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For Distribution on Farming Demonstration Train "The Hog and Field Pea Special"

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OREGON AGRICULTURAL COLLEGE AND EXPERIMENT STATION

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INTRODUCTION.

This is the sixth demonstration train operated in Oregon through the co-operative efforts of the Oregon Agricultural College and Experiment Station and the Oregon and Washington Railroad and Navigation Company and the Southern Pacific Railroad Company in a campaign of education for greater crops and a larger diversification of agricultural productions.

On the part of the College and Station it is a duty, but on the part of the railroads it is business, they knowing full well that just in proportion as the farmers prosper traffic increases. However, a true spirit of altruism should characterize every effort put forth for the betterment of mankind.

The primary purpose of this demonstration is to carry directly to the farmer the latest information obtained through scientific investigation and practical observation of farm problems relating immediately to this local environment. This effort, however, is not actuated through a spirit of faultfinding with the present methods employed by the farmer, but with the single and sincere purpose of aiding, if possible, in the betterment of his financial and social position.

Agricultural history points conclusively to the fact that the one-crop system is not good for any community. With this system of farming either one of two conditions, a light crop or low price, is liable to prevail at any time, thus disturbing the commercial equilibrium of the whole community. It is a well established fact that the wider the range of agricultural production the more stable is the financial condition of the community. Then again with exclusive wheat production no means is afforded to keep up the fertility of the soil, hence lean years gradually become more frequent until finally serious local financial conditions are developed. To grow wheat successfully for a series of years it must be accompanied with some form of animal husbandry so that certain rotation systems of crop production can be successfully carried out. If a given area of the farm is devoted to the growing of the field pea, alfalfa, corn, milo maze, kaffir corn or other forage plants, and these crops are fed to hogs, poultry, sheep, cattle or horses, it is confidently believed that the prosperity of the community will be much better than if wheat alone were produced. Not only will this system afford larger and surer returns, but the work of the farm will be more evenly distributed throughout the year. The revenues of the farm will also be coming in more regularly, and not in a lump sum at the end of the crop year. It is estimated that $750 coming in a little at a time during the year will do the farmer more good than $1,000 coming as a lump sum at the end of the year. The income from the sale of the diversified productions of the farm coming in as it does from time to time during the year, will greatly aid the farmer in establishing the system of doing his business upon a cash basis, which is very desirable.

Not only should we strive for greater financial possibilities of the farm, but should also work for better and more permanent farm homes in the great wheat producing districts of the state. While these districts have many excellent farm homes, it is distressingly apparent that there are many in these districts which are not what they should be. This in a measure is due to the tenant system of farming, which is not as a whole for the best interest of the community. Renting farms is

honorable and legitimate, but it is much more desirable and contributes largely to a more permanent husbandry if the farmer owns his farm. The great want of much of the Inland Empire is permanent and attractive farm homes. The country and its environment are ideal conditions for the development of the highest class of citizenship, hence the work done for the betterment of farm conditions by our educational institutions, the press, railroads, other business interests and by individuals is of the most commendable class. Let every honorable interest of the state stand together as a unit in this work for the upbuilding of the basic industry of our commonwealth, agriculture.

JAMES WITHYCOMBE,
Director Oregon Experiment Station.

SWINE HUSBANDRY IN OREGON.

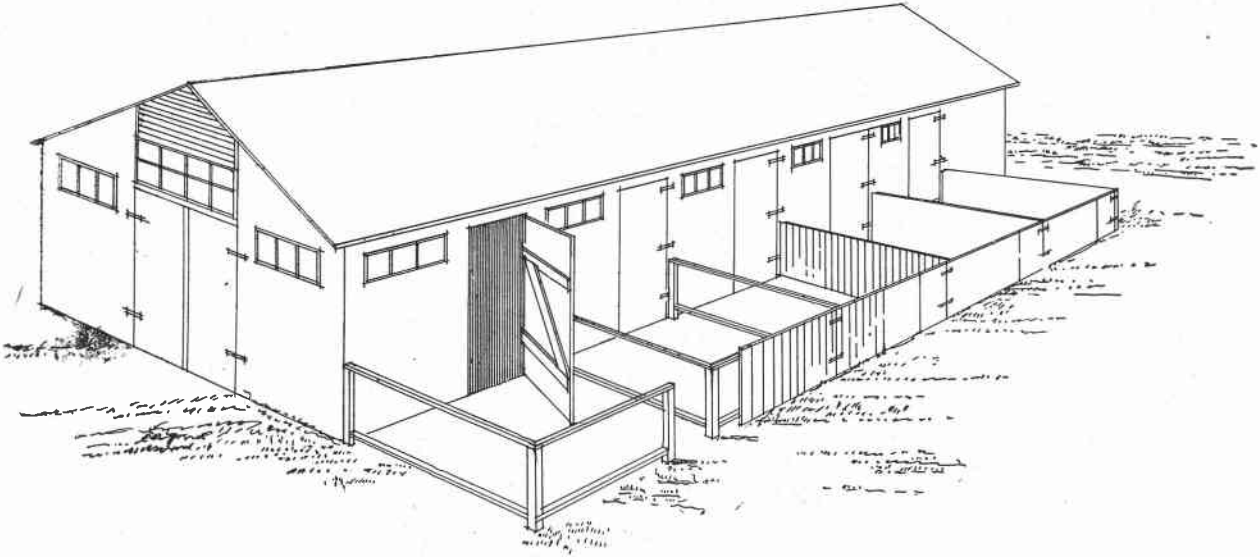
James Withycombe
E. L. Potter

Hogs are correctly classed as "mortgage lifters," and after they have lifted all the mortgages from the farms they will assist in building up more modern farm homes and contribute more to the general upbuilding of a rural community than perhaps any other animals upon the farm. In view of the fact that the hog, when properly handled, is a profitable animal, it is somewhat of a mystery why farmers in the Northwest have not given more attention to the growing of swine. Market values for some time have been very encouraging; in fact the local supply does not by any means meet the demand. It is estimated that $6,000,000 worth of live hogs have been brought to the Northwest during the past year. This would seem to be almost a travesty upon the agriculture of the state, when we consider the abundant opportunities for the economical production of swine. Market conditions promise to be good for some time. The large and modern packing plants at North Portland will always be an active factor in maintaining a stable market for all of the hogs produced in the Northwest. Thus the farmer may have little fear as to the ultimate outcome of the industry.

EQUIPMENT.

Success in growing hogs does not depend upon the expenditure of a large sum of money in buildings, nevertheless they should be kept comfortable and not be exposed to cold and rain. The hog is perhaps the most sensitive to cold of all farm animals. On many farms there are old sheds or other unused buildings which may be made to shelter a few sows and thus enable the beginner to get a start without investing any capital in buildings. Where the industry is conducted upon a large scale and is expected to be more or less permanent such makeshifts are usually unsatisfactory. They are inconvenient and generally unsanitary, hence success in the industry without proper buildings is scarcely to be expected. Hog houses are of two classes, the large or centralized, and the individual, or colony house. The former is intended to shelter the entire herd, while the latter accommodates only one sow and her litter, and thus necessitates as many houses as there are sows.

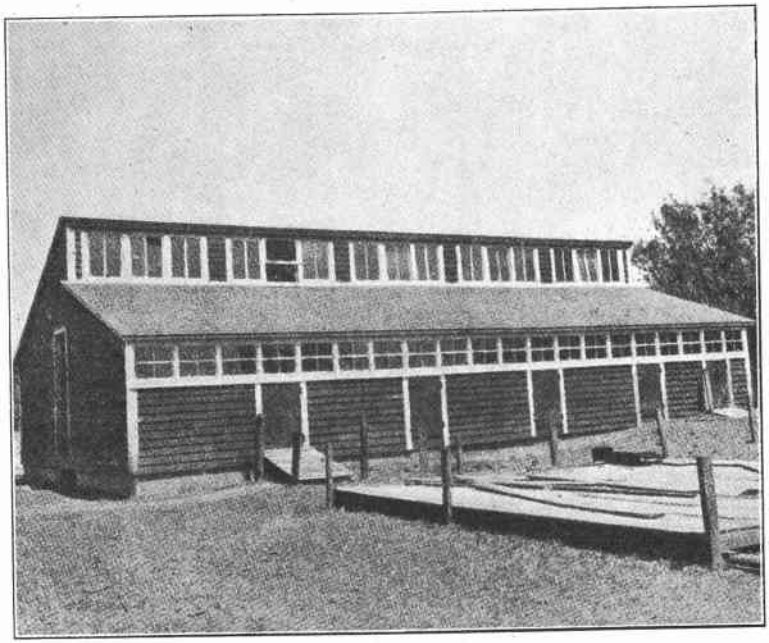
There are many types of large houses, but the simpler ones are usually the better. Each sow in the herd should be provided with a tightly boarded pen inside of the house. Each pen should be about 8 x 10 feet, and should have a window and door opening to the outside. This door should be full height. Doors just high enough to admit the hogs are a nuisance. There should be no passage ways for hogs through which the attendant cannot pass with ease. Each pen should be connected on the inside with a feed alley, so that the feeding may be done under cover and without the necessity of entering the pens. There should be a door from the pen into the alley, and if this door can be of the same width as the alley, so that it will swing across to close the alley, so much the better. On the outside there should be a small pen connected with the inside pen, at least as large as the inside pen, and as much larger as can be made without too great an expense. In Western Oregon the long winter rains make it necessary to floor this outside pen, hence it must necessarily be quite small. In Eastern Oregon such flooring is not required, and the pens may therefore be



Cut 1—A convenient piggery.

quite large, even large enough to be called pastures. If the house can be built adjoining a good alfalfa field part of the pens could be made about an acre in size and the remainder merely small lots. It is not necessary, however, to have a separate pasture for each sow.

