheese. Add to this a little chopped onion. Two or three times a day give the little poults all of this they will eat up clean and at least once a day give them some finely cracked corn, mixed with wheat and oatmeal, equal parts by weight. After the second week, increase this grain ration, and also give more of the pot cheese, cutting down the bread and milk in the ration. Pot cheese is considered better than beef scrap for turkeys, although, of course, beef scrap is a valuable article for them. Of course, as they grow older you gradually give coarser grain and finally the whole grain.

Grit and charcoal should be before them all the time—this is always necessary with any kind of poultry.

Water must be where they can help themselves, but it should be

in a fount such as will protect the young poults from getting wet. Turkeys should always have a good supply of water.

To Fatten for Market.—Give the turkeys free range, if possible, else they will "worry." At night, give them all the whole corn they will eat. In the morning give them a mixture as follows: Six parts corn meal, three parts middlings, one part meat scrap, mixed with sour skim milk. Do not let this get too soft and sticky, but make a good stiff mixture. The last week of the fattening for market put the birds in darkened coops and feed the following "cramming" ration, which you can make up into pellets and feed by hand: Two parts corn meal, two parts ground oats (without hulls), one part middlings, one part scraps, mix to a stiff dough with sour skim milk as before.

RATION FOR BREEDING SEASON.

Equal parts by weight of ground oats, corn meal, wheat, bran, wheat middlings, meat scrap mixed with sour skim milk. Oats is the best all around grain at breeding time. During breeding season turkeys should always be given free range all day and allowed to roost at home in the open. They like high roosts and fresh air. Let them have their way and you will succeed. Turkey hens lay from thirty-five to forty eggs during the season. Time for incubation is 28 days. Some poultrymen use hens for hatching, but there is great danger from lice unless extra care is taken. However, by giving the first clutch to sitting hens you can keep the turkeys laying and dusting the nest and hen frequently with good lice powder will help destroy the pests. Lice will kill little poults very quickly. Young poults thrive best on woodland range, where they will not get tangled in wet grass and can pick up most of their living. But if confined try to change their runs from day to day and disinfect thoroughly. Thoroughly clean all eating vessels.

DUCKS

This is another branch of the poultry industry which has not been fully appreciated. Duck raising is profitable. They are easier to manage than chickens, have fewer diseases and mature more quickly. But it takes common sense to make a success of the business.

Ducks are raised chiefly for meat, but their eggs are valuable and with proper feeding there is not that strong flavor which has been objectionable. Duck eggs generally command a higher price than hen eggs. Ducks commence laying when five months old.

The Pekin and Indian Runner Ducks are now the favorites. Pekins are a large early maturing pure white breed, and will easily weigh over five pounds at ten weeks old. More Pekins are raised for market than all other breeds and they will reach ten or twelve pounds when full grown and are excellent layers. There is also additional profit in their feathers, which are pure white and command a high price. The Indian Runner meets the demand for a small carcass and good layer and especially for a winter layer, when most ducks shirk. The eggs of this breed are about the same size as the others. Ducks are hardy and Indian Runner the hardiest of all. If given a free range they will nearly rustle their own living. They feather and mature early. The drakes weigh about 5½ pounds and the ducks one pound lighter.

DUCK RAISING.

Start always with good breeds and fine stock. Select the breeding stock from the early hatches. Mate the drake in the breeding season with about six ducks and later increase to twelve. Water is an advantage but not necessary in the breeding season, and when fattening for market it is a disadvantage, as they fatten more quickly without it to play in. Young ducks are ready for market in about ten weeks.

HOUSING

Ducks can be housed more cheaply than chickens. The only thing is to keep them dry as possible. Cold and snow they don't mind until they "get cold feet." Cold feet stop egg production instantly. The other important thing about housing is to have a rat proof floor. Keep the litter on the floor reasonably clean, as they will "roost" on the floor.

Water should be where they can get at it day or night for drinking. They need plenty of water inside, but the less they have to play in the better, as they will be sure to slop water over the floor and get it unfit for their own use.

FEEDING.

The duck has no crop, hence cannot stand much hard grain, but should be given mash feed. Ducks are heavy eaters, can be crowded for market, but of course there is a limit. Feed all they will eat up clean. Never leave stale food around to become filthy and fermented and thus a source of disease. Always give them some green food unless they are on range.

As with chickens, do not attempt to feed the new hatch before 36 hours, but let the little birds fully absorb the yolk. Then give two-thirds part wheat bran to one-third part corn meal, moistening to a crumbly mass with a little water or milk. Mix in one raw egg with each quart, and also mix in a little sand or fine grit. Keep this before them for 48 hours, watching to see that it does not get stale. Give them clean water to drink in a fountain such that they can wet their bills and heads but can't get their bodies in the drinking water.

At one week: Give three parts wheat bran, two parts corn meal, with about five per cent of beef scrap. Keep changing above so as to have equal parts wheat bran and corn meal at six weeks, with about fifteen per cent beef scrap. With this feeding the ducks will be ready for market at ten weeks. Watch the beef scrap and reduce the amount if the bowels seem affected. They certainly like green feed, but much will tend to make the skin yellow, and the market demands white. Wheat is fine for giving this white skin, and besides it makes good strong bones.

The feeding trough should be plenty long so all can feed at once.

Breeding stock are best given free range during the day, starting them out after a scant breakfast so that they will be sure to exercise well in foraging.

Laying stock will make good returns on the following ration: Equal parts corn meal, wheat bran and low grade flour. To this add one-fourth the bulk of cooked vegetables, such as potatoes, turnips, etc. Mix in beef scrap, about twelve per cent. Mix with a little cold water to a crumbly feed. Keep grit and ground oyster shell before them all the time. Also plenty of water, as ducks wash down their food with water.

Usually the flocks are brought in from range the last of November or early in December, then put on laying ration and commence egg production in about three weeks after housing. As would be expected, the first eggs are more liable to be infertile. For hatching, the eggs should not be trusted to the ducks, as they are inclined to be unreliable. Where most convenient hens can be used for hatching and brooding, but on a large scale the best way of course is to use incubators and brooders. Eggs will require 28 days for hatching.

GEESE

There are many places on the average farm that are not suitable for cultivation or for the raising of chickens, that could be profitably utilized for a goose pasture. Low, swampy places can be used provided there is also some high ground.

Goose culture requires less capital than any other branch of the poultry business, as very little housing is necessary and they are turned onto the land very much like cattle. A rough shelter free from extreme drafts should be provided and a deep litter kept on the ground inside. The quarters should be kept reasonably clean, for although they will stand more filth and neglect than chickens it is not the proper way to care for them and good results cannot be obtained without considering the health of the flock.

Mating usually takes place some time in February and after the fowls have been penned together for a week or ten days it is not necessary to keep the various pens separate. Once the family ties are firmly established they will be lived up to during the entire season. Two or three females are all that should be mated to a male.

Geese are long-lived and ten-year-old birds are quite common. Females of three years or over are the best for breeding purposes and their usefulness continues throughout their entire life. Young ganders are more desirable for breeders because of their activity. Old ganders also get quarrelsome with age.

There is a difference of opinion as to which is the best bred of geese, but the Toulouse, Embden and African are the most popular for general purposes.

A goose will lay from twelve to twenty eggs before becoming broody, but twelve is about the right number for a setting for the best results. Twenty-eight days are necessary for incubation.

If goslings are well hatched little difficulty will be experienced in raising them. They can be given about the same feed as little chicks, with the exception that green food such as fine cut grass or vegetable matter should be given several times a day after the first day.

The old goose should be kept in a coop and the goslings allowed to run about. After a month they can be let out to range and very little attention will be necessary. They are very light eaters and if the pasture is good only a little other food will be needed. A good mash feed for them is made by mixing two parts of bran with one of corn meal. A variety of vegetables such as beets, potatoes, turnips, cabbage, etc., should be given them.

Because of their rapid growth and the small quantity of grain they consume, geese will be found one of the most profitable kinds of stock for the farmer.

SQUAB RAISING

The best variety of pigeons to keep for squab raising is the "straight" Homer. These magnificent birds are large and healthy; are good workers, always active and hunting about like Leghorn fowls; are the best of feeders; are of quiet disposition when properly mated; and their eggs are seldom infertile. For these reasons Homers are par excellence among all the pigeon kind for squab farming.

FEEDS AND FEEDING.

Though the houses may be well constructed and the birds well selected and properly mated, no success can be expected unless proper kinds of feed are procured and the birds are regularly fed. While it is true that some breeders have had fair success for a while by feeding only cracked corn and wheat, long-continued feeding on these two staples alone invariably fails to produce as good squabs or as many as when a further variety of grains is fed. In their free state, pigeons can select a variety of grains, avoiding one kind and choosing another, as their appetites dictate, but when they are kept in a small inclosure they must, of course, take what the breeder gives them. Hence, it becomes highly important that the breeder have good judgment as to kinds and quality of food to set before them, and that he have interest

enough in his flock to avoid stinting the quantity, or feeding too largely of one kind because its price happens to be low.

The feed room.—A room should be set apart for a store room. It should be supplied with a feed bin divided into the proper number of sections to hold each variety of feed used; or, instead of such feed bin, small barrels with lids may be used.

Feeds and other supplies.—In these receptacles should be kept a generous supply of sifted cracked corn, Canada peas, wheat, German millet, Kaffir corn, and hemp. These are the six principal feeds.

On the floor of each pen keep about a peck of clean sand evenly spread. Procure three boxes about the size of small cigar boxes; fill one about one-third full of fine table salt, the second with cracked oyster shells, pigeon size, and the third with ground charcoal, about as fine as ground coffee. These three substances are very essential to the health of pigeons. Clean out and replenish each of these boxes weekly. Do not fail to keep the salt box filled and before them all the time, for the health of pigeons demands it.

Feeding troughs.—In each pen is placed a feeding trough, made of inch stuff, 10 inches wide, 4 feet long, and with sides 1½ inches high. This trough is placed in the middle of the pen to avoid feeding in the open fly, where the birds and grain would both be subject to the weather. In feeding, a tin pail holding a peck is convenient, as is also a grocer's tin scoop No. 3, which holds about 3 pints.

Rations.—For the morning ration give equal parts of cracked corn, wheat and peas, well mixed, using two scoopfuls of the mixture to each pen of 50 pairs of birds, and taking good care to see that all droppings are cleaned out of the troughs before feed is put in.

The ration for the afternoon is composed of cracked corn, kafir corn, millet and peas in equal parts.

If at any feeding time any of the previous supply has not been used, reduce the quantity. If, however, the troughs should be entirely bare, slightly increase the quantity. When a number of squabs are in the nests the birds will feed more freely and need a more liberal supply.

Special feeds.—On Thursdays and Sundays use hemp in the ration instead of millet. Care must be taken that the birds do not get this feed too often, nor in too large quantity, as it is very fattening and if fed in excess has a tendency to give the birds vertigo. For the same reason caution must be used in feeding millet. A small quantity of rice may be fed once a week with advantage.

Time of feeding.—Regularity in time of feeding should be strictly observed. The morning feed in summer should be given at 6:30 and in the winter at 7 or 7:30. The afternoon ration should be given at 4 o'clock in the summer and 3 in the winter. The afternoon hours are quite important, and must be adhered to in order that the birds may have ample opportunity to fill themselves and feed their young before nightfall.

Be sure to attend to the feeding yourself. Always go alone; never permit anyone to accompany you, for birds are often very timid of strangers, and chilled eggs may result if a stranger should remain in the fly at feeding time. Go in quietly, making no noise or sudden movements; and, after the feed is placed in the trough, always leave the birds alone for a full hour that they may be absolutely uninterrupted in feeding themselves and the squabs.

Feeding indoors.—Never feed out of doors under any circumstances in either summer or winter. Besides the loss occasioned by sparrows taking advantage of the opportunity to help themselves, in summer the heavy dews and hot nights will cause any feed left over to sour, and in winter storm and sleet will prevent birds from feeding.