In order to best meet the requirements set forth above, and at the same time make the cost of the building as small as possible, the style of building shown in Cut. No. 1 is recommended. A house of this kind may best be constructed of what is commonly called "box" construction, that is, the walls are made of common lumber nailed vertically. The only framing required is a 2 x 4 scantling crosswise at the top, bottom and center, together with a similar scantling placed upright on each side of the doors. In Western Oregon the cracks need not be battened unless on the exposed side, and then only rarely. The house will be sufficiently warm without battens and will be much better ventilated,



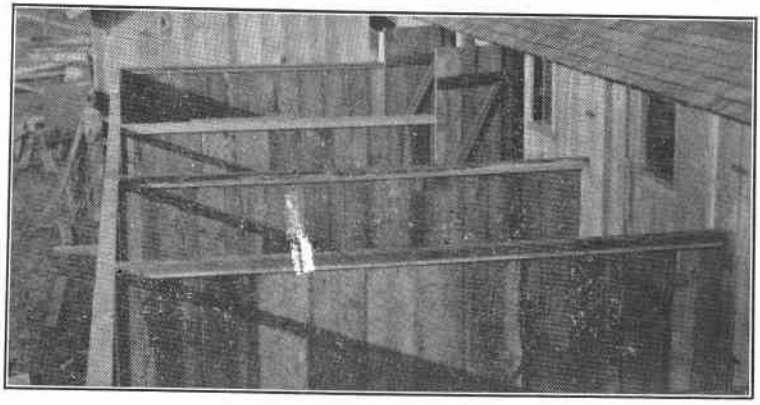
Cut 2—Piggery affording maximum sunlight (U. S. Dept. Agri.)

and ventilation is quite a problem in the rainy winters of Western Oregon, as the air seems to circulate slowly in the damp weather. In Eastern Oregon the cracks should be battened, in most cases. It is not necessary to make the house warmer than this, however, as additional warmth cannot be secured except at the expense of fresh air. Wealthy stockmen sometimes build houses of stone, concrete, brick, double boards with sawdust between, and similar forms intended to afford the greatest possible amount of warmth and to exclude the wind. Then in order to prevent the hog from suffering from foul air they put in such an extensive ventilating system that the building is no warmer than if it had been more simply constructed. In other words, they have wasted their money. It must be distinctly under-

stood that there is a limit to the warmth that may be obtained in a building not provided with artificial heat and still maintain a satisfactory circulation, and between cold air and foul air the cold air is the lesser evil.

The style of house shown in Cut No. 2 is rapidly gaining favor in the central states, and it has many advantages, especially in admitting light and sunshine. This building, of course, faces the south, and the outside pens are on the north and south sides. The inside pens on the north are well supplied with light and sunshine, but the outside pens are necessarily cold and shaded. This form of construction is quite desirable for Eastern Oregon conditions, but style No. 1 would be better in Western Oregon, where the question of getting the direct rays of the sun are less important. Style 1 is simpler and easier to construct, and the outside pens, being on the east and west, get an equal amount of light and sunshine.

A perfect floor for a hog house is yet to be discovered. Concrete is clean, sanitary and durable, but is cold, entirely too much so to be satisfactory. An over-lay of boards is sometimes put on the concrete



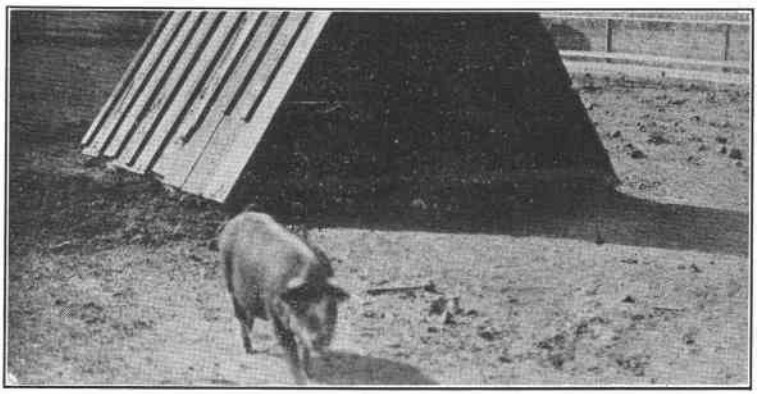
Cut 3—Outside yards for piggery in Western Oregon

in the sleeping pens, but this is no better than the plain board floor and much more expensive. Boards are rather hard to keep clean and rot out quickly, but are quite comfortable for the hogs. For Western Oregon the two-inch board floors are recommended. The small outside pens should be floored with the same material, and the floor made continuous with that of the inside pen. The entire floor should have about four inches slope from the center to the outside. This will facilitate drainage, and in cleaning, the floor may be swept from the inside pen to the outside pen. In Eastern Oregon the floor for the outside pens is unnecessary, while for the inside pens boards will be about the best, although where the ground is well drained and the hogs are not too closely confined a dirt floor will do very well. It is much less expensive and much warmer than any sort of artificial floor. Where hogs are allowed considerable freedom they will usually leave their droppings outside of the house, and thus the house will require very little cleaning. One pen at the end of the house may be partitioned off for the storage of feed.

The small individual houses are largely used in the corn belt where there is much danger from disease, especially cholera. By having a

number of these houses in different pens any outbreak of disease will be confined to one lot, and will not affect the entire herd. The construction of the most simple and best form of individual house is shown in Cut No. 4. If intended for summer use the front need not be closed. For winter a door running the full height of the house should be put in and each side boarded up. A narrow door about two feet wide is the best, as the pigs are afforded more protection, while the door is left open for ventilation. It will be a convenience if the door is made in two sections, so that either the top or bottom section may be left open and the other section shut.

The best device for feeding is a flat-bottomed trough about ten inches wide and five inches deep. This trough should run across the end of the pen next to the alley. It will extend in front of the door leading into the feed alley, but this will not be an inconvenience, as it is low and easy to step over. If made to extend only to the door it will not be large enough to accommodate the pigs the pens will properly



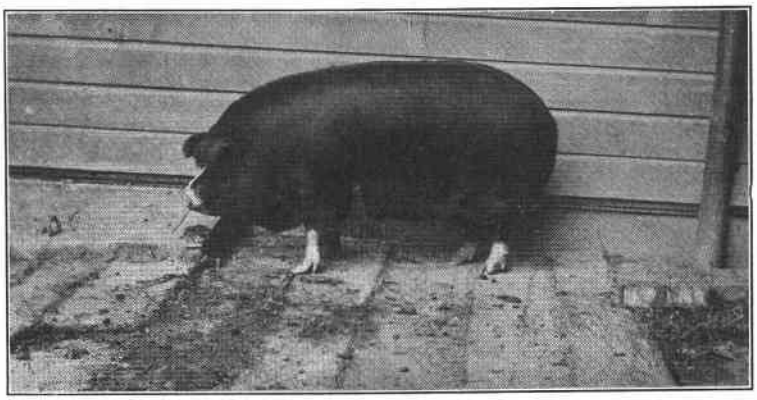
Cut 4—Colony house. (Top of house cut off by mistake of engraver)

hold. It is quite common in the corn belt to build a small feeding floor in the outside lot and put the trough on that. The corn is commonly fed in the ear and the ears are scattered about on the floor. Where small grain is fed such feeding floors are not so common, but they have a considerable advantage in forcing the pigs to get out into the open. In Eastern Oregon, where the hog lots are large and on dry, well-drained ground, such floors will be quite an advantage, and they entail no additional expense, since the house may be made smaller. A 6 x 8 pen with the feeding done outside will be as satisfactory as an 8 x 10 pen with the feeding done inside. Often where feeding is done in this manner the house is simply a long shed about 10 feed wide, with the roof sloping to the north and connecting pens on the south. The feed floors are then placed at the end of the lot fartherest from the house. Where individual houses are used the feeding is usually done in this manner. Many of the best breeders follow this plan with their brood sows because of the exercise afforded. Its efficiency for fattening stock is rather doubtful. In Western Oregon it is not desirable to have the pigs eating out in the rain and trailing back and forth in the mud.

SELECTION OF THE SOWS.

To the beginner in the hog industry the purchase of good thrifty grade sows is recommended rather than pure breds. They will be cheaper and for economical production for the market will do just as well. No beginner should start into the pure bred hog business expecting to sell breeding stock until he has first thoroughly mastered the business of raising hogs for the market. In the first place he should have this knowledge in order to be familiar with the demands of his customers, and in the second place, pure bred hogs are expensive, and it is cheaper for the beginner to do his experimenting and make his mistakes with grades. He should not buy too many; four or five will be plenty. Many men have made failures by plunging abruptly into the hog industry on a large scale. A large hog farm, like any other large business, must be started modestly and built up from its own profits. One should not become excited about the stories he reads of the fabulous profits in hog raising. Hog raising is a good conservative and profitable business, with a very bright future in this state, but it is not a "get-rich-quick" scheme.

If possible the first sows should be bought in the winter, already



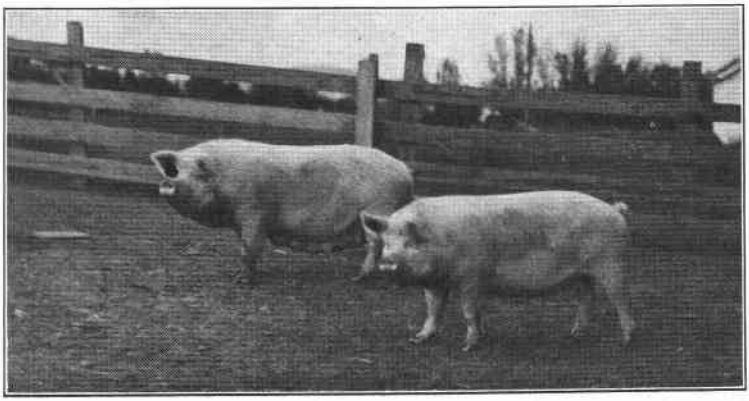
Cut 5—A high class Poland China sow

bred. In this way it will not be necessary to buy a boar the first year, especially with only a few sows, and at the end of a year it will be an easier matter to select the proper kind of a boar. The sow pigs will be old enough also to breed by that time, and may be bred to the new boar, whereas if they were his progeny it would not be desirable to breed back to him. Old sows are generally to be preferred to gilts, but the latter are usually much easier to obtain. Uniformity in sows is also much to be desired. For these reasons it is preferable to select from the same blood lines and even from the same breeder. Some farmers select from widely different herds in order that their sows may not be in any way related, but this is a mistake. It is preferable that all stock be closely related except the boar, which should be of unrelated, but similar blood lines. The points to be considered in the selection of individual brood sows are: An over-fat condition should be avoided, but a marked readiness to fatten is always desired; length of body is considered an especially good point, but in general it must be remembered that any good qualities the pigs may have are to be in-

herited from the sows and the boar, and if the sows are coarse and roughly made the pigs are likely to inherit that tendency.

SELECTING THE BOAR.

In selecting a boar the best should be secured—a first-class pure bred boar of the breed most suitable, and one good enough to head a pure bred herd. Especial care should be exercised in selecting a boar suitable for the sows. If the sows have produced one litter their value as breeders can be easily determined. It is a popular error to think that if the sows are faulty in some respect the boar should be the opposite extreme, if the sows are rangy and leggy the boar with which they are mated should be the extremely short, low down, blocky type. This is a mistake. Boars should be selected which are as nearly perfect as possible in the points in which the sows are deficient, and not those which are just as bad in the other extreme. Perfection in any point is seldom obtained by breeding together two radical extremes. A good thrifty early spring pig may be used for breeding to bring pigs in the following spring, but an older boar is preferable. If an old



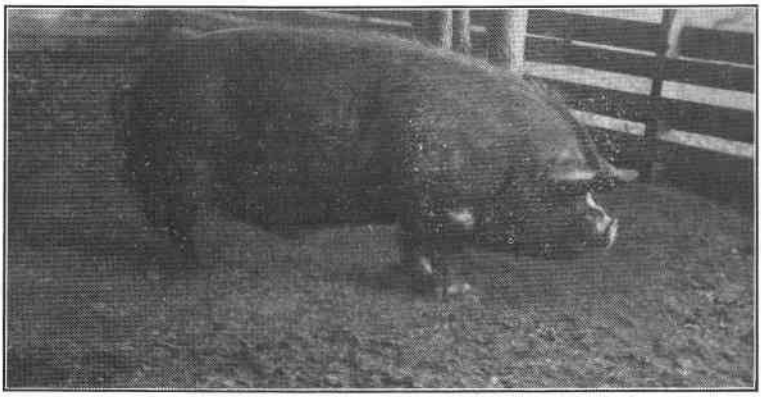
Cut 6—Useful types of brood sows

boar can be purchased, which some good breeder is about to discard, so much the better. A tried sire is always preferable to an untried one, and is usually purchased at less cost. A boar five or six years old should be just as good a breeder as he ever was and even more sure, providing he is active. He may, however, be a little heavy to use on young sows, thus necessitating a breeding crate. By putting the sows in this and carefully adjusting it to the size of the sows a very heavy boar may be used on light sows without danger. Some breeders use such a crate for all their sows. The construction and dimensions of such a crate are shown in figure 5. Some farmers expect to get a boar for twelve or fifteen dollars. Such breeders never get very far in raising good hogs. A boar that is not worth around fifty dollars is not the proper kind. Plenty of boars can be bought for less, but not good ones. In buying sows about the usual market price per pound is customary for grades. Nice pure bred gilts run from $50.00 up in this state. Many successful breeders prefer that their sows be pure or high grades of one breed, and that their boar be pure of another breed. The cross bred pigs so produced are generally especially thrifty and easy to

fatten. Such a practice has many points in its favor, but it is sometimes difficult and expensive to keep up a supply of sows of a different breed than the boar, and then some of the cross bred pigs will look so fine that many farmers succumb to the temptation to keep them for breeding. Choice as they may be for the market they are not to be compared with pure breds for breeding purposes.

THEORIES OF BREEDING.

It is impossible in this article to go extensively into the various theories of breeding and of heredity. A few fundamental truths in the principles of breeding will be given. First, "like begets like." Pigs of the right class can be produced if the right class of boars and sows are used and if (note the "if") the ancestors of the boar and sows are also of this type. There is no other safe rule to follow. There is no mysterious secret known only to the elect. There is no way in which to control the sex of the offspring. Sudden frights, or other vivid mental impressions received by the female during pregnancy or



Cut 7—A famous Berkshire boar owned by the Oregon Agricultural College

at the time of service do not affect the offspring. The first male to which the female is bred does not in any way whatever affect the offspring produced later by a different male. There are volumes written on the subject, but the statements given cover most of the facts which are of practical value to the breeder.

TIME FOR FARROWING.

The most desirable time of the year in most parts of the state for a sow to farrow is in March, with the exception of some of the colder and more exposed places, where April or even May is more desirable. The breeders should therefore be careful about the time of breeding, in order that the pigs may come when wanted, and above all, so that they may know just when the pigs will come, and so be able to prepare for them. By far the best way is to keep the boar in a separate enclosure and take the sow to him when she is in season. One service at one period of heat is ample, more would be exhausting the procreative powers of the boar to no purpose. The sow carries her young about 112 days, but may vary somewhat from this. The periods of heat last