A few cautions.—Cracked corn must be sifted, for fine meal can not be used by the birds, and in hot muggy weather it will sour over night, necessitating extra trouble in cleaning out the troughs.

Be sure that every grain is sound and strictly first-class. Do not feed new wheat until it is thoroughly dry, usually not sooner than October 1, and do not feed new corn until Christmas. Especially avoid musty grain.

Because one of these feeds mentioned may sometimes be quite cheap, do not be tempted to feed largely of it, thinking to save money thereby. This practice so often causes trouble that caution is urged in departing from the proportions named.

Too much wheat in the ration will almost always cause looseness of bowels and make the squabs skinny and dark.

Birds need a variety of feed, and it would be as injudicious and disastrous to feed exclusively on peas, a high-priced food, as on wheat alone or some other cheap food.

How the squabs are fed.—Some wonder why squabs die in the nest or get on the floor or do not fatten up properly. Very frequently the reason is simply because the old birds are not properly fed. We should constantly bear in mind that a squab is very different from a chick. A newly hatched chick can run about and help itself to food and water. The squab, on the other hand, is utterly helpless at birth; it is unable to walk and must be fed in the nest with whatever the parent bird brings to it. For about five days nature provides a special food commonly called "pigeon milk," a creamy substance contained in the crops of the pigeons and which they have the power to eject from their mouths into the mouths of their tender young. After a few days of such feeding the squab is fed on such grains as the pigeon gets, and by the same process of transfer from the parent's mouth to its own; hence, it is essential that proper food be given the pigeons.

Watering.—A generous supply of fresh, pure water for drinking purposes should be supplied. The flock should be watered each morning before the supply of feed is given. The water supply should be near the feeding troughs. Two-gallon stone fountains may be used in summer and galvanized iron ones in winter. These fountains are placed on the floors of the pens, one to each pen being sufficient. They should be thoroughly cleaned out each morning and filled with pure fresh water, which will last all day, although during the heated spell of summer it is better to put in a fresh supply of water before the afternoon feeding. For thoroughness in cleaning the fountains, it is well to use a small brush. About twice a week place a piece of stone lime about the size of a hickory nut in each fountain. At least three times a month the fountain should be disinfected by using 10 drops of carbolic acid to a two-gallon fountain, leaving the acid in the water for the birds to drink that day, as it will do them no harm.

RAISING GUINEA CHICKENS

On the basis of experience, a southern poultry raiser considers that it is best to raise guinea chicks with a common hen or turkey as a mother, particularly since they can be kept out of wet grass and weeds in the early morning more readily than when hatched by guinea hens. In the experience of this writer attacks of mites and lice more often end fatally with guinea fowls than with other poultry, and whitewashing the trunks and branches of the trees where they roost is recommended. This writer also believes that after laying, sitting, and molting the guinea hens should be caught and dipped in water and grease to free them from vermin.

Another poultry raiser on the basis of personal experience recommends for newly hatched guineas a coop 8 or 10 feet long, 5 feet wide, and about 2 feet high, covered on the sides with 1-inch mesh wire netting and on the top with 2-inch mesh netting. This coop, which can be easily moved from place to place, has a door in one end, and in bad weather can be covered on top with boards. If fed in the coop and

fastened in so that they will roost there, the chicks will readily learn to return to the coop at night.

H. de Courcy, in an article on the guinea fowl for British poultry raisers, recently published by the Board of Agriculture of Great Britain, points out the value of this class of poultry for the table and discusses their feeding, care, and management. He suggests that when newly hatched the chicks may be fed on any one of the commercial chicken meals, moistened with milk and raw beaten egg.

They should also get green food from the start, and the best kind is chopped onions or leeks, but lettuce, dandelion, etc., may be used to advantage. When the chicks are a few days old plainer foods may be freely used, and one of the most wholesome is coarse oatmeal fed dry. This may be varied by the occasional use of boiled rice, raw rice meal hemp seed, millet seed, etc. At a later stage—say when three or four weeks old—some middlings and fine barley meal may be added to the mash. Grit of fine quality must be regularly supplied from the time the chicks leave the shell.

There is nothing so wholesome for the chicks as insect food. Dried ants and ants' eggs are often used (in Great Britain) by those who rear pheasants and guinea fowls, but in many districts, especially where the soil is sandy, there are ant-hills in the fields. In such farms it is only necessary to place the coop in which they are kept near an ant-hill and the chicks will feed greedily on the insects and their eggs. * * *

When a few weeks old the chicks should be given a free run with the old hen, and the best kind of range for them is an overgrown, weed-covered garden, orchard, or shrubbery. In such a place they can find as much insect food as they need to keep them in health; but if the run is small, or if too many birds are kept on it, it becomes necessary to feed the guinea chicks with a small quantity of meat in their mash. One of the prepared meat foods or finely chopped fresh meat and fresh bone may be used.

POULTRY DISEASES AND REMEDIES

Poultry Powder—Ground bone or slacked lime, 12 oz.; ginger, 2 oz.; gentain, 1 oz.; capsicum, 1 oz.; sulphur, 1 oz. Reduce to powder. Mix well and add a teaspoonful to a quart of feed.

Lice—Cleanliness will usually prevent the appearance of lice. They are first found on the poorer and weaker fowls, and it is believed that they must be introduced by an infected fowl. This is a reason against buying grown fowls rather than raising from eggs. It has been estimated that a single pair of lice in three months will produce 100,000.

A few drops of sweet oil or lard on the head, wings and throat of little chickens will prove best. Older fowls should be allowed nature's remedy—dust baths. Powdered sulphur or insect powder dusted into the feathers is good. Some put fowls in tight boxes, with head protruding, and fumigate with sulphur fumes for a few minutes. This is said to do no harm and kill all pests. If the poultry house is infected it should be thoroughly cleaned—whitewash, sprayed chlorides, or an emulsion of kerosene oil (if spraying is done thoroughly) being recommended for this purpose.

Chicken Cholera—Is more prevalent in warm than in cold climates. It is a bacterial disease and is highly contagious for the simple reason that the bacteria germs are ejected with the excrement and the healthiest and most robust succumb to its ravages alike with those that are more delicate. Investigation by the government officials shows that the first symptoms of chicken cholera is, in the great majority of cases, a yellow coloration of that part of the excrement which is secreted by the kidneys and which is normally of a pure white. This yellow coloring matter appears while the excrement is yet solid, while the patient presents a perfectly normal appearance and the appetite

is good, before there is any elevation of the temperature. In some cases the first symptoms is a diarrhoea, the excrement being passed freely, and after a day or two it becomes a dark green in color. The comb is pale or bloodless and sometimes of a dark purple or blue.

The duration of the disease varies; sometimes the bird dies within ten hours of the first attack of the disease, and again they will some times linger for several days.

There are numerous remedies for the cure of chicken cholera. In the first place isolation is necessary. Give them a warm, dry and comfortable house. Disinfect the premises thoroughly with a solution of eight ounces of sulphuric acid and two gallons of water; sprinkle the ground and everything in the house thoroughly with the disinfectant; remove all the droppings from the house away from the healthy fowls. To each gallon of drinking water add a teaspoonful of carbolic acid. This is also a good disinfectant and will act as a preventive. The following recipe is one that will be found efficacious in the cure of the disease:

Isolate those affected, and give each a pellet about the size of a grain of corn or a pea, three times a day, made from the following powder (use a little flour and water to make the pellets):

2 oz. capsicum, 1 oz. pulverized rhubarb, 2 oz. pulverized asafoedita, 6 oz. Spanish brown, 4 oz. carbonate of iron, 2 oz. sulphur.

As a preventive, add a tablespoonful of the above powder to the soft food for every ten or twelve fowls, twice a week.

Roup in Its Various Stages—One of the most dreaded diseases among poultry is that of roup, which usually begins with a cold. All fowls are subjected to colds, as well as humanity, and should have the same attention that we would give ourselves; for should we neglect to apply a remedy when we take cold, the result might prove quite serious. The same will be applicable in case your fowls take cold, which may be brought about in numerous ways, viz: roosting in damp quarters, cold draughts of air passing over them in their sleeping apartments, sleeping in brood coops on the ground where they are packed so close as to smother some during the night and those not suffocated are over-heated so that when exposed to the cold air in the early morning a severe cold is the result, and if a remedy is not speedily applied and the cause removed, roup will invariably follow, which of all poultry diseases is the most obstinate, sickening, and difficult to cope with, and if necesary precautions are not taken in the start to arrest the disease, it will run through the entire flock and leave nothing but death and destruction in its path. In our opinion roup is more to be feared by poultrymen than the deadly disease, cholera.

Symptoms of roup may be described thus: Fowls begin coughing, sneezing, and sometimes their breathing is heavy, accompanied by a wheezing sound. Eyes become inflamed, heads swell and they have a watery discharge from their nostrils which sometimes has quite an offensive odor; they are drinking almost continuously if they have access to water, which is an indication of their being feverish. As the disease advances the head becomes inflamed, swelling on one or both sides, frequently obstructing the sight, the eye sometimes being entirely destroyed. It may be noticed when fowls are affected with this disease they have splendid appetites and eat until the last, provided they are not internally affected, in which case they are stupid and a discoloration of their excrement may be noticeable, which is much the same as that of fowls affected with cholera.

Cure for Roup—When fowls are in the advanced stages of the disease, the best remedy is the hatchet, as they can seldom be cured, although in the early stages they may be cured by taking a small spring-bottom oil can and injecting in their nostrils and roof of their mouths a little kerosene oil; if heads are swelled, anoint the part swollen with sweet oil and alcohol, equal parts each day. Add some good condition powder to their morning mash. Put about one-half teaspoonful of

aconite into each quart of their drinking water. Keep them in good, dry, comfortable quarters, with an abundance of sunshine in their room, and it should be well littered with straw or leaves, which must be changed frequently. Their drinking vessels should be cleansed with boiling water. The utensils in which they are fed their morning mash should be cleansed with boiling water, as this is absolutely necessary to accomplish a speedy cure, not forgetting to remove all sick fowls from those not affected, to prevent spreading of the disease.

Gapes—Old fowls are never affected with the gapes. The disease is found only among chicks, and is caused by a worm or worms which infest the trachea. When once noticed on the premises it can never be entirely eradicated. It appears to be in the soil, and chicks each year will be subject to the gapes more or less after the place has once become contaminated therewith. Gapes among chicks may be cured by the use of horse hair. Twist one together so as to form a small loop at one end; insert this end down the wind pipe and if you turn it around several times the worms get caught in the loop and can be drawn out. Here is another remedy which, it is claimed, never fails to relieve the chicks of the gapes, and with proper care you will not lose a bird. Take a tight box about three feet long, one foot high and one foot wide; place a partition crosswise about twelve inches from one end, made of lath or wire screen. Then place a brick or stone on the floor in small end of box; after this take a piece of iron and heat it red hot. While the iron is heating catch the chicks that have the gapes and place them in the larger end of the box. Take the red hot iron and place it on the stone or brick and pour a spoonful of carbolic acid on it. Close the box for a minute or two, then open and stir the chicks around so that they all can inhale some of the gas, which will kill the gape worm. If some of the chicks are overcome, lay them out and they will soon revive again. Do not leave them in the box too long or the gas will suffocate them. The first application usually cures, but should there be any that has not been cured with the first dose, repeat the second time, and it will never fail to cure them.

Scaly Legs—Is usually caused by the chicks or fowls sleeping in filthy quarters. It is also caused by a small parasite which works underneath the scales of the legs. I have seen fowls with scaly legs that were twice their natural size. If the legs of each fowl were anointed once each month with equal parts of sweet oil or kerosene oil and alcohol they would never become scaly, but would remain in a fine, healthy condition. A good remedy is lard and kerosene oil, equal parts; add enough pulverized sulphur to make a paste then apply this to the legs and bandage them, leaving the bandage on for a week. If at this time the scales are not all peeled off, repeat the application of the same ointment, as it is a sure cure. The bandage may be sewed on so that it cannot be scratched off by the patient.