about three days, and recur about every three weeks. After the sow is bred she should be kept on a moderate ration which will keep her in good average condition, unless she is immature, when she should be kept growing nicely. Mature swine of all kinds are generally supposed to maintain a constant weight, and neither gain nor lose to any appreciable extent when fed a ration of one per cent of their live weight per head per day in grain or grain equivalent. A 350 pound sow would therefore be expected to hold her own on 3½ pounds of grain per day, or the equivalent thereof. It is not, however, desirable to feed so small a ration of grain alone, as there is not enough bulk to properly distend the digestive organs, and the animal will therefore constantly crave more feed. In Western Oregon kale or roots or vetch hay, together with about one or one and a half pounds of grain per day will constitute a good ration. In Eastern Oregon alfalfa hay and about one pound of barley per day will be sufficient. Sows are often maintained on less than this amount of grain, especially during the first part of the period of pregnancy. The hay used should be of good quality and especially fine in texture. Small racks similar to those used for feeding cattle are sometimes used, but many farmers feed the hay in troughs or on the floor and do not require the hogs to clean up the coarse stems, but take them out and use for bedding or feed for other stock. Where many horses are kept the best possible plan is to feed the hogs the fine stems and heads which accumulate in the bottoms of the mangers. This is much better than the hay direct from the stack. Common red clover will do just as well in every way as alfalfa when cured under similar conditions, many claiming it is better. Grinding alfalfa for hogs is not usually a good practice, and costs more than is gained. Alfalfa is especially good for brood sows, as it has plenty of bulk and above all, because it contains the protein and mineral matter necessary for the proper development of the litter without too great a tendency to fatten. On a ration of barley, which is sometimes fed, the sow must have enough to make her fat, sometimes too fat, in order to get enough protein and mineral matter to properly develop the pigs. Skim milk is another good feed for sows, and should be fed about as liberally as the supply will admit. In estimating the amounts required for maintaining sows about 2½ to 3 pounds of milk or alfalfa will take the place of one pound of grain. One quart of milk weighs about two pounds, one quart of wheat nearly two pounds, of oats one pound, of barley one and a half pounds. While the estimate of one per cent of the live weight per day is about as accurate an average maintenance as can be given, similar results will not be obtained in all cases, especially where hay or milk of variable quality is substituted for the grain, and the ration will therefore often need to be varied according to the condition of the sow. Some people have a great fear of excessive fat on a brood sow. This is a mistake, for while sows may be injured by excessive fat, a great many more are injured by excessive leanness, and where the sows are excessively fat the damage more often comes through having been fattened on feed with too much of a fattening tendency, and not enough protein and mineral matter. It is not within the scope of this circular to explain in detail what is meant by protein and mineral matter, or to give the chemical analysis of feeds. We will say, however, that the feeds which are unusually well supplied with these elements are alfalfa, clover, vetch, peas, skim milk, shorts, tankage, and kale. Of the grains, wheat and oats have a fair amount, while barley is somewhat deficient. Roots of all kinds, while having a good influence upon the digestive system and being in many ways especially good for brood sows, are not as good for building bone and muscle as the other feeds mentioned, and

when fed should be supplemented with feed having an abundance of protein and mineral matter.

Care should be taken that the sow is not constipated. If there is a tendency in this direction give more laxative food. Roots, kale, alfalfa and bran have a laxative tendency. Do not wait until the sow is about ready to farrow before seeing to her physical condition. Keep her in good condition and there will be no trouble. Sudden changes in the feed and management are quite dangerous just before parturitiou, and should be avoided unless the condition of the sow makes it imperative.

Of almost equal importance with good rations is plenty of exercise. The sows must not be allowed to lie around in their pens day in and day out if good strong litters are expected. They must be made to take exercise. In Western Oregon this is often quite difficult, but in the Eastern part of the state the ground is more frequently frozen and deep mud is less common. In this case feeding at a distance from the sleeping sheds is quite an advantage when the sows do not get out enough of their own accord.

When farrowing time approaches the sow should be separated from the remainder of the herd, and given a nice, well-sheltered pen, such as one of the pens in the hog houses shown, connected if possible with a small lot on the outside. A fender should be made around the sides of the pen by arranging a piece of lumber along the sides about seven or eight inches from the wall and an equal distance from the floor. This will prevent the sows from lying down close to the wall and thus crushing the pigs. Such fenders should be put in temporarily, as they are only in the way and take up a great deal of room after the pigs have attained some size. A good dry floor with light bedding should be provided. Where there is too much bedding the pigs are apt to get tangled in it and crushed by the sow. This is especially true of long, fresh straw. It is often recommended to cut the straw, but this is unnecessary if it is put in a few days prior to farrowing so that the sow will have time to wear it down a little.

If the sow has been fed a proper ration and is in comfortable quarters little or no trouble may be expected; if she has been fed on an unbalanced ration, or is excessively poor or excessively fat, or if she is unduly exposed to the cold and wet, various troubles may be expected. Among these may be mentioned: difficulty in farrowing; weak or dead pigs; pigs chilled to death; refusing to own pigs; eating pigs, or crushing pigs by lying on them. If the simple rules above outlined are followed these troubles will be largely obviated. However, if in addition record of the date of farrowing be kept and the attendant will be on hand when the pigs are born, a large number of pigs may be saved. When it is quite cold and there is danger of the first pigs farrowed chilling to death before the others are delivered, the first may be put in a tub or keg containing a jug filled with hot water, and with a blanket over it. This will keep them warm, and when all have come they may be put back and allowed to suck. Sometimes it is necessary to place them in the tub a few times before meals. In ordinary cases such precautions are not necessary. Quite often the scum and mucus covering the pig at birth will close up the nostrils and smother the pig, but wiping the nose at once with a wisp of straw will prevent this. Where the sow is extremely restless and there is much danger that the pigs will be trampled or crushed, in spite of the fenders, they may be removed one at a time as fast as they come and put into a warmed tub, as previously described. Often by keeping them there for a few hours, except when with the sow for suckling, the sow will quiet down and there will be no further danger. There are many

remedies proposed for sows eating their pigs, but about the only real remedies are preventives. Sows usually start eating their pigs because of a feverish condition of the system. Sometimes this is due to having been fed on feeds that were excessively heat-producing, and lacking in mineral matter and protein; sometimes it is due to a lack of exercise; often it is due to cold, wet and general discomfort at farrowing time. After a sow has once learned to eat her pigs she will very likely do the same thing the next time, though the condition which caused her to begin the practice be no longer present. In other cases the sow is apparently naturally vicious and restless. After the habit is once formed the chances for its cure are small. The sow should be sent to the butcher and the pigs put with other sows if possible. Feeding the sow raw meat, salt pork and various other remedies have been suggested, but they are not reliable.

After farrowing all feed should be withheld from the sow for twenty-four hours. Especial care should be exercised regarding this, as many sows are injured by being fed too heavily the first day. After twenty-four hours give a thin slop of middlings and water or milk, and gradu-

Cut 8—A family of thirteen

ally increase the ration until by the end of ten days or two weeks the sow is receiving all she will eat. Before farrowing the ration should be rather light and bulky, afterwards it should be heavier and more concentrated. The best grain at this period is composed of barley or wheat and middlings. The ideal ration would be entirely of middlings at first, with barley added gradually until at weaning time the ration is half barley. Wheat could take the place of barley and would be even better. Middlings are the best possible feed for brood sows with pigs, but the price is often so high as to be prohibitive. At a price not more than ten per cent higher than wheat or barley it is about as cheap for any class of pig feeding. A liberal amount of feed should be given at this period, as the sows suckling pigs will pay better returns for the feed given than at any other time. The sow should be given all she will clean up well, which with a mature animal will amount to as much as ten or twelve pounds per day. For best results some supplementary food should be provided with the grain, the best being skim milk. A small amount of tankage, or the run of a good pasture is also good.

SUCKLING PIGS.

When the pigs are from two to three weeks old they should be taught to eat. A small corner of the pen should be fenced off in such a way that the pigs can enter but the sows are excluded. In this pen a slop of middlings or shorts should be placed so the pigs can help themselves. They will eat very little at first, but will learn rapidly, and by the time they are one month old will be eating enough to make appreciable improvement in their gains. This is the time when it does not pay to economize in feed, either in the amount fed directly to the pigs or in the amount fed to the sow. It will require less feed to make a pound of gain on little pigs at this age than it will on pigs after weaning, not deducting the amount of feed which the sow uses for her own maintenance. An experiment made at Wisconsin shows that sows and pigs for ten weeks before weaning made 100 pounds gain on 316 pounds of meal. This includes the gain made on the sows as well as that made by the pigs. The sows gained little, however. After weaning, the pigs for seven weeks required 384 pounds of meal to make 100 pounds gain, while the sows during the same period required 947 pounds of meal to make 100 pounds gain. Deducting the amount of feed which it was estimated was required by the sows for their maintenance, it was found that the pigs before weaning made 100 pounds gain on about 250 pounds of feed (grain or its equivalent). Other experiments and practical experience indicate that the above figures are not far from correct.

WEANING.

Pigs may be weaned at from six to twelve weeks of age. Where two litters per year are raised it is necessary to wean at the earlier age, since sows do not as a rule breed readily while suckling. Pigs, to do well when weaned at six weeks old, must have been taught to eat before weaning and must have a good deal of milk after weaning, otherwise they will be somewhat stunted. Some breeders wean by taking away the whole litter, returning them to the sow a few times; other breeders take away most of the litter, but leave a few for several days. The most common way, and in most cases the best way, is to take all the pigs away at once and not return them. Where the pigs reach the age of ten or twelve weeks the sow may wean them, or in case they do not the pigs are so nearly weaned that they do not notice the separation. The main object of returning the pigs to the sow after they have once been taken away is that she may be dried off gradually, but the pigs are much more restless after they have once been back. The better way is to leave the weaker pigs with the sow for a few days, except in a few cases where the pigs which are left refuse to suck any but the teats to which they have been accustomed. This, however, is not apt to occur unless the pigs get all the milk they can consume from the teats to which they are accustomed.

AFTER WEANING.