Dysentery—Dysentery in chicks is invariably brought on by irregular heat. If quite young chicks get chilled, bowel complaint will be the result. If overheated the same disease will follow, which is fatal in most instances; at least it retards their growth. Never allow chicks to get chilled or overheated if you wish them to do well. Usually during the warm summer months the most difficulty is experienced in this line, owing to the warm days and cold nights we often have at this time of the year. Cure: To a pint of soft food add a tablespoonful of finely ground raw bone, which should be fed at least three times a week to the healthy chicks as well as to those affected. Boil two ounces of ginger and one ounce of copperas in a gallon of water. Moisten the food with this fluid, but avoid feeding corn in any form when chicks have the dysentery.

CATARRH

This is an aggravated form of cold—an inflammation of the mucous membrane. Some make quite a distinction, technically, between Catarrh and Roup, but we class them under the same heading. Certainly the method of treatment applies equally well to either.

TUBERCULOSIS

Symptoms—Lack of life, emaciation with indications of indigestion, but there is in Tuberculosis a decided rise in temperature and, during the last stages, violent diarrhoea.

Treatment—Kill all which show any symptoms and burn and bury the ashes. Remove the balance of the flock to new quarters and, with a sprayer or sprinkling can, disinfect everything that the fowls have come in contact with.

INFLUENZA

Influenza, "epizootic," or grippe is a contagious, catarrhal disease distinct from Roup, although it often appears with Roup. Its common form is like a Roupy cold and has the Roupy smell, with or without Diarrhoea. It may well be classed as Roup for all practical purposes, as the cause, symptoms, and treatment are the same.

SWELLED HEAD

While Swelled Head is generally an aftermath of Roup and its kindred diseases, fowls may be found with hot and swollen heads without having had any severe case of Roup or Cold.

Symptoms—Swelling of head with more or less closing of eyes, etc.

Treatment—Same as for Roup. Sometimes it may be necessary to lance in order to remove the pus.

CONGESTION OF THE LUNGS

This is caused by the sudden chilling of the surface of the fowl's bodies and is due to exposure of various kinds. It is more frequently found in moulting fowls when their strength is not up to standard and their bodies are not in condition to protect them from the cold.

Symptoms—Stupor and lack of life, accompanied by difficult and rapid breathing. The comb may turn black or blue, and blood-tinged mucous may be discharged from the mouth. The disease appears without much warning and may quickly cause death.

Treatment—Owing to the fact that this disease is so quickly fatal, there is nothing that can be done to cure it. The prevention should be given all your thought.

CROP BOUND

This trouble is usually caused by improper feeding. Too much grain in the crop will distend it and impair its functions. It may be the result of the fowl eating a mass of dry grass, or wire grass, or indigestible chaff, etc., which forms into a hard ball and cannot pass beyond the crop. The contents of the crop ferment and the bird is liable to starve with its crop full.

Symptoms—The symptoms are usually easy to discover as the crop is hard and greatly distended. In some cases, an ill smelling liquid will run from mouth and nostrils. The comb is pale, the beak is open as the pressure on the trachea makes it difficult to breathe, its feathers are ruffled and the bird has a general appearance of dejection.

Treatment—Pour a little sweet oil into the fowl's mouth and force it to swallow. Grasp the legs with one hand, and, with the other, beginning at the top of the crop, gently press and work the contents of the crop, and endeavor to loosen up a small quantity of the matter that may thus be set free. Supply oil often while working, so that the contents of the crop may be kept as moist as possible. As soon as the crop is emptied, put two or three grains of baking soda in water and keep it before the fowl. Do not feed anything for a day and then very sparingly and carefully of soft foods until recovery.

OBSTRUCTION IN THE THROAT

A fowl will sometimes attempt to swallow a piece of food which, because of its shape or size, will lodge in the throat. Unless removed at once, inflammation and consequent swelling will result and without immediate relief death will follow.

Symptoms—Frequent attempts to swallow, and often a hard substance can be felt from the outside.

Treatment—Give a small quantity of sweet oil and work the substance out at the mouth by easy pressure and movement.

EGG BOUND

This happens with older fowls and during the latter part of the winter. It may be traced, in most cases, to an over-fat condition due to improper feeding.

Symptoms—The symptoms are unmistakable as the bird becomes listless and makes frequent attempts to expel the egg. If the bird is examined, the egg may be felt as a hard substance in the posterior part of the body.

Treatment—In ordinary cases, inject a small quantity of sweet oil into the vent and then, by gentle pressure, assist the passage of the egg. When this is accomplished, reduce the feed and give green food in abundance, withholding all carbohydrates or fat-producing foods.

EGGS WITHOUT SHELLS

These are usually accounted for by a lack of shell-making material in the ration of the fowls. They may also be traced to the inflammation of that part of the oviduct where the shell is formed. This trouble leads to more or less irritation and should be corrected at once. This can be done by providing plenty of crushed oyster shells, mortar, granulated or broken dry bone, wheat bran, etc. We do not advise the use of egg shells as this may lead to the egg-eating habit.

POISONING

Through careless distribution of insect killers, salt brine, salt meat, lye, fertilizers, copperas, phosphorus from matches, rough on rats, paint left in old cans, Paris green, etc., many fowls meet death annually. It is necesary to use the utmost precaution to prevent fowls from obtaining access to them.

Symptoms—Trembling, convulsions, and drowsiness. The fowls seek a dark place and draw their heads into their body. As a rule, the cause of the trouble is discovered too late to permit treatment.

Treatment—If the nature of the poison can be discovered in time, an antidote for same should be given. Where the poison is due to salt, lye or fertilizers which contain nitrate of soda, give as drinks strong coffee, brandy or flaxseed and water after steeping. This flaxseed preparation is also good for arsenic poisoning. Sulphate of iron in drinking water can also be used. Where poisoning is due to copper, zinc, phosphorus or lead, give white of egg in liberal quantities.

EGG EATING

While this is more of a habit than a disease, it is often caused by a physical longing for oyster shell, or other lime-containing, shell-making material, and the absence of sufficient animal food in the diet. It is a most annoying and expensive habit and a difficult one to break. No sooner is there an egg laid than it is eagerly eaten, and one fowl quickly teaches the others until a number in the flock may be seen to rush for an egg as soon as it is deposited in the nest.

Treatment—One of the best methods is to make a small incision in either end of an egg and allow the contents to run out. Then make a mixture of soft soap and red pepper and refill the egg, closing

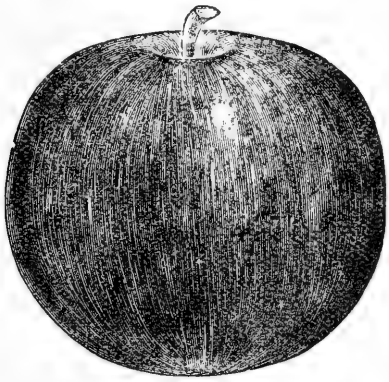
the ends with court plaster and placing a number in the nests where the fowls can get at them. If these are eaten, fill others. It should not take long to sicken the fowls of the habit. If you see that fowls are kept busy, that shell-making material is provided, such as oyster shell, mortar, bone, etc., and that the nests are dark and well supplied with straw, you will have but little trouble from this cause. Remember to darken nests as much as practical, have china nest eggs, and always collect freshly-laid eggs as quickly as possible.

How to Make Hens Lay in Winter—Give a portion of minced meat, mixed with their other food, every day or as often as convenient, and see that they have plenty of gravel, old plastering, or powdered eggshell. The latter may be mixed with their food. Without some substance of this kind, which cannot be obtained when the ground is frozen or covered with snow, there will be nothing to form the shell.

Handling Eggs—Above all, eggs sent to market should be clean and free from all disfigurement. If the nests are kept clean, the eggs will usually be clean, but sometimes the first eggs of pullets are streaked with blood, and eggs will on occasion become soiled. A moist rag will usually clean them up without the expenditure of much time.

Fattening for Market—In fattening fowls, care should be taken to give young fowls some exercise in order to keep them in a healthy and vigorous condition. Old fowls require little or no exercise. Especially should little exercise be allowed for a few weeks just before killing, if a choice quality of meat is desired. Close confinement improves the quality of the meat.

THE ORCHARD



One of the first questions that confronts a person who is starting an orchard is the problem of where to put it. It is true that fruit will grow and thrive under a variety of conditions, but there is always one which is best. This condition is based on such factors as the soil, site, location, kind of fruit that is to be grown and markets that are to be supplied.

Orchard soils should be rich, as it takes a great amount of soil fertility to supply the necessary elements to build up the wood in the tree, and this must always be done before the fruit can be developed.

NEW LAND

New land is very desirable for an orchard, and especially land which has just been cleared of a heavy growth of timber. The decaying foliage and roots of the forest growth leaves the soil with a generous supply of humus, and will produce a luxuriant growth of wood in the young trees. However, the land should be freed from all stumps and roots before the orchard is planted. In any land from which the timber

has just been removed it is always best to put the ground into some cultivated or soil building crop such as corn, potatoes, clover or cow peas for a couple of years before planting the trees.

Stony land is not at all objectionable for orchards, as on steep slopes the stones help in protecting the soil from excessive washing, and no doubt helps materially in warming up the soil in the spring. A stony soil is usually a well drained soil. On lands which have a very steep slope the stones can easily be made into terraces below the trees or they may be placed in the form of terraces between each two rows of trees. Unless the soil is very thin stones may be considered as a benefit rather than otherwise, because of the value they are to the land in assisting in drainage and in protecting the soil from washing.

Where virgin soil cannot be had for the orchard, only rich land should be used. An orchard will occupy the land for many years, and very thorough preparation should be given before the trees are planted. Never set the trees on poor land or dry land for if they do start they are so stunted that they seldom make a satisfactory orchard. Lands which have been used for grain crops for several years without the addition of plenty of manure or green manuring crops should not be planted until the soil has been built up. Old pasture lands while perhaps fertile should have a cultivated crop for at least one season before planting to orchard. Before planting trees thoroughly plow the land deeply. If soil is shallow and underlaid with hardpan follow the furrow with a subsoil plow to break up the hardpan under the trees. The young roots can then penetrate deeply and increase their feeding area.

SELECTING A SITE FOR THE ORCHARD

The site for the orchard has a great influence on its bearing qualities. Northern and eastern slopes are regarded as best for apple orchards owing to the fact that they warm up later in the spring than others. This results in retarding blooming and many times avoids injury from the frost. A site facing prevailing winds often has a marked influence in the damage from frost.

Soils on the northern and eastern slopes are generally deeper and richer than those found on southern or western slopes, possibly because the sun does not strike such slopes so directly and does not burn out the humus so quickly.

Southern slopes are earlier and permit of a longer growing season. Trees which are situated on southern exposures receive more sunshine, and usually develop fruits of higher color than on the north and east. In regions where the growing season is short, it is always best to select a strong southern exposure for the orchard. In high altitudes this fact is often of great importance, as any element which will prolong the season for late apples and induce them to take on their full color should be favored. Early varieties in high altitudes will usually mature on northern or eastern slopes.

PREPARING LAND FOR AN ORCHARD

A serious mistake that is commonly made in planting an orchard is to be in too great a hurry. An orchard is planted to last for years, and undue haste at the beginning will generally result in a shorter life for the trees. This great hurry to get the orchard planted is most apparent in lack of preparation of the soil. It takes time to put any soil in the best condition to receive the trees, and frequently, to get the trees planted as cheaply as possible they are put into the ground before the soil is ready to receive them. This is especially true when orchards are planted on land from which the native growth has just been removed.