After weaning, the pigs must have a liberal supply of skim milk or pasture in addition to their grain. If neither of these supplements are obtainable growth will be more slow and expensive. The following taken from Henry's "Feeds and Feeding" gives the average amounts of feed per day, daily gains and feed per one hundred pounds gain for pigs of different ages.

	Daily Feed.	Daily Gain.	Feed per 100 lbs. Gain.
15 to 50	2.2	.8	293
50 to 100	3.4	.8	400
100 to 150	4.8	1.1	437
150 to 200	5.9	1.2	482
200 to 250	6.6	2.3	498
250 to 300	7.4	1.5	511

The above table does not represent extremes, but average pigs eating an average feed and making average gains. The daily feed is expressed in terms of grain, although it must be remembered that the ration in many cases was not all grain; where it was not the other feed has been reduced to terms of grain.

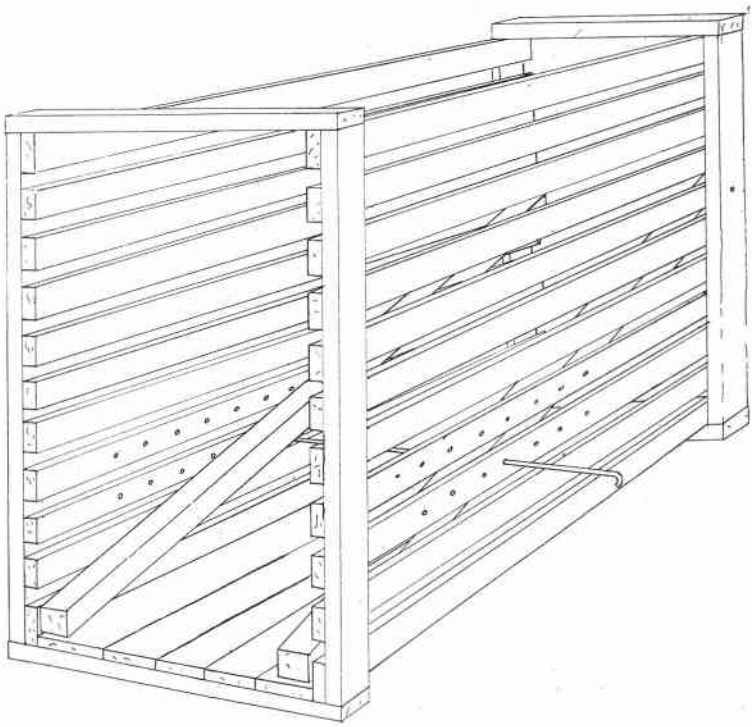
Good thrifty pigs fed on a first class ration may be expected to eat more feed and make faster gains, and in some cases more economical gains than the averages given. Poor pigs and poor feed will not make as good a showing. The average pigs at the Oregon Experiment Station eat more feed and gain faster than indicated. Nevertheless the table given is a good indication of what can be done under average conditions, and it is suggested that the prospective pig raiser memorize this table. It will always serve as a guide as to what should be done. The first column, 15 to 50 pounds, will represent pigs at about weaning time. Few pigs are weaned at less than 15 pounds even at six weeks of age, while on the other hand few reach 50 pounds while yet with the sow, although they will crowd that weight if allowed to run until twelve weeks old. The equivalent in grain required at this time is 2.2 pounds. Part of this may be made up of pasture or skim milk, or even roots or kale. Not less than 1.5 pounds of grain per day should be fed at any time, and from that up to a full ration of all they will clean up with a relish. The time from weaning to the last period when they are crowded and fattened is called the growing period, although they will often fatten some during this time. Practice differs as to the amount of grain it is well to feed at this time. The minimum amount for pigs to be of good form and not stunted and pot-bellied is 1.5 pounds per day up to 100 pounds live weight, and a proportionate amount above that weight. The maximum amount will be all that they will clean up with a relish. A safe rule is that when the price of pork on foot at the farm is more than five times the price of the grain a rather heavy ration should be given; when the price of pork is five times or less than the price of grain a minimum amount should be fed; for example, when pork is 8 cents on foot and grain is 1¼c a heavy grain feed should be given; when pork is 6½c per pound and grain 1¼c, a minimum amount of grain should be fed. This growing period will last until the pig is from five to six months old, depending upon the amount of grain he has been getting, usually only five months, and at a weight of nearly 100 pounds.

FATTENING.

After the growing period the pigs should be put on a full ration and fattened for market as rapidly as possible. This fattening period will last about 60 days, and at the end of this time the pigs should weigh about 200 pounds, which is the most salable weight in this state. After this weight the gains are slower and more expensive, and the price per pound received for the animal will be less, hence the total profit to the grower will be less. As pigs are ordinarily handled the growing season will come at the time of the best pasture, and by the time they are ready to fatten the pastures will be short and dry and will furnish but little feed. The fattening pigs do not need much exercise, so it is

well to put them in comparatively small pens and feed grain, supplemented with skim milk, tankage, middlings or some similar feed. A little rich, green alfalfa pasture, such as is found in many places in Eastern Oregon, will be very satisfactory, but the pastures of Western Oregon, especially those found in the latter end of the season when the pigs are ready to fatten, are of little value except for growing pigs and stock hogs. Rape properly cultivated, however, will furnish a good pasture late in the season.

The grains that are used for fattening are largely wheat and barley. Pound for pound these two are about equal. The one chosen should therefore depend upon the market price. In some places and in some

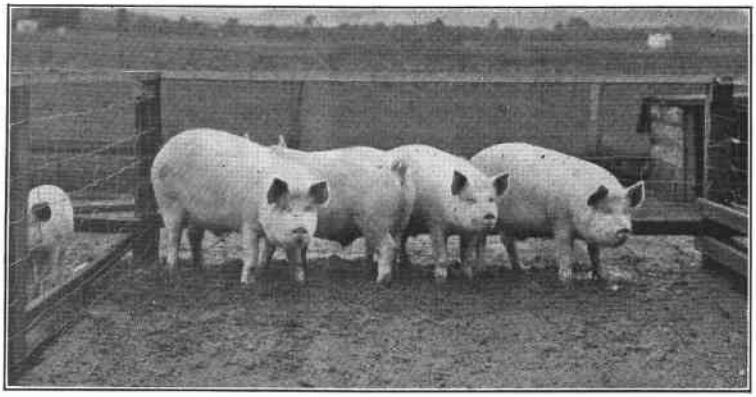


Cut 9—Breeding crate

years a little corn may be used. Corn also has about the same value as wheat, pound for pound, the preference, if any, being for the corn, if it is properly supplemented. None of these feeds should be fed alone, but supplemented with a small amount of some such feed as skim milk or tankage. The pigs will eat more, will go off feed less readily, will gain faster and take less feed per pound of gain when so fed. Of all the supplements which may be used skim milk and tankage are the best. It is hard to say which is the better, not considering price. Ten pounds of milk per day per pig should be about right. If tankage is used about one-half pound per day per pig would give about the same results as the ten pounds of skim milk, although perhaps a

trifle more grain would be used by the tankage hogs; say one-half pound more grain per day. On this basis one pound of tankage and one pound of grain would be equal to twenty pounds of skim milk. In experiments at the Oregon Experiment Station, where pigs were fed on this basis, practically the same gains were obtained. Also from the standpoint of the chemical nutrients contained the two would be about equal. Tankage will cost in ton lots about 2½c per pound. On this basis skim milk would be worth a little less than 20c per hundred pounds, or roughly, about 1½c per gallon. Where these supplements must be purchased they may be purchased on this basis. In most cases, however, the skim milk will be a home product and would otherwise be largely wasted, but the tankage must be purchased.

In comparing the feeding of grain alone with grain supplemented with skim milk or tankage, the results are in favor of the supplements. Experiments at the Oregon Experiment Station, where grain feeding has been compared with grain and skim milk, have shown that 100 pounds of skim milk have saved from 20 to 50 pounds of grain, more commonly about 30 to 40 pounds. One hundred pounds of tankage have saved about 400 pounds of grain. A dollar invested in tankage



Cut 10—Some thrifty pigs

at 2½c per pound, or in skim milk at 20c per hundred pounds will thus usually save from $1.50 to $2.00, and in some cases even more. It must be understood that this saving applies only where limited amounts of such feeds are given in connection with grain. If these supplemental feeds were to take the place of the entire amount of grain no such saving would result; instead the pigs would probably go off feed and the results would be entirely unsatisfactory. The reason for this is that grain, as wheat or barley, supplemented as mentioned, makes a well balanced ration. It is appetizing and suited to the pig's digestive system, and contains the proper amount of the nutrients which the pig needs. Grain alone, or skim milk or tankage alone, will not meet all of these requirements.