Land that is to be planted to orchard should be under cultivation for at least two years before the trees are planted, and especially so on lands which have a heavy growth of timber. With such land all of

the stumps and roots should be removed, and this can be done at much smaller expense before the orchard is planted than afterwards. New land is always hard to cultivate, because of the roots which sprout and try to grow, and among young orchard trees such sprouts cause endless trouble until they are removed. It is best on such new land to plant some green manure crop for a year or two. In preparing the ground for an orchard it should be plowed as deep as possible to loosen the soil and make the roots penetrate deeply into the lower soil. Shallow rooted trees do not live long. Use every effort to force the tree roots to go deeply and the wind will not then affect and blow loose the tree. The roots will also obtain more water in this way.

LAYING OUT THE ORCHARD

The plan for laying out the orchard can be arranged in any manner that suits the planter's convenience, although there are two systems generally used, the square or hexagonal. With apple trees the distance for planting varies in different sections. The far western states' apples are frequently set as close as twenty feet, while in the extreme East they will be double or treble this distance.

With pears the distance can be somewhat less, as most varieties are of a more upright habit than the apple. Peaches are generally set about eighteen or twenty feet apart, although when trained with an open center it crowds the trees after they have reached their maturity.

Before laying out the orchard it is always best to figure out how the trees can be arranged to best advantage. They ought to be set so as to allow of ample room around the sides to do the necessary work without crowding against the boundary fence. It is better always to plant the trees so that they have the same, or nearly the same, distance on all sides, rather than to have twice the distance in one direction as in the other.

There are a number of different ways of laying out an orchard and some of the simple plans are very satisfactory. In using any plan the effort should be to get all of the trees set in perfectly straight rows, so that they may be sighted over in any direction and perfect rows can be seen. This is simply to improve appearance.

WHAT KIND OF NURSERY STOCK TO PLANT

There is always more or less uncertainty with the inexperienced as to kind of stock to buy. It always pays to buy the best and is also advisable if not sure to write your state experiment station for their advice. One year trees are now the favorites for planting.

It does not pay to buy trees just because they are cheap. Good trees cost money to grow, and the buyer must expect to have to pay a good round price for good trees.

TIME TO PLANT

Fruit trees can be set out in either the late fall or early spring months. In the Western states spring planting is preferred, as the soil is then in much better condition and more easily worked than in the fall. But in the rest of the country the land is generally in good shape in the late fall, unless excessively wet or unusually dry.

Fall planting has the advantage of getting the trees into their new location with the least amount of time in storage, and trees set out in the fall will make some root growth during the winter and be in good shape to start into growth in the spring. There is generally more time for planting in the fall than in the spring and the work can be done in better shape.

The amount of cutting back of the tops that is necessary at the time a tree is set depends on the age of the tree, whether peach, apple, plum, etc. Peaches are generally cut back to a whip. Apples are shortened back about one-half. Pears, plums, cherries, etc., when two years old stock are cut back about one-third, and where one year old about one-third the length of the tree.

HOW TO PLANT A TREE.

Many persons inexperienced in handling trees lose numbers of them by lack of knowledge. The roots should never be exposed to the air from leaving the nursery until planted in the orchard. Don't expose roots of trees to sun or wind. If not ready to plant when stock arrives heel them in, covering the roots with moist soil until ready to plant. The hole that is dug for the tree must be large enough so that the roots may be spread out naturally without crowding. The hole need not be wide but deep enough to set a little deeper than it stood in the nursery. All of the longest roots need to be shortened in to about six inches and cut with a smooth clean cut. Any roots that are broken or bruised need to be removed, and all cut surface need to be made smooth so they will heal quickly.

Filling in the soil about the trees is a very important step in tree planting. To get the best results the soil must be packed closely about the roots, so that there are no air holes or crevices. The best way to do this is with the hand. When the tree is in place spread the roots out and throw a shovelful of soil over them, shake the tree up and down several times and then work it into the crevices between the roots with the fingers. Throw in a little more soil and work into the remaining crevices, and then with the feet tramp the soil solid. Throw in more soil and tramp, repeating until the hole is full and the dirt about the tree is packed down solid and tight. Moving the tree up and down while the earth is being thrown in will assist materially in avoiding air holes and in bringing the soil in close contact with the roots. There is little danger of packing the soil too tightly about the roots. The greatest danger is in not getting it packed tightly enough and leaving air holes that will let the roots dry out and the tree die.

The trees should be set just a little deeper than they stood when in the nursery, although not over an inch deeper. Setting too deep is as dangerous as not setting deep enough. The best guide is the line marking the change in color of the bark at the crown where the tree enters the ground.

After the tree has been firmly packed in the hole throw an inch or so of loose earth over the packed soil to serve as a dust mulch and prevent from drying out. Watering at the time the tree is planted is not necessary in the Eastern or Middle Western states, but in the semi-arid country, where the trees cannot be irrigated immediately after being planted, it is often advisable to pour a bucketful of water about the newly planted tree. This should be done before the hole is filled with soil, and the water allowed to percolate away. Then fill up with the dry soil and do not pack the surface, but rather let this soil lie loose and prevent the water from evaporating. A dust mulch will very effectively conserve the moisture in the soil for the use of the tree.

ORCHARD TILLAGE.

The ideal system of cultivation for any orchard, either East or West, is to combine the tillage with a cover crop. Stirring the soil is a necessity, not only for the purpose of improving the physical condition of the soil, but for liberating the fertility. In soils that are plowed early in the spring air is admitted and the soil warmed up and drained of excess moisture through evaporation. In summer the plowed layer serves as a means of preventing the evaporation of moisture that is deeper down in the soil, by breaking the capilarity. It also increases the water holding capacity of the soil. By increasing the moisture in the soil decomposition of the organic materials is hastened, and their fertility made available for the use of the plants.

The exact manner of cultivation in an orchard will be governed largely by the kind of trees and the location. It is best in most instances to put the young orchard into a crop of some sort which will necessitate the cultivation of the land. Crops like corn, cotton, potatoes, strawberries, cantaloupes, or other crops of that nature make excellent crops in a newly planted orchard. These crops are temporary,

and are planted for the profit that can be obtained from them. Their culture is intensive and requires a frequent stirring of the soil and these are the conditions needed for young trees. Every effort should be made the first few years to promote wood growth in order to get a large framework for future production of fruit. A tree starved when young will not be productive.

Where strawberries are grown between young trees they will occupy the ground for at least three years, after which time they should be plowed under, and the land planted to clover or some other legume. This is for the purpose of restoring nitrogen to the soil and stimulating the wood growth of the trees. Where corn, cotton or other "hoed" crop is grown, the land will be occupied by any one crop no longer than one year. It is considered to be the best practice not to plant the same kind of crop in the orchard for more than two years in succession. In fact soil experts will advise that any particular crop occupy the land but one year and then be followed by a crop of a different sort. This is because the soil quickly becomes impoverished where one kind of crop is repeatedly grown on the same area. In the young orchard this is especially true, as the trees are to remain for many years and the soil's fertility must not be reduced. A good rotation of crops in a young orchard is to plant cotton or corn the first season and follow with potatoes the next year, following it the next season with a legume of some kind.

Vegetables of all kinds may be grown in a young orchard in place of the crops mentioned, and will serve well in keeping the ground of the orchard well stirred and the trees growing thriftily. Sugar beets are extensively used in the irrigated districts, but are not always desirable because of the late watering that is needed to get the beets to mature. This late watering induces late growth in the trees and makes them liable to winter killing.

Under no condition should small grain be planted in an orchard, as it will not permit of cultivation, and cultivation is necessary in a young orchard for reasons which have been mentioned. This statement applies to the growing of a grain crop that is to be allowed to reach maturity and be harvested either as grain or hay. Rye, wheat, oats and buckwheat are frequently planted in an orchard, but they are used altogether for green manures and under the best systems of culture are not allowed to remain for more than a few weeks, or over winter at the longest.

In plowing the ground in a young orchard, the plows should be run six or eight inches deep, so as to provide a deep covering of plowed soil and to cut the surface roots of the new trees and make them penetrate into deeper soil where it is cooler in summer and warmer in winter.

In the bearing orchard if any crop is grown it should be turned under, adding to the fertility of the soil. It takes an immense amount of soil fertility to produce foliage and wood and much more to furnish the fruit. Orchard land should therefore not be expected to produce a crop of some other sort also.

COVER CROPS.

Cover crops, called also green manures and shade crops, are such crops as are grown in the orchard for the purpose of clothing the surface of the soil during late summer and winter months. They are used to protect the soil from washing during the winter rains, and for this reason are always to be advised for orchards that are on steep, hilly land. In general orchard practice cover crops are sown late in the summer and allowed to remain throughout the winter when they are to be turned under the following spring and become a green manure. For such purposes a number of different kinds of crops are used, depending largely on the soil, climate and the needs in hand.

ORCHARD HEATING

Orchard heating is of very recent origin, although for many years

fruit men and gardeners have tried various plans of preventing frost from injuring their plants and blossoms.

OIL AND COAL FOR FUEL

From the experiments that have been carried on it seems apparent that the source of heat must come from any one of three available sources, viz., wood, oil and coal. Which of these to use will depend on the cost of the fuel laid down in the orchard. In sections where wood is still the most abundant and cheapest fuel, it will be the best to use. In sections where oil can be had cheaper than coal or wood, it will serve; and in other sections coal will be the cheapest fuel.

Doubtless at the present time more persons are using coal for fuel in some way than any other material, and are more familiar with its combustion. In the work of orchard heating it has given great satisfaction and many orchards have been saved from frost by coal burners.

In heating the orchard it is not necesary to run the temperature more than to the freezing point, or at most a couple of degrees above, as there is nothing gained. In fact it may be even objectionable through causing the buds to grow a little and become even more tender than they would be if the temperature is held close to the frost line. To be certain as to the departure of the temperature above or below the freezing point it is necessary that the orchard be provided with several thermometers located at convenient places where they can be looked at frequently by the overseer of the operations.

THINNING AND HARVESTING.

Thinning is done for the purpose of removing a portion of the fruit on the trees so as to allow that which remains to reach a larger size. It is profitable only on trees that are carrying a heavy load. To a certain extent the thinning can be done by prunning away some of the fruit producing wood, but in other cases it will take hand thinning to properly distribute the fruit.

It has been frequently argued that it costs too much to thin, but as a matter of fact, it will cost no more to pick the fruit when it is small than it will when it reaches maturity. In many instances it will not cost as much. It is money well invested at any rate, as the reducing of a heavy crop works to the advantage of enlarging each individual fruit left on the tree, and allows the tree to form fruit buds for the next year.

It is impossible to lay down any set rules for thinning as much depends on the size of the crop. Years of very light crops, thinning may not be necessary, but in heavy years it is advisable. Apples usually produce fruit in clusters of three to six. All but the best should be removed. On the tips of the longest whips fruit is often formed, but will not develop into fancy fruit, so they had best be removed, allowing only the fruit on the spurs to remain, thinning out to only one on a spur.

Pears have about the same habit of fruiting as do the apples, and need to be thinned in the same way. With young trees and with trees that are not carrying a very heavy load of fruit, thinning is not always a necessity, as if thinned on such trees the fruit may become larger than is most desired for market fruit. Very large pears are not wanted by the average market, as when they have to sell at a price above 5 cents each the demands are not sufficient to warrant most dealers handling them.

Peaches, plums and cherries are thinned to a large extent by the operation of pruning. Peaches especially set a far larger number of fruit buds than the tree can possibly bring to maturity, and thinning by removal of some of the fruit producing wood saves a large amount of labor later on. All of the fruit of the peach is produced on wood of

the last year's growth, and the middle portions of such branches will have one or two buds at each node. The thinning should be done before the peaches get any larger than a pigeon egg, and need to be thinned out so that the fruit on any one branch is separated by at least six inches from any other fruit on the same limb.

In thinning stone fruits the work can be done by pulling the fruits off, but with apples and pears it is safest to clip the fruit with sharp pointed shears, as if pulled there is too much liability of breaking off the entire spur.

HARVESTING.

To know when to pick a fruit is a fine art. To know how to pick a fruit can be learned by practice, but not every one can or will learn how to do the operation with all of the care that is necessary in handling a high class crop. The commercial fruit markets of today demand fruit that is in excellent condition, and will pay prices that warrant all of the care that the grower can give the fruit during the harvest.

All kinds of fruit must be picked by hand, rather than by raking off the tree, or shaking onto the ground to be picked up later on. Fruit that is picked from the tree must be laid carefully into a basket, bucket or bag and carried to the packers with the least possible shaking about. Most of the fancy fruit is held in cold storage till late in the season and its keeping qualities will largely determine its price. Fruit which is fully ripe but not over ripe and placed at once in storage keeps best.

FRUIT PLANTING IN BRIEF

APPLES.

As a rule, the apple tree is as hardy as most of our native forest trees, and any soil that will produce good crops of grain or potatoes will be found to be adapted to the growth of healthy and vigorous apple trees.

No other fruit occupies, in the north temperate zone, the commanding position of the apple. Whether it be in size, form or color; in flavor, sweet or sour, an infinite variety of shades; in crispness or tenderness, it will in some variety or other suit any taste. No ordinary farm crop will, on the average, produce one-fourth as much income per acre as a good apple orchard. The fact that six to eight years must elapse before a newly planted orchard will begin to bear deters many from planting. But, as a matter of fact, land can be used a large part of the time for crops, and no great investment is required to plant at the rate of 30 to 50 trees to the acre. When once in bearing, with little actual time spent upon it each year, it will be an unfailing source of cash income.

DWARF APPLES.

The dwarf apple is very much appreciated by those who have small space for planting. Grafted on Paradise stock, the trees never attain large size. They are symmetrical and produce fruit at an early age—three years from planting. They can be set 5 or 6 feet apart and the fruit is easily gathered. For orchard purposes they are as productive as the standard trees, for the increased number of trees per acre produce as much fruit as the smaller number of large trees, and the fruit is more easily gathered, and trees can be more thoroughly and conveniently sprayed.

APRICOTS.

The apricot is a fruit somewhat intermediate between the peach

and the plum. The tree is a round-headed, spreading grower, with dark, somewhat peach-like bark and very broad or almost circular leaves. The fruit, which generally ripens in advance of both the peach and plum, is peach-like in shape and color, with a smoother skin, rich yellow flesh, and large flat stone. The flesh is commonly less juicy than that of the peach, and, as a rule, perhaps of higher quality. Cultivate as for peach.

BLACKBERRIES.

Plant on good land, moderately manured. Rows seven feet apart, three feet in the rows for field; prune as with raspberries. Form a hedge or tie to wire. Cultivate shallow.

CHERRIES.

The cherry thrives best on a dry, sandy or gravelly soil, and there attains its highest perfection, but will do well in almost any situation except a wet one. Cherries are divided into two classes: (1) Hearts and Bigarreaus; (2) Dukes and Morellos. The former are strong and vigorous growers, making large, open, spreading heads; their fruit is large, heart-shaped, meaty and sweet. The Dukes and Morellos do not attain so large size, but are more hardy and less liable to injury from bursting the bark. Their fruit is usually sour.

For dry soils we rate the cherry, and particularly the Morellos class, one of the most profitable fruits grown. The Hearts and Bigarreaus are profitable for home market, but for shipping (except the Dikeman) the Dukes and Morellos carry the best and yield the largest returns. Ordinary well-grown trees produce from five bushels per tree upwards.

CURRANTS

Ripe just before raspberries are gone, and continuing in prime order for several weeks, there is no more useful fruit than the currant, and it is among the earliest to cultivate. Plant in rows 4 feet apart each way, if practicable. Light and air will do as much to enhance the value of currant bushes as with other plants. Keep the ground mellow, free from weeds, and in a good state of fertility, and prune freely every spring. Should the currant worm appear, dust a little white hellebore powder, from a small coarse bag, over the bushes when the leaves are damp. In some instances it may be necessary to repeat this process, but the trouble and expense of exterminating the worms are trifling, if the powder is applied as soon as the worms appear.

THE DEWBERRY

A most wonderful berry, ripening an immense crop of fruit several weeks ahead of anything else in the blackberry line. In some locations it ripens in May. Large, firm, of superior flavor, and attractive. A rampant grower and may be trellised like grapevines. Roots from tips like Cap Raspberries. Those who have grown it consider it to be the greatest berry ever introduced.

GOOSEBERRIES.

This fruit is so useful for cooking when green or ripe and may be canned with such facility that it is being cultivated extensively. Requires same cultivation and treatment for worms as the currant. The American varieties are best although not as large as the English kind, but are not subject to mildew.

GRAPES.

The vine comes quickly into bearing, yielding fruit usually the second year after planting; requires but little space, and when properly trained, is an ornament to the yard, garden or vineyard. The soil for

the grape should be dry; when not naturally so should be thoroughly drained. It should be deeply worked and well manured, always bearing in mind that it is an essential point to secure a warm, sunny exposure.

The best grape vine trellis is probably the wire trellis, with four wires, 18 inches apart. Pruning should be so done that each year two or three of last year's branches shall alone be left, at the spurs of which the present year's growth may start.

During the season when the shoots have reached the upper part of the trellis, they may be pinched to prevent further growth. The following spring the canes should be cut back to two buds. Allow but one bud to throw out a shoot, and treat as in the previous year. This system of pruning should be followed each year.

MULBERRIES.

Mulberry trees are particularly desirable for shade on account of their rapid growth and hardiness. Some people prize the fruit highly for pies. The fruit is used by many farmers for feeding to chickens and hogs, and a tree planted in the chicken yard is a valuable addition to it by reason of the dropping fruit.

NECTARINES.

Culture same as for the peach. The fruit having a smooth skin is liable to the attacks of the curculio, and must be sprayed as soon as the blossoms fall and again every two weeks during May and June.

PEACHES.

The peach tree requires a well-drained, moderately rich soil; warm, sandy loam is probably the best. In order to preserve the continued healthy growth of the tree and the fine quality of the fruit, the peach should have the shoots and branches cut back to one-half the preceding season's growth every year, so as to preserve a round, vigorous head; this should be done the last of February, or as early in the spring as practicable. The land should not be seeded to grass, but kept in constant cultivation.

PEARS.

Cultivate as for peach.

Imperfect fertilization.—Kieffer, Bartlett and some other varieties of pears, when planted in a solid block by themselves, do not properly fertilize. To obviate this difficulty, other varieties should be planted with them. Another active agent in helping the spread of pollen is a hive of bees.

PLUMS.

The plum does best in heavy loam; but it will do extremely well on a sandy or gravelly loam, especially if there be some clay in the soil. They should be thoroughly cultivated and not allowed to stand in grass. Plums should be pruned sufficiently to prevent a straggling growth, and to keep the head from being too crowded. "Black knot" must be removed as soon as it is discovered. The only remedy is to cut off the diseased part and burn it. Permit no black knot to exist about your premises or your neighbor's, if you can help it, but have it removed and burned.

QUINCES.

Plant 12 feet apart, 302 trees per acre. They should be thoroughly sprayed during the fruiting season. Cultivate as for peach and pear.

RASPBERRIES.

Coming immediately after strawberries, when there is a dearth of other fresh fruits, raspberries are equally desirable for planting in the

garden for home use, and in the field for market. They are very easily cultivated. Beds seldom require renewing. Their season of ripening is long. The fruit bears transportation well, and aside from the demand for it for immediate consumption, it brings highly remunerative prices for drying and canning.

Plant in good soil and manure from time to time freely. The hills should not be less than four feet apart each way, with two or three plants in a hill. Cut out the old and weak shoots each year, preserving not over six for fruiting. If the location is so much exposed that the plants are inclined to kill down seriously, they may be bent over in the fall, on mounds of earth formed at one side of the hills and covered sufficiently to keep them down until spring. Surplus suckers take strength from the bearing plants. They should be cut away or hoed up frequently.

RHUBARB OR PIE PLANT.

Deep, rich, moist soil is best, but it is such a strong, vigorous-growing plant, it will thrive almost anywhere. Plant in rows 4 feet apart and the plants 3 feet apart. Set the roots so that the crowns are about an inch below the surface. Rhubarb is a gross feeder; the more manure it is given, the larger and finer the yield.

STRAWBERRIES AND HOW TO GROW THEM.

Strawberry plants are exceedingly hardy, and as a general rule, it is very easy to get a full stand. Plants begin growing within a few days after they are set out, especially when weather conditions are favorable. Should the plants not start growing at once, do not become discouraged, but continue cultivating and hoeing. This will make a dust mulch which will draw the moisture around the plants, encouraging the feeding roots to take hold, and a new growth will soon start from the crown. Should an occasional plant fail to grow the runners from adjoining plants may be layered so they will fill in the vacant places.

If, for any reason, your stand of plants is poor, give the plants which do live good care, and allow them to make a large number of runners. When hoeing, draw the soil with the hoe blade over the runners just back of the node where the young plant is forming. This will aid the young plant to take root quickly. In the fall when the soil is quite moist take up the best of these runner plants, allowing as much soil to adhere to the roots as will and set them wherever the plants failed to grow. By following this plan you easily can have every row completely filled in by October 1st or earlier. In this way plants will not be checked in growth and will give a good crop of berries the following spring.

TIME TO SET PLANTS.

The best time to set plants is in the early spring months; the earlier you can get them into the ground the better. Fall set plants do not bring good results like those set in the spring.

FERTILIZING AND PREPARING THE SOIL.

The best of all fertilizers for strawberries is barnyard manure. It is the great plant and fruit builder. During the winter and early spring months scatter evenly over the ground from twelve to twenty tons of manure per acre, the quantity used depending largely upon the present condition of your soil. In the spring, just as early as your soil will do to work in, plow the manure under, following with the harrow as early as possible so as to pulverize the clods before they have time to become hard. Continue the harrowing until the soil is made fine to the depth of the plowing. Then go over the soil with roller or float so as to press the soil grains firmly together. This leaves the soil in ideal condition for the tool which is to make the marks for the rows. If you are to grow berries in the single-hedge, double-hedge or narrow-matted row, you should make the rows three

and one-half feet apart and set the plants two feet apart in the rows. For hill culture rows should be made from twenty-four to thirty inches apart, setting the plants from twelve to fifteen inches apart in the rows.

THE CARE OF PLANTS.

When plants are taken to the field to be set they should be kept covered in a cool shady place. The tip ends of the roots should be cut back from one to two inches, using shears or knife.

MATING VARIETIES.

In setting plants be careful to get the pistillates in rows between the rows of bi-sexuals. This insures perfect pollination, berries and lots of them. Be careful to have openings in the soil made large enough so that you can put the roots of the plants down straight into the soil. Press the soil firmly against the roots, being careful not to cover the crowns of the plants.

CULTIVATION AND HOEING.

As soon as plants are set you should follow up with a cultivator. You also should hoe shallow round the plants. This hoeing and cultivation will make a dust mulch which will hold the moisture about the plants, encouraging the feeding roots to develop at once. Cultivation should be continued every eight or ten days throughout the entire growing season, unless the ground is wet. Always cultivate after a rain as soon as the soil will permit. The soil should be broken up shallow around the plants often enough to prevent crusts from forming. By cultivating and hoeing in this manner you will keep down all weeds and obnoxious growth. It will keep a dust mulch around the plants which will hold moisture and which will keep the plants growing very vigorously.

In a short time after plants are set they begin to blossom. All blossoms should be pinched or cut off as plants should not fruit the first season set.

MULCHING.

In the early winter cover plants with straw or marsh hay very lightly, just enough to slightly protect the plants. Leave the mulch undisturbed until the plants begin to grow the following spring. Then, with a fork or rake, part the mulching directly over the row. In making this opening in the mulching see that it is wide enough to allow the plants to grow without any obstruction. The mulching should remain between the rows to hold moisture and to keep the berries clean at fruiting time.