There are other feeds which may be used as a supplement to wheat or barley with good effect. The best of these is middlings. Where middlings are fed from one-fourth to one-third of the ration should be of this feed. When fed in this way good results can be expected, and it will be found that the middlings will save much more than their own weight in grain. When used in this way middlings will be worth from

$2.00 to $3.00 per ton more than wheat, barley or corn, and may be purchased on this basis. As to using more than one of these supplements at once, we would not recommend the purchase of tankage when skim milk is abundant, and not ordinarily when middlings are cheap. Both middlings and skim milk may be fed to advantage to hogs of any age, but especially to sows suckling young pigs and to growing pigs from one to four months old. Shorts may be used in place of middlings if of similar composition. Some shorts are about the same as middlings, while in other cases they are the same as bran. Bran is a bulky feed and contains so much fiber that its use for pigs is not recommended, and its value for dairy cows makes the price too high to justify its use for pigs. Alfalfa, vetch or clover hay, which is especially valuable for stock hogs in winter, has little value for fattening hogs, and its use for this purpose is not recommended. The same may be said of kale and roots. Oats are very good for pregnant sows, but have too much bulk for the best results with other stock. Sheaf grain is very good, but much better results are secured if it is threshed. Experiments conducted at the Oregon Experiment Station some years since showed plainly that the waste of feeding sheaf grain amounted to a great deal more than the cost of threshing. In some places the hogs are allowed to run in the field of uncut grain, or to "hog it down" as it is called. There is of course no expense to this method, the waste is comparatively small, and the indications are that the practice is one that may well be extended. There is not sufficient conclusive evidence on the subject at hand, however, to unqualifiedly recommend the practice, but it is suggested that growers try it on a small scale, especially in the dry farming sections, and on grain that is too short to harvest by the usual methods.

FEEDING EXPERIMENTS AT THE OREGON EXPERIMENT STATION.

Nearly fifty experiments in pig feeding have been carried on at the Oregon Experiment Station in the last twenty years. In some cases the results have been unsatisfactory, and in others it has been necessary to duplicate the experiment a number of times before correct results could be determined. Nevertheless a number of important problems relating to the feeding of pigs, especially regarding the fattening for market, have been worked out. It will be impracticable to give a full account of each experiment, but the principal points investigated will be noted briefly.

THE GRAIN REQUIRED FOR 100 POUNDS GAIN during the fattening stage has been a little less than that required at the eastern stations. The Oregon station has found the average to be about 450 pounds as compared with 500 pounds in the east. There are perhaps two reasons for this; first, a balanced ration has been fed in nearly all cases; second, the pigs have been fed at an earlier age. The western markets demand pigs weighing about 200 pounds, while the eastern markets prefer a pig weighing nearly 300 pounds. On exactly the same feed it will take about 50 pounds more feed to make 100 pounds gain on the larger pigs.

GROUND GRAIN has in all cases proved more economical than whole grain. This result has also been confirmed by experiments conducted by eastern stations with small grains, although eastern stations have found it unprofitable to grind corn.

SKIM MILK has been fed in a large number of cases as a supplement to wheat or barley, and in comparison with these grains, fed alone. The gains were in all cases larger and more economical. The pigs ate better, gained more rapidly, were better finished, and brought a higher

price at the close of the experiment. Leaving out one experiment where the results were evidently abnormally high, and one where they were abnormally low, it was found that from 159 to 393 pounds of skim milk were required to take the place of 100 pounds of wheat or barley. The average amount was 271 pounds. This does not apply to feeding pigs on skim milk alone, but to feeding 5 to 15 pounds per day in addition to a full grain ration. The proportion of milk to grain for the most economical gains was 3 pounds of milk to 1 pound of grain, or thereabouts. With grain at $1.25 per 100 pounds the milk might be figured to have a value of about 46c per 100 pounds. This estimate would not, however, be strictly correct for two reasons. In the first place the skim milk ration was compared with a ration of straight grain, which abundant evidence has shown to be not an economical ration, and also some other supplement might have been purchased which would have given equal results at less cost than milk at 46c. For example, tankage at 2½c per pound would have been as cheap as milk at 20c per 100 pounds. In the second place, the straight grain ration may have been fed at a financial loss and any profit that may have been made from the mixed ration would depend upon the cost of 271 pounds of milk being less than the cost of 100 pounds of grain.

WHEAT COMPARED WITH BARLEY gave approximately the same results on the average. They were compared in a number of cases, both when fed alone and when mixed with skim milk. The chemical composition of the two grains would indicate that the wheat might be the better when fed alone and the barley when supplemented with milk, but the results were rather to the contrary. Averaging all of the results, it required 432 pounds of barley alone to make 100 pounds gain; 337 pounds of barley and 278 pounds of milk; 475 pounds of wheat alone, and 309 pounds of wheat and 264 pounds of milk. It is believed that further experiments, conducted on a larger scale, will show less difference between the two grains. Most of these experiments were conducted upon a comparatively small scale, where perhaps the individuality of a single pig might have influenced the results.

TANKAGE AND BARLEY vs. BARLEY ALONE showed that the pigs getting the tankage made 54 per cent more gain, and that 100 pounds of the tankage took the place of 413 pounds of barley. However, it must be borne in mind that tankage and barley, a balanced ration, were fed against barley alone, which forms an unbalanced ration.

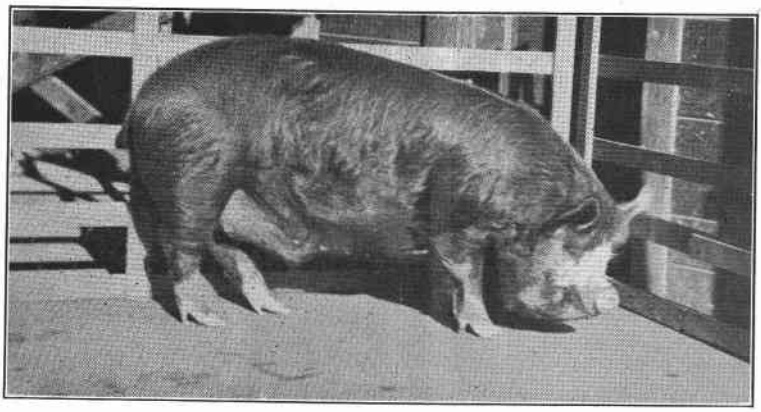
TANKAGE vs. SKIM MILK is a comparison between two balanced rations. In 1910 two lots of pigs were fed, one on barley supplemented with 10 pounds of skim milk, and the other on barley with ½ pound of tankage. In order to make the rations of practically the same nutritive ratio, containing the same digestible nutrients, the pigs which were fed tankage also received about ¼ to ½ pound more barley per day than the other lot. The pigs in both lots made a gain of 1.9 pounds per day per pig, which is exceptionally good. The feed per pound of gain was also very low. The two rations therefore proved about equal, as might be expected from their composition. As to cost, the milk was a by-product of the farm and did not have a fixed market value. In this case 10 pounds of milk was equal to ½ pound of tank- and the ½ pound of barley. One-half pound of tankage costs 1¼ cents and the ½ pound of barley, .62½ cents, a total of 1.87½ cents. The 10 pounds of milk had an equivalent feeding value and may therefore be considered to have a value of 1.87½ cents, or a value of 18¾ cents per hundred pounds as compared with tankage at $50 per ton and barley at $1.25 per 100 pounds.

Wheat and barley have been considered as good feed for fattening

hogs, and are without doubt the best among all the cereals for this purpose. However, the experiments mentioned were undertaken for the purpose of determining the value of supplemental food that would constitute a more nearly balanced ration. The results show conclusively the economy of combining either skim milk or tankage with wheat or barley for fattening hogs.

MARKETING.

Hogs may be sold to local butchers, to buyers who will ship them by the carload to Portland, or they may be shipped direct by the owner to Portland. Whenever the hog supply is insufficient to meet the local demands the local price will usually be more than the Portland price, otherwise the butchers pay about the shipping price. Shippers buy small lots from the different growers and ship in carloads. They expect, of course, to make a profit and such profit is legitimate and permissible.



Cut 11—The packer's model

If the farmer has a carload of his own it will in most cases pay better to ship them himself. If he does get more than the shipper it will be because his judgment was better than the shipper's, which is not usually the case.

Cattle and sheep are usually sold "shrunk"; that is, they are either weighed full of feed and docked about four or five per cent, or they are kept off of feed and water for twelve hours. Hogs, however, are ordinarily sold "full", that is, just as they come from the feed lot. When, however, they are hauled or driven a considerable distance before being weighed, there will be some shrink as compared with the weights upon leaving the feed lots. Occasionally buyers have gone into places where hog raising was new and the farmers were unfamiliar with the business, and made the sellers believe it was customary to dock or shrink the hogs a certain per cent. This is, of course, pure graft. It is customary for the buyer to pay exactly what the hogs weigh when delivered. The place where they are weighed will, of course, be subject to mutual agreement. This "shrink" in the case of cattle or sheep is supposed to cover to an extent the shrinkage which occurs in transit from the shipping point to the larger market. Even when bought with a shrink of five per cent cattle and sheep will not weigh as much when they reach Portland as at the shipping point.