SPRAYING THE PLANTS.

Fortunately, the strawberry has but few enemies. However, there are some insects which work upon the plants. For any insect which eat holes in the leaves of the plants spray with arsenate of lead, using three pounds of the lead to fifty gallons of water. Put the lead into a three-gallon bucket; pour over it enough water merely to moisten. Then with a mallet similar to a potato masher pulverize it thoroughly, adding water as you pulverize, until you have made it into a creamy paste. Add this to fifty gallons of water and mix thoroughly. Generally one spraying will destroy any leaf-chewing insect.

For any fungous trouble, such as leaf-blight or mildew, use lime-sulphur solution in the proportion of two gallons of solution to fifty gallons of water. This material may be purchased from any manufacturer of spraying materials. However, it is unnecessary to spray at

all unless some insects are working upon your plants or some fungus is present upon the foliage.

PICKING, PACKING AND MARKETING.

Do not pick strawberries when the vines are wet from dew or rain, unless the season is wet and local conditions make it necessary to do so. Do not jerk the berries off, but pinch the stem with the thumb nail, leaving a short piece of stem to each berry, which will aid the berry in shipping and also will give it a better appearance. Berries which are to be shipped a long distance should be picked before they become fully ripe. Berries which are to be marketed at home may be perfectly ripe before picking. Pick over the vines every day or as often as enough berries ripen to justify it.

TREATMENT OF PLANTS AFTER FRUITING.

After the plants have fruited mow off the foliage, using an ordinary two-horse mowing machine or sickle or scythe. The size of the patch will determine the kind of tool which should be used. If the foliage dries quickly after being cut off—say within forty-eight hours—the entire patch may be burned over by setting fire on the side of the patch from which the wind is coming. The wind will blow the fire over the field quickly and it will consume all of the mulching and foliage without injuring the crowns of the plants. Should conditions not permit the burning over, rake up the refuse and haul it off the field. After the mulching has been taken care of either by burning or hauling away, take a common breaking plow and throw a furrow from each side of the row into the center of the space between the rows. This will leave a ridge or back furrow between every two rows of plants. This may be leveled down either with a five tooth cultivator or with a harrow. It is well to use a harrow going both north and south, and east and west over the patch. This levels the soil and draws enough fine soil over the crowns of the plants to permit them to make their new root system. Should you not care to use a breaking plow to narrow the rows, take a two-horse corn cultivator and tear out the sides of the rows, leaving only a narrow space in the center. Harrow the same as with the breaking plow, and be sure and use a harrow which will permit the teeth to be slanted backward, so that it will not tear out the plants. After the plants begin growing, cultivate and hoe the same as with newly set plants. When hoeing, cut out all the weaker plants, leaving only the strongest and best ones.

By following these suggestions you can get a large crop of berries the following spring, making two big crops from one setting of plants. After the second crop of berries is picked, plow the plants under and sow forty to fifty pounds of winter-vetch seed per acre. This is one of the greatest legume crops ever grown, and the best crop to prepare the ground for another crop of berries.

GRAFTING

(By Prof. O. B. White, Colorado).

It has been proven by long experience that if properly done, the grafting over of old trees by top-working brings quicker returns than the replanting of young trees. In fact, it is not uncommon to see a fairly good crop on the three-year-old top of a top-worked tree.

Top working, as a means of establishing a weak-growing variety on a stronger root system than its own, is coming into high favor.

The practice of grafting is not a mysterious art, as many suppose, but is so simple that any careful orchardist can and should do it himself. All common fruit trees can easily be budded or grafted.

The apple and pear may be inter-grafted upon each other, and this is true of the peach, plum, apricot and almond. However, such wholesale mixing is not good practice, and the pear and apple never take a good union.

Peach grafts start vigorously upon apricots, and plums upon the peach trees.

Growth in diameter of the tree only takes place in a very small region between the bark and the sap-wood. This part of the stem is called the cambium, and in this thin layer of tissue the cells are still active while the activity of each succeeding layer on each side grows less and less.

The important point in grafting is to see that the cambium layers of the stock and the scion are matched at some point. When the growth is active we say the bark "peels." Budding is done during this period, not only because the ease with which the bark separates from the wood simplifies the work of inserting the bud, but as the growth is more active the tissues of the bud and the stock are more likely to unite.

It does not pay to graft trees which show poor growth, and it seldom pays to top-work any crab. It is also questionable as to whether it pays to top-work stone-fruit trees. While good tops may be grown on either peach, apricot or almond, it is doubtful whether these crops will bear much quicker returns than young trees set in the place of the old ones.

There are various methods of grafting, the most common in the West being cleft and kerf grafting. These operations are simple and are known to most orchardists.

In cleft grafting, the limb is sawed off squarely, the stub split down about two inches with the grafting chisel, and the clefts wedged open with the scion inserted as a wedge.

The first bud should be left a little below the top of the wedge, cutting the edge of the wedge opposite the bud a little thinner than the other. The scion is then driven firmly into place with the lower bud to the outside and a little below the top of the cleft.

It is important that the inner bark on the outer edge of the wedge should be brought in contact with the inner bark on the stub. It is between these parts that the union takes place.

Kerf grafting is almost the same as cleft grafting, only the stub is prepared by saw cuts instead of splitting. These are made on opposite sides of the stub and trimmed to thin V-shaped grooves with a saddler's knife, the scion is then trimmed to fit, driven firmly into place and waxed as in cleft grafting.

It is not good practice to remove the whole top of the tree the first year and graft all the stubs. Often this proves too much for the tree and it fails even after the grafts have made a good start. They may linger two or three years and then die.

A better plan is to cut away only enough limbs to set scion for a good top, generally about half of the tree. Working of more stubs results in too dense a top, or necessitates their removal later.

The remaining limbs may be shortened, but some foliage is needed to protect the stubs and trunk from sun-scald, as well as to supply nourishment.

PRINCIPLES OF PRUNING

It is an easy matter to learn how to prune where one has the plants to work upon, and the time to watch their responses to the operations made upon them; but it is a difficult matter to tell others how to prune. No two plants are alike. No two branches are alike. No definite rules can be formulated which will apply to every kind of plant in every locality in which it may be growing.

While there is more or less of difference in the style or system of pruning used in different sections of the country, there are certain well defined principles which will apply to all plants in any climate, or under any system of pruning. Pruning will modify the vigor of plants, and in some ways will cause them to produce larger and better fruits. It will keep the plants within bounds and may

change the habit from wood producing to fruit producing. Pruning allows the removal of superfluous parts and of injured branches or roots. Intelligent pruning will facilitate the operations of spraying, harvesting and cultivating the orchard, and will enable the operator to train the plant in the form most fitting with his ideal.

When the plants are making an excessive amount of wood growth they do not make fruit buds. Checking the growth on the top by pinching or summer pruning will tend to produce fruitfulness.

And while fruit bearing may be to a large extent governed by the methods of pruning, the habitual production of fruit is better regulated by small amounts of pruning regularly done, than by heavy pruning at infrequent intervals. In the case of old trees which have been neglected, it may take two or three years after severe pruning before the balance between top and roots can reach an equilibrium and the tree become fruitful. Light pruning every year is much better for the trees than heavy pruning done occasionally.

Pruning may be made a means of thinning the fruit by removing the fruit producing wood. In the case of plants which produce their fruit on the long growths of the season before, as in peaches, quinces, raspberries, blackberries and grapes, many fruit producing buds will be removed with each branch that is pruned off. In the case of trees that tend to an alternation in the years of fruitfulness, as in apples and pears, the tendency to alternation may be somewhat overcome through pruning.

SPRAYING

The operation of spraying has come to be regarded as of vital importance to the horticulturist, taking rank along with each of the other important cultural practices. "Spraying is only one of the several practices which are of fundamental importance in the care of fruit plantations. Old and neglected orchards are hardly worth the labor and expense of spraying. Spraying is perhaps not always necessary unless insect or fungus troubles are present, but as these enemies are nearly always troublesome and no one can be sure of their absence, it is good insurance to spray. The risk is too great to allow the practice to be omitted.

HAND AND POWER PUMPS.

In orchard spraying there are but two types of sprayers to be considered, one the hand pump and the other operated by power, as gas, compressed air, gasoline engine or traction power. It is the opinion of all practical orchardists who are making a success of their spraying work, that the hand power outfits are not suited to an orchard covering more than four or five acres. This is because the necessary pressure and speed cannot be obtained in hand power machines to cover the larger acreage in the limited amount of time that is available.

In point of time, any application of spray mixture must be applied when it will do the most good, and with insects this limits the number of working days to just a few, possibly ten days, when the insects can be most effectively reached. The spraying must be done during that time, as either before or after that period the spray mixture will not be so effective as the insects will have passed out of reach. The same thing is true of fungous diseases and the grower must know something of the life and habits of the pests he is combating.

The time has long since passed when it is reasonable for any orchardist to ask if it pays to spray. That problem has been so thoroughly proven and so widely advertised that anyone who asks such a question, especially if he has been anyway concerned in fruit growing or has read, even casually, any publication treating on the subject of fruit growing, cannot help being convinced that spraying does pay, and pay well, when properly done.

But to make it pay the best the spraying equipment must be suited to the conditions under which it must be used. The chief points to be considered in this respect are the kind of plants to be sprayed—that is, whether they are strawberries, grapes or tree fruits, and the acreage to be covered. In all machines it is important that there be an effective agitator for keeping the liquids stirred constantly while being applied to prevent the heavier part of the material from settling to the bottom and causing irregularity in the strength of the material that is applied.

SPRAYING MATERIALS.

Since the discovery of effective means of controlling insect and fungous diseases of plants a great number of preparations have been devised for the control of special diseases on certain crops. Such a formidable list of these preparations have been published that it would seem at first glance that one would need an elaborate chemical laboratory in order to prepare the materials. However, the years of scientific and practical experimentation along this line have eliminated many of these spraying materials so that the plantsman today needs to know how to prepare less than a dozen different sprays in order to control any of the diseases for which a remedy is known.

TO PREVENT HORNS GROWING ON YOUNG CALVES

When circumstances are favorable, as in the case of farmers who build up their herds by raising the progeny, the horns may be prevented from growing by a simple and practically painless method, and the custom of preventing the growth of the horns is becoming more popular and more generally practiced under all conditions except in the case of calves dropped on the open range The calf should be treated not later than one week after its birth, preferably when it is from three to five days old. The agent to be used may be either caustic soda or caustic potash, both of which may be procured in the drug stores in the form of sticks about the thickness of an ordinary lead pencil and 5 inches long. These caustics must be handled with care, as they dissolve the cuticle and may make the hands or fingers sore. The preparation of the calf consists in first clipping the hair from the parts, washing clean with soap and warm water, and thoroughly drying with a cloth or towel. The stick of caustic should be wrapped in a piece of paper to protect the hands and fingers, leaving one end of the stick uncovered.

Moisten the uncovered end slightly and rub it on the horn buttons or little points which may be felt on the calf's head, first on one and then the other, alternately, two or three times on each, allowing the caustic to dry after each application. Be very careful to apply the caustic to the horn buttons only. If it is brought in contact with the surrounding skin it will cause pain. Be very careful also not to have too much moisture on the stick of caustic, as it will remove the skin if allowed to run down over the face. After treatment, keep the calf protected from rain, as water on the head after the application of caustic will cause it to run down over the face. This must be carefully avoided.

HOW EARLY TO PLANT

COOL WEATHER VEGETABLES.

The seeds of which may be sown, or the plants set out very early, even before the last of the light frosts are over—temperature in the shade averaging 45 degrees: Asparagus, beet, brussels sprouts, broccoli, cabbage, carrot, kohl-rabi, leek, lettuce, onion, parsley, parsnip, peas, potatoes, radish, rhubarb, salsify, spinach and turnip. Cauliflower, celery, celeriac, corn salad, endive, kale.