Good cattle shipped from Corvallis to Portland, a distance of about one hundred miles, shrink approximately 50 pounds per head from their shrunk weight at starting, thin cattle even more. On longer hauls the shrink is greater, but not in proportion. Hogs, on the other hand, weighed in the feed lot at Corvallis and shipped to Portland will shrink but little, even though their Corvallis weight is not "docked". In case the hogs are hauled in from the country a few miles and weighed in town they will weigh as much when they arrive in Portland as at Corvallis. On a longer haul there will be some shrink, but most of the shrink comes in the first two hundred miles. Hogs will often go 1500 miles on a five or six per cent shrink.

Freight rates in this country are quoted on the basis of a carload, the car being 36 feet 6 inches long. Such a car, if single deck, will hold about one hundred 200 pound hogs. The double-deck cars have just twice the room, but it is not customary to load twice as heavy. The freight rates from the various towns in Oregon are at the present date, as follows:

RATES PER 36.6 SINGLE DECK CAR TO NORTH PORTLAND, ORE.

From—	
Ontario, Oregon	$92.80
Baker, Oregon	81.00
La Grande, Oregon	70.00
Heppner, Oregon	58.00
The Dalles, Oregon	32.00
Corvallis, Oregon	28.00
Roseburg, Oregon	53.00
Ashland, Oregon	74.00
Redmond. No rates published at present. Line not in operation.	
Shaniko, Oregon	53.00

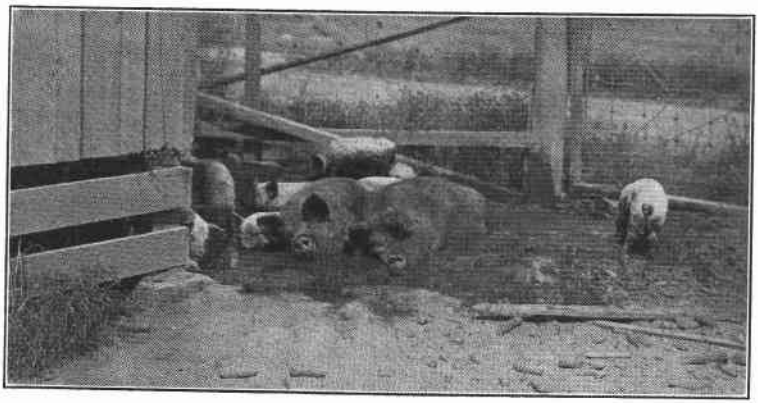
Occasionally farmers find it advisable to sell dressed hogs to the local trade. Well finished hogs, weighing approximately two hundred pounds, should dress from 75 to 80 per cent. Hogs dressing over this amount must be heavy, fat, and fairly well shrunk before butchering. Hogs dressing under 75 per cent are thin or washy, and perhaps have been fed on an excess of thin or sloppy feeds. Younger hogs always dress less than older ones. With these figures in mind it is not difficult to estimate whether the advantage lies with selling the hogs dressed or on foot. For instance, if good 200 pound hogs are selling for 7½ cents and can be weighed direct from the feed lot they will bring $15.00 per head. The same hogs dressed will weigh 150 pounds each, and in order to bring $15.00 must sell for 10c per pound. This will allow no profit on the work of dressing. If, however, they can be sold for 10½c, 75c per head will be received for the dressing.

SOURCES OF INFORMATION CONCERNING HOGS.

This bulletin has of necessity been brief and if the reader obtains therefrom a general idea of the subject and acquires a greater interest in hog-raising, the mission of this booklet will have been fulfilled. The intelligent farmer, however, will not be satisfied with this and will wish for further information. The best source of such information will be found in close observation of the results obtained in his own herd. Close observation, however, means no guess work, but requires that the feed and the pigs both be weighed from time to time in order that both the gains and the feed per pound gain may be accurately determined. Even then the observation must be extended over a large number of instances and through a considerable length of time. A most common fault is to make sweeping statements on the basis of very limited observations. One man has a Berkshire sow that has only

three pigs. He therefore says: "Berkshires are no good; they have only a few pigs to the litter", when the facts are that the Berkshire is one of the most prolific breeds. There is no rule in stock growing to which there is no exception; in fact the so-called rules are statements of averages. When it is said the Berkshire breed is prolific it is not meant that all sows of that breed have large litters, but that the average size of the Berkshire litter is quite satisfactory. When the statement is made that the usual amount of grain required per hundred pound gain on fattening pigs is about 450 pounds, it should be borne in mind that over half the pigs fed will miss that mark by at least 25 pounds, one way or the other, but when a large number is fed the average will come close to that figure.

Another good source of information is to watch the practices of neighbors. Proper methods can be learned from the successful growers, and methods to be avoided from the unsuccessful. It will also be found helpful to watch hogs slaughtered and cut up, and a trip to the Portland stock yards and packing plants would be especially valuable. A trip



Cut 12—The medicated wallow for destroying lice

to Portland will be of more benefit than to the large Chicago yards, since Portland is the logical market for Oregon hogs, and when hogs are sold to local butchers the price is based on Portland prices.

As a second source of information books and papers are recommended. The best all around book on hogs is "Swine in America" by F. D. Coburn, the Secretary of the Kansas State Board of Agriculture. This book gives complete and accurate information on the various breeds, breeding, judging, marketing, general care and management, and feeding. Data from all of the important bulletins on hogs issued by the various experiment stations are summarized and put in readable form in this book. It may be obtained from the Orange Judd Company, New York, for $2.50 postpaid. "Judging Live Stock" by John A. Craig, gives the best information on judging hogs, together with similar information concerning the judging of all other kinds of live stock. This book is one of the first that any farmer should buy. It may be obtained from The Breeder's Gazette, Chicago, Ill., for $1.50 postpaid.

There are a number of books which contain valuable information on

hog raising, but practically all of this information is included in the books mentioned.

WATER FOR HOGS.

It is important that hogs be supplied with an abundance of drinking water. This, however, does not mean that it is absolutely necessary to have running water, or even the proverbial hog wallow, but clean drinking water should be within their reach at all times.

In the strictly dry farming sections the question of water supply is frequently a serious one, especially where it has to be hauled for any considerable distance. The average hog will consume about ten pounds of water daily, thus the hauling from distant points will entail some expense, in fact it may be so much as to preclude the successful growing of hogs. When water is scarce and difficult to obtain watering devices which reduce the waste to the minimum should be provided. One form consists of a covered wooden trough with holes in the cover just large enough to admit the hog's mouth, or constructed in such a manner that will prevent the hog from putting his feet in the water. Another device consists of a square, tight bottom trough about six inches deep and just large enough for a barrel standing on end to fit snugly. A hole is bored on the side near the bottom, and one on the upper end, the barrel is filled with water, the end plugged and the plug on the side removed. The water will flow from the barrel automatically as it is consumed by the hogs. In refilling the plugs are reversed. The barrel and trough should be secured solidly so the hogs may not root them over.

METHODS OF SUCCESSFUL GROWERS.

At the request of the Director of this station, the following methods have been kindly furnished:

Mr. A. A. Bonney, Tygh Valley, writes that he wintered 10 brood sows upon alfalfa hay without supplementary feed, and that they brought good litters of strong healthy pigs. It was estimated that those sows would consume about ten pounds of hay each per day.

Mr. H. W. Strong, Moro, who is recognized as a very successful farmer and hog grower, writes:

> "For spring and summer pasture I sow fall and spring wheat; for fall pasture, grow corn, milo maize, and sorghum. I think milo maize will prove a very profitable green food crop in this section, especially for pasture. As for fattening hogs, I use self-feeders and place them in the pastures, and for winter feed threshed and unthreshed grain".

Mr. C. J. Quinn, Mayville, who is one of the pioneer and most successful hog growers of that section, writes:

> "In wintering hogs of all kinds they are allowed the run of the stubble fields and after the rains graze on the volunteer grain. The careful hog man will give them a feed once a day of whole wheat to bring them home; night is the usual time. A little more care is taken of the brood sows which are expected to have a litter, but many do not go to much trouble in this respect, allowing them to find a place in which to have their young, mostly an old straw stack. The sows are driven home as soon as practicable after farrowing, so that the coyotes do not get too large a percentage of the pigs. These sows are fed wheat or barley, whole or chopped as the owner may happen to have. The hogs intended for sale usually have

the run of the stubble fields until the best has been gotten, then they are confined in a feed lot and fed wheat or barley chop in self-feeders, allowing them to eat all they want until they are ready for market. Some shelter of some kind is generally provided so they can get in out of the storms.