REFERENCE TABLE FOR VEGETABLE SEED SOWERS

KIND OF VEGETABLE.	Open Ground.	Ready for Use from Seed Sown.	DISTANCE TABLE		Quantity of Seed, Etc., Required.
			Apart in Rows.	Rows Apart.	
ASPARAGUS, Seeds	April and May	3 to 5 years.			2 oz. for 100 ft. row.
ASPARAGUS, Roots	April		1 ft.	2 ft.	100 for 100 ft. row.
BEANS, Dwarf	May to August	45 to 75 days.	3 in.	2 ft.	1 qt. for 100 ft. row.
BEANS, Pole and Lima	May to June	65 to 100 days.	3 ft.	4 ft.	1 qt. for 100 hills.
BEETS	April to August	60 to 75 days.	4 in.	1 ft.	2 oz. for 100 ft. row.
BORECOLE (Kale) for spring use	Aug. and Sept.	85 to 100 days.	2 ft.	2½ ft.	¾ oz. for 100 ft. row.
BORECOLE (Kale) for fall use	June	85 to 100 days.	2 ft.	2½ ft.	¾ oz. for 100 ft. row.
BRUSSELS SPROUTS	April to July	100 to 120 days.	1½ ft.	2½ ft.	¼ oz. for 100 ft. row.
CABBAGE, Early	April	100 to 125 days.	1½ ft.	2 ft.	¼ oz. for 100 ft. row.
CABBAGE, Late	May and June	120 to 180 days.	2½ ft.	2½ ft.	¼ oz. for 100 ft. row.
CARROT, Early	April	65 to 85 days.	4 in.	3 ft.	1 oz. for 100 ft. row.
CARROT, Late	May to July	100 to 120 days.	5 in.	3 to 5 ft.	1 oz. for 100 ft. row.
CAULIFLOWER, Early	April	100 to 115 days.	1½ ft.	4 ft.	¼ oz. for 100 ft. row.
CAULIFLOWER, Late	May and June	100 to 135 days.	2 ft.	4 ft.	¼ oz. for 100 ft. row.
CELERY	April	125 to 150 days.	6 in.	2½ ft.	¼ oz. for 100 ft. row.
CORN, SUGAR	May to July	80 to 100 days.	3 ft.	1 ft.	1 qt. for 200 hills.
CUCUMBER	May to July	60 to 85 days.	4 ft.	2 ft.	1 oz. for 60 hills.
EGG PLANT		125 to 160 days.	2½ ft.	1½ ft.	¼ oz. for 100 ft. row.
ENDIVE	April to August	75 to 100 days.	1 ft.	1 ft.	1 oz. for 100 ft. row.
KOHL RABI	April to July	65 to 85 days.	1 ft.	1 ft.	¼ oz. for 100 ft. row.
LEEK	April and May	120 to 160 days.	6 in.	8 ft.	1 oz. for 100 ft. row.
LETTUCE	April to August	75 to 100 days.	1 ft.	1 ft.	¼ oz. for 100 ft. row.
MELON, MUSK	May to June	90 to 120 days.	4 ft.	1 ft.	1 oz. for 60 hills.
MELON, WATER	May to June	100 to 125 days.	8 ft.	1 ft.	1 oz. for 30 hills.
ONION, Seed	April and May	120 to 150 days.	3 in.	1½ ft.	1 oz. for 100 ft. row.
ONION, Sets	April and May		3 in.	2 to 4 ft.	3 pts. for 100 ft. row.
PARSLEY	April and May	90 to 100 days.	4 in.	2 to 4 ft.	¾ oz. for 100 ft. row.
PARSNIP	April	100 to 150 days.	6 in.	2½ ft.	½ oz. for 100 ft. row.
PEAS, Wrinkled	April to July	50 to 75 days.	2 in.	2½ ft.	1 qt. for 100 ft. row.
PEAS, Smooth	April to August	50 to 65 days.	2 in.	8 ft.	1 qt. for 100 ft. row.
PEPPER		135 to 150 days.	2 ft.	1 to 1½ ft.	⅛ oz. for 100 ft. row.
POTATOES	April to June	75 to 100 days.	10 in.	1½ ft.	1 peck to 100 ft. row.
PUMPKINS	May to June	100 to 125 days.	8 ft.	1 to 1½ ft.	1 oz. for 30 hills.
RADISH	April to Sept.	25 to 50 days.	2 to 4 in.	4 ft.	1 oz. for 100 ft. row.
SALSIFY	April and May	125 to 160 days.	6 in.	8 ft.	1½ oz. to 100 ft. row.
SPINACH	April to Sept.	60 to 75 days.	4 in.	3 ft.	1 oz. for 100 ft. row.
SQUASH, Summer	May to July	60 to 75 days.	4 ft.	1 to 1½ ft.	1 oz. for 50 hills.
SQUASH, Winter	May to June	100 to 125 days.	8 ft.	2 ft.	1 oz. for 50 hills.
TOMATO	June	125 to 150 days.	3 ft.	2½ ft.	⅛ oz. for 100 hills.
TURNIP	April to Sept.	60 to 75 days.	6 in.	1½ ft.	¾ oz. for 100 ft. row.

POTATO CULTURE

A rich sandy loam well drained and well supplied with vegetable matter is the best soil for the potato. Stiffer land may be improved as a potato soil by green manuring and drainage, and lighter soils can often be made sufficiently rich by the addition of green manure and fertilizers. Potatoes should not, as a rule, be grown continuously on the same land but should be alternated with other crops. Barnyard manure may be freely used but should as a rule be applied to previous crops in the rotation. If commercial fertilizers are used, a mixture containing nitrogen in the form of nitrate of soda, phosphoric acid as superphosphate, and potash as sulphate, and in which potash predominates, is recommended. Preparation of the land should be deep and thorough.

Planting without ridging generally affords the larger yields, but a stiff soil and the desire for an extra early crop sometimes necessitates planting on ridges. The best time for planting depends on the climate of each locality. The planting should be at times so as to bring the period when the tubers are rapidly forming at a date when the average rainfall is ample. On mellow, well drained soil deep planting (3 to 5 inches) is best, especially when the season happens to be dry. For the early crop or on soil with a tendency to bake, the depth of planting may be decreased. The use of the harrow before the plants are all up and frequent shallow cultivation afterwards until the vines shade the land is advisable. Seed potatoes should generally be selected from varieties grown in the locality to be planted if possible. Cutting the seed pieces a few days before planting appears to exercise no injurious influence, provided, of course, that the cuttings are carefully stored in the interim.

The yield from planting the seed or bud end is generally greater than from the stem or butt end of the tuber. The eyes on the seed end are the first to germinate, and hence are especially important when an early crop is desired.

Exposing unsprouted tubers in a warm place before planting hastens growth, but if continued until sprouts form (which are rubbed off) the yield may be considerably reduced.

Experiments indicate that it is more important to cut the tuber into compact pieces of nearly uniform size than to so shape the pieces as to have a definite number of eyes in each set. No piece should be entirely devoid of eyes, and the majority of the seed pieces should be large enough to support at least two eyes, and better three or more.

At distances of 1x3 feet, and with seed tubers averaging 4 ounces, an acre requires of quarters about 15 bushels.

The total yield increases with every increase in the size of seed piece from the single eye to the whole potato. This increase occurs both in the large and in the small potatoes, but chiefly in the latter.

The gross yield of salable potatoes (large and medium) also increases with the size of the seed piece from one eye to the whole potato.

the net yield of salable potatoes (found by subtracting the amount of seed potatoes and the yield of small potatoes from the total yield) increases with every increase in the size of seed piece from one eye to the half potato. The half potato affords a larger net salable crop than the whole potato, on account of the excessive amount of seed required in planting entire tubers. Taking the average of many experiments, it was found that for every 100 bushels of net salable crops grown from single eyes there were 114 bushels from 1-eye pieces, 131 bushels from quarters and 139 bushels from halves, but only 129 bushels from planting whole potatoes.

These results favor the use of halves as seed pieces if seed potatoes and crop are assumed to be of equal value per bushel, but when seed potatoes command a very high price quarters may be used to advantage.

THE KEEPING OF APPLES

In a bul'etin of the New Hampshire Station F. W. Morse brings out in a very striking manner the fact that the steady loss of weight which fruits such as apples undergo even under most favorable conditions in storage is due to a process of breathing similar to that occurring in animals, whereby oxygen is taken in and carbon dioxid given out.

Since apples and other fruits have no body heat to maintain, the breathing process is not so active as in animals, and they may last months after being picked from the tree. Yet there is a steady, continuous loss in weight as the weeks go by, although the fruit is sound and firm.

This breathing or respiration is stated to be "partly a chemical reaction, and in apples, like most chemical reactions in the laboratory, it grows more rapid as the fruit becomes warmer and is slowed down when the fruit is cooled." Professor Morse's experiments indicate that these chemical changes "take place from four to six times as fast at summer temperatures as in cold storage, and from two to three times as fast in cool cellars as in cold storage."

There is a practical application of this law to be made to the care of fruit, especially at apple picking time.

It is frequently the case that warm days with temperatures of 70 degrees F. occur in October, and sometimes continue for a considerable period. Fancy apples intended for long keeping in cold storage should be cooled as soon as possible and kept cold. The breathing process is at the expense of cell contents and must weaken the keeping qualities as it goes on. And this destructive action is from four to six times as fast out of cold storage as inside it.

Another fact in connection with the respiration is important. It is not stopped in cold storage, but simply slowed. Apples can not be kept indefinitely, but keep about twice as long in cold storage as in a cool cellar.

NUT CULTURE

Nut culture in the United States is in its infancy. Great strides are being made both in the number of nut trees planted and the improvement in variety and quality.

The constant and growing demand for nuts, and the immense quantities of them yearly imported to meet it have given a great impetus to the planting of nut-bearing trees. So palatable and wholesome are the nut-kernels that they should become a staple article of food here as in Europe. The returns from established nut-bearing orchards, as well as numerous experiments, show plainly how successful nut culture may be made in America. Most farms contain land that would pay better planted in nut-bearing trees than in anything else; the nuts, in many cases, paying better than farm crops or fruits, while the trees are growing into valuable timber.

BUTTERNUTS.

This lofty, spreading tree is one of our finest native nut trees, valued for its tropical appearance and beautiful wood, as well as for its nuts. Produces large, handsome, elongated nuts with rich, sweet, oily kernel; very nutritious. Cultivation increases the size of the nuts. The tree grows rapidly and yields large crops in a few years.

FILBERTS (HAZELNUTS)

The filbert succeeds well on almost all soils, the little trees or bushes bearing early and abundantly.

HICKORY.

In flavor and quality of kernel this is generally esteemed the

choicest of our native nuts—of all nuts, some experts have said. The tree is a handsome, stately shade tree, with tough white wood of great strength and elasticity.

HARDY PECAN TREES.

Interest in the growing of pecans is no longer confined to the southern states. It is a success far beyond what has heretofore been known as the "pecan area."

The demand for hardy trees and varieties adapted to the middle and northern states has stimulated experiment. The object of these experiments has been to propagate pecan trees that would not only prove hardy in the northern states, but would produce and ripen their fruit.

Hardy stocks on which these trees are grown, are produced by planting nuts from far northern states and growing the seedlings under northern conditions. The seedlings are budded when two or three years old. Trees from these northern nuts never "winter kill" even with low temperatures and variable weather conditions in the spring.

ENGLISH WALNUTS.

There is no question but what there is a great future in the cultivation of English walnuts in the eastern and northern states, as well as in California and the south. It is generally considered now, that the acclimated trees will succeed wherever the peach thrives. The demand for the nuts is enormous and constantly increasing. It is a fact not generally known that more dollars worth of English walnuts are shipped from California each year than of oranges.

Transplanting may be done with equal success in spring or fall. In planting, the tap root should be severely pruned so as to promote the growth of numerous fibrous roots as well as laterals. The trees should be mulched liberally with coarse stable manure as soon as planted and for the first two or three years the ground should be cultivated or hoed.

The trees are very productive, usually bearing five years of age from $3 to $4 worth of nuts, and at six years are quite likely to double this quantity.

CHESTNUTS.

In America, we eat the nut after meals as a desert, and between meals. We do not look upon the nut as a food. Chestnuts differ from most other nuts in that they contain less fat, and more carbohydrates, being also fairly rich in protein. When taken into the animal body, protein forms tissue, fats are stored as fats, carbohydrates are changed into fat, and the mineral matter (ash) aids in digestion and in forming bone, teeth, etc.

LOCATION AND SOIL.

The chestnut orchard is possible in almost any locality, but should be located on well-drained gravelly soil for best results. It succeeds well on rocky hillsides with soil of sufficient looseness and depth, and with either a northern or eastern exposure. It will thrive on rather poor land, but is slow and uncertain on stiff, clayey clays. In general, it is considered more important to have a thoroughly drained soil than soil of a particular character.

There are numerous methods of planting, but in all the most important thing is to take care of the roots. They are very sensitive to sun and wind and should never be exposed long enough to be dried out. In planting, do not cramp the roots in any way, and see that the growing ends are down and not up. Place fine soil among the roots and pack it thoroughly; if sod has been taken out, turn it upside down on the ground, close to the tree. Young plants are sensitive to being planted too deep and so should not be deeper than they were in the nursery. When large roots have been broken or bruised, they should be cut off smooth with a sharp knife. Planting can not be done too carefully.

CULTIVATION.

Trees in the permanent orchard should be set not less than 30 feet apart each way. They are usually pruned to an open spreading form, with three to five main branches, and cultivation given to that of a young apple orchard.

INSECTICIDE AND FUNGICIDE REMEDIES FOR PLANTS, TREES, ETC.

Insects That Eat Foliage, Fruits, Flowers, etc., whether they are bugs, worms, caterpillars or slugs, etc., are best destroyed by some poisonous insecticide, such as arsenate of lead, paris green or hellebore. If for any reason it is not deemed safe to use a poison, the next best non-poisonous insecticides are Persian Powder, Slug Shot, Fir Tree Oil Soap, Kerosene Emulsion, Tobacco Extract or Tobacco Dust.

Insects That Suck the Juices of Plants, such as lice, green and black fly, red spider, scale, mealy bug, etc., can only be destroyed by skin-irritating insecticides, such as Kerosene Emulsion, Extract of Tobacco, Tobacco Dust, or Fir Tree Oil Soap.

Plants and Fruits Affected by Fungous Disease, such as mildew, spot, dry rot, rust, etc., should be promptly treated with either Bordeaux Mixture, Ammoniated Copper Solution or Flowers of Sulphur.

For Tree Borers—Insects on trunks, eggs on bark, and to prevent crawling up the trunk, use Whale-Oil Soap or Tree Tangle-Foot.

Never apply insecticides or fungicides when fruits are in bloom; it kills the bees and affects pollination.

Application of insecticide and fungicide is best done for fluid solutions with a spray pump, knapsack sprayer, syringe or vaporizing bellows. In powder form they are best applied with a powder gun, bellows or duster.

Arsenate of Lead—A poison rapidly taking the place of paris green. Its great advantages are that it adheres well to the foliage and spraying doesn't have to be repeated as it does not readily wash off by rain. It also remains well suspended in solution so that an even distribution can be obtained. It is white in color and shows just where it has been applied. It does not injure tender foliage.

A. L. For young and tender vegetation 1 lb. to a 40-gallon barrel of water will usually be strong enough; for hard-wooded plants the strength can be increased up to 2 or 3 lbs. Apply as a spray.

Bordeaux Mixture—A fungicide, curing and preventing black rot, mildew, blight, rust, scab and all fungoid diseases of fruits and plants. B M. Dissolve 1 gallon to 50 gallons of water, and apply in a spray. B. P. A combined fungicide and insecticide is best made by adding 1 lb. of paris green to 150 gallons bordeaux spray prepared as above.

Carter's Worm-Killer—For angle or fish worms in lawns, putting greens, etc. It is a non-poisonous powder to be strewn evenly over the affected surface at the rate of half a pound per square yard and then the ground must be thoroughly saturated with water so the powder will soak in; this will cause the worms to immediately come to the surface and die, when they may be swept up and removed.

Clubicide—An insecticide, germicide and disinfecting fluid particularly valuable in addition to its other uses—as a soil sterilizer. It destroys all soil insects, ants, worms, slugs, maggots and fungous diseases and in consequence plants attain maximum root development and produce larger and better crops. It is a certain preventive of club root, maggots and root lice that infest carrots, onions, cabbage, asters, etc. Water the plants thoroughly with it once a week in proportion of 1 gallon of Clubicide to 1000 gallons of water, gradually increasing the strength to 1 gallon of Clubicide to 500 gallons of water as the plants approach maturity.

Copper Solution, Ammoniated—A fungicide, the essential ingre-

dient, "carbonate of copper," being dissolved in ammonia in this, while in bordeaux it is counteracted by the lime. Bordeaux is the cheaper for all ordinary purposes, but for late sprayings, when fruits are nearing maturity, or plants in bloom, copper solution is usually used, as there is no limy sediment left to be washed off.

C. S. Dilute 1 quart to 25 gallons of water; apply in a spray.

TO CAN AND PICKLE VEGETABLES FOR WINTER USE

All vegetables must be freshly gathered and carefully prepared. Not a single law or rule can be modified or overlooked.

To Can Asparagus.—Select perfectly fresh asparagus; wash it well; peel the butts and cut off the hard portion. Cover with boiling salted water, boil fifteen minutes and cool. Arrange the asparagus in wide-mouthed jars, butts down. Fill the jars with cold water, adjust the rubbers and put the tops on loosely. Stand these in a boiler, the bottom of which is protected by a rack. Surround the jars partly with cold water, cover the boiler, and boil continuously one hour. Lift one jar at a time, screw down the lid, cover the boiler and boil for another hour. You cannot lift the lids from any of the jars and lay them on the table, and then put them back on the jar, and have the contents keep. The lids must be screwed down without taking them from the jar. The lids should be solid, either glass or other material without lining.

To Can String Beans.—String and wash the beans. They may be canned whole or cut. Cover with boiling water, add a teaspoonful of salt and boil rapidly twenty minutes. Drain and pack into the jars. Fill the jars with cold water, adjust the rubbers, put the tops on loosely and proceed exactly the same as you would for asparagus, cooking it first one hour, and then thirty minutes after the lids are screwed down or fastened.

To Can Lima Beans.—Fill the jars full of young uncooked beans, then fill them full of cold water, adjust the rubbers and lay on the tops. Place the jars in a wire protecting rack, and pour in sufficient cold water to half cover them. Put the boiler over the fire, cover it closely with the lid, and boil steadily for three hours. Take up the jars, see that they are filled to overflowing, and screw on the covers as tightly as possible. Stand aside, where the air will not strike them, to cool. When cold, again screw the covers, and keep in a dark, cool place.

To Can Corn.—Corn must be perfectly fresh from the field. Remove the husks, cut the tips from the grains, or score them down the center, and press out the pulp. Pack this pulp at once into perfectly clean glass jars, filling the jars within one inch of the top; adjust the rubbers and lay on the tops. Stand the jars in a wire protecting rack boiler and surround them with cold water. Cover the boiler, and after the water begins to boil, boil for three hours. Lift one at a time and fasten the top; do not lift the lid. Then add sufficient boiling water to entirely cover the jars and boil for one hour. Let them cool in the boiler, taking it, of course, away from the fire.

To Can Peas.—Select perfectly fresh green peas; shell and pack at once into clean jars. Fill the jars with cold water; adjust the rubbers, lay on the tops, and finish precisely the same as with corn, cooking the same length of time. The last boiling must be done with the jars covered with boiling water.

To Can Tomatoes Whole.—I have canned many jars of whole tomatoes that have been sufficiently solid to use for salad. This condition, of course, will depend upon the care in selecting the tomatoes. They should be small, round and perfectly solid. Put the tomatoes in a wire basket and then into boiling water for a moment, lift out

and remove the skins. Pack the tomatoes neatly in wide-mouthed jars. When you have all the tomatoes in, fill the jars with cold water, adjust the rubbers, and lay on the lids. Stand the jars in a wash boiler on a rack; surround them partly with cold water; cover the (boiler; bring quickly to a boil, and boil three minutes; lift and fasten.

Blackberries and Raspberries.—Fruit should be ripe, but not so soft that it will mash when handled. Remove all stems. Pack firmly without crushing. Cover the berries with water, add sugar if desired; exhaust for three minutes, process for ten minutes.

Cherries.—These fruits can be quickly pitted with a machine. Pack solidly in syrup or water as desired, in two-pound cans. Exhaust seven minutes and process for twenty minutes.

Peaches.—Use firm, solid fruit that is not too ripe. Peel, cut into halves and remove the stones. Pack firmly in the cans and cover with syrup or water as desired. Exhaust for five minutes, process for fifteen minutes. The best grade of fruit must be unbroken halves. They may be packed in two, three or ten-pound cans . Pie peaches are usually packed in the larger sizes of cans.

To Pickle Beets.—For every dozen new beets use one teaspoonful of whole mace, one quart of vinegar, one teaspoonful of ginger, two tablespoonfuls of grated horseradish. Boil the beets without breaking the skin; when done, if small, leave them whole; if large, cut them into slices, and put into glass jars. Heat the vinegar and spices in a porcelain lined kettle; take from the fire, strain and add the horseradish and pour, while hot, over the beets. Cover and stand in a cool place. They are ready to use in twelve hours and will keep any length of time; or cover left-over beets with plain, cold vinegar.

To Pickle Cabbage.—Chop sufficient cabbage to make one gallon, add to it two good sized onions chopped fine, two red and two green peppers cut into small strips. Put a layer of this in the bottom of a stone jar, sprinkle with a tablespoonful of salt, then another layer of cabbage, and another spoonful of salt, and so on until all the cabbage is used; cover and stand away over night. Next day take it out and press thoroughly in a colander. Put a layer of the cabbage in the bottom of the jar, sprinkle over a few mustard seeds and one or two whole cloves, then another layer of cabbage and mustard seed, and so on until all the cabbage is in. Do not pack tightly. Cover with good cider vinegar, wait until the vinegar soaks to the bottom of the jar, cover again, and so continue until the cabbage is thoroughly moistened with vinegar, and it is ready for immediate use.

Red cabbage may be pickled in the same way, leaving out the peppers.

To Make Sauerkraut.—Select large, hard, white heads of cabbage; shred them on a slaw-cutter. Line the bottom and sides of a clean cask or barrel with the outside leaves of the cabbage. Put in the bottom a layer of shredded cabbage, three inches thick, sprinkle over four ounces of good salt, and with a heavy wooden pestle mash it down. Put in a second layer of cabbage, then salt, and so continue until the cask is full. Cover the top with the outside leaves of the cabbage. On top of this a round board, about two inches smaller than the top of the cask, and on this, a heavy weight. A good clean stone is best. Allow this to stand in a warm place to ferment. When fermentation begins, the cabbage will sink, and you will have considerable liquid on the surface. Take any scum from the surface; cover the cask and keep it in a cool, dry cellar. Sauerkraut will be ready for use in about two weeks. Each time you remove the board to get a portion of the sauerkraut, be careful to replace it.

To Pickle Small Cucumbers.—Wash and wipe one hundred small cucumbers, and place them in jars. Cover them with boiling brine, strong enough to bear an egg; let stand twenty-four hours. Then take them out, wipe, place in clean jars, and cover with hot vinegar spiced with onions, twelve whole cloves, one ounce of mustard seed, and three blades of mace. They will be ready to use in two weeks.