"Summering hogs as a general rule consists in turning them loose to prey upon anything and everything they can find, not matter to whom it may belong. This is what has brought the hog industry into such disrepute in this locality. The man who has hogs and who has any respect for his neighbors, sows a pasture of fall wheat or rye, wheat preferred, into which he turns his hogs, and supplements this with a feed of grain once a day. If given plenty of pasture they will do well. This continues until harvest when they are turned into the stubble-fields. Of course where the farmer has alfalfa he uses that with a small ration of grain. The great drawback is the want of more bulky feed than grain to bring hogs to maturity. Farmers who have been most successful are those who are able to buy thin hogs, raised by men who had farms in the timber and could let their sows run at large and bring in a litter, but who did not raise grain wherewith to fatten the pigs. These hogs were bought in the fall and put on the stubble and fed chop until sold".

HOG DISEASES.

The Northwest is remarkably free from hog diseases, although an outbreak of cholera is occasionally recorded. Hence, great care should always be exercised in bringing new hogs upon the farm, especially those shipped from eastern points, or from large stock yards. These newly purchased hogs should always be kept from the balance of the herd for at least two weeks so as to definitely determine if they are free from contagious diseases.

Space in this circular does not permit of the discussion of swine diseases. Suffice it is to say, however, that lice will be one of the most troublesome parasites with which the grower will perhaps be troubled. These may be controlled by an occasional dipping with some non-poisonous sheep dip, or a simpler method for summer treatment is to construct a shallow wallow and put in one part of Zenolium, or some of the creolin sheep dips, to about 100 parts of water. Some growers who are established in this industry upon a more or less permanent basis use a shallow cement wallow for the purpose of eliminating these parasites.

DIVERSIFIED CROP PRODUCTION FOR THE OREGON DRY FARMER

H. D. Scudder.

Diversified farming means the production of a variety of marketable materials from the farm, as opposed to the growing of a single marketable crop (such as grain) continuously from the same fields. The growing of a diversity of farm products for market means not only a larger, steadier and more certain income and a more economic distribution of farm labor through the year, but more important still, in-

sures some rotation of crops such as is likely to maintain or increase the permanent fertility of the soil and correspondingly increase the production per acre.

That the dry farmers of Eastern Oregon are growing interested in diversified farming there is little question. Continued wheat cropping on the extensive scale has reached and passed the climax of its usefulness. Its evil effects on fertility are yearly becoming more noticeable—the rapid decrease in the humus content of the soil, the growing tendency of the soil to blow in summer and crust in winter, the increasing foulness of the land with weeds, the increased labor required to get the seed-bed back into condition each year, and the greater uncertainty of a good wheat yield.

The more intensive and more permanent agriculture that diversified farming will bring about is dependent primarily upon the use of more thorough tillage methods and of such crop rotations as will restore and maintain fertility.

SUCCESSFUL THOROUGH TILLAGE METHODS.

The highest production in the Oregon dry farming areas is dependent first and foremost upon the fullest possible utilization of the precipitation. Fully one-half of the total annual precipitation may be conserved for crop use by means of thorough tillage operations. This amount is ample for much higher production than is now being obtained. On the average farm probably not more than one-fourth of the total precipitation is now used for crop production.

Deep plowing is the first essential in moisture-conserving tillage. It not only increases the absorbing and storage capacity of the soil, but prevents the formation of the hard-pan often resulting from the plow pressure and higher evaporation from continued shallow plowing. Much of the rainfall is lost because it never gets into the deeper soil, which is the dry farmer's reservoir for the storage water that supplies the crops through the dry season. Variation in the depth of the plowing with an occasional deep plowing of eight or nine inches is the first step in thorough tillage.

Fall plowing is the second step—it not only permits plowing to greater depths than can safely be done in the spring, but it leaves the land rough and loose through the wet season so that it holds the snow and quickly absorbs the rainfall of early fall and spring. Leaving the land in the stubble all winter causes great loss of the rainfall through evaporation, due to the running together and crusting of the surface soil, which prevents the water entering the soil reservoir, and also causes surface-washing. Fall-plowed ground may be worked earlier in the spring, and permits earlier seeding as well as lessening the rush of the spring work. Fall plowing is also beneficial in making plant food available and killing weed and insect pests. Where the lateness of the fall rains makes extensive fall plowing difficult because of the dryness of the soil, this may be offset under the thorough tillage system by double-discing the stubble with the disc harrow, immediately after the grain is harvested. The difficulty in dry plowing may also be offset by the proper use of the disc plow for fall work. Disc plowing has not been found highly successful the country over, and is ordinarily considered the poor farmer's method, but this is not because of the plow, but because of the farmer. The poor farmer uses the disc plow because it gets over the ground more rapidly and with less horse power—in other words, he is doing a poor job of shallow plowing. Properly used disc plowing should be deeper than moldboard plowing (eight to nine inches), more horse power should be used, and the plow should be kept moving faster, so that the soil is

more thoroughly pulverized and the stubble better covered. Disc plowing is easier when done on land previously spring plowed, and then double-disced immediately after the harvest, particularly where the stubble is heavy. By fall-plowing half of the land and spring-plowing the other half, and then using the disc plow on the land previously spring-plowed, and with the additional precautions stated above, the work of this machine has not been found inferior. It has the one advantage of permitting fall-plowing in a dry soil on an extensive scale. Unless the conditions named are observed, however, the disc plowing is not recommended.

Where the land cannot be plowed in the fall it should at least be double-disced with the disc harrow. Double-discing should always be done by lapping half the first round—never by discing crosswise. This disc harrowing has many of the same benefits as fall plowing, and in addition it makes spring plowing much easier, as it prevents the running together and packing of the soil during the winter. It also aids in the decay of the stubble, causes the weed seed to germinate early in the spring, and makes spring plowing more effective by causing a more perfect union of the plowed land with the ground underneath, so that the storage water in the soil reservoir is more readily brought into the root area during the dry season. The disc harrowing should preferably be done immediately after the harvest. At this time it gets the weeds that appear after the grain is taken off and catches and holds the moisture from the early fall rains. No more important practice for the dry farmer can be urged than this one. Such a machine as the double-action cutaway disc harrow is especially good for this work.

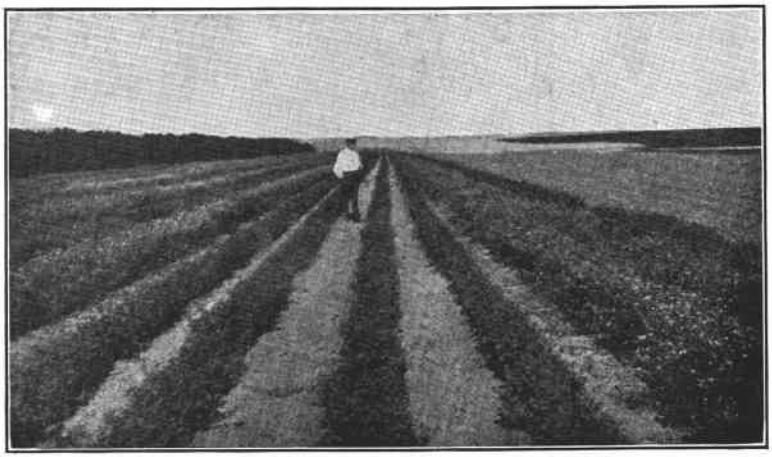
Where the land goes through the winter in the stubble and the plowing is done in the spring it is of the greatest importance that it be preceded by double-discing very early in the season. This early double-discing will bring up the weeds, will help conserve early spring rains, break down the stubble and make the spring plowing very much easier and more effective, in just the same way as does the fall discing. To make a better union between the plowed land and the land underneath is more important in the spring, however, than in the fall, as the soil has no time to settle into place at this season. On this account, also, sub-surface packing is of the greatest value on spring-plowed land. Such packing smashes the clods beneath the furrow, fines the surface soil, and compresses the dry stubble and trash turned under, thus preventing the rapid drying out of the plowed land and eliminating the air spaces under the furrow which shut off the rise of storage water from the lower depths of the soil. Spring plowing should always be followed immediately by the smoothing harrow in order to prevent rapid loss of moisture from the loose, newly turned land.

After correct plowing methods the chief end sought in the thorough tillage system relates to moisture conservation through summer cultivation, not only in the summer fallow, but of row crops as well, The object of summer cultivation is not only to rid the fields of weeds, which are enormous feeders upon moisture and plant foods, but above everything else to maintain a loose, dry soil mulch, to prevent loss of moisture through evaporation. Summer cultivation should be shallow, each cultivation varying slightly in depth, all the way from two to four inches.

These cultivations as a rule should follow rains that have compacted the surface, so as to break up the crust formed. Care should be used not to keep the soil too fine, particularly where blowing is bad. A mulch of small clods is superior to a dust mulch, and hence cultivation should be given immediately after rains when the soil is still moist enough to clod slightly, but not wet enough to puddle. A

mulch of this character is more effective and will not blow, nor will it run together and pack as readily under heavy rains. Where soil-blowing is the difficulty, other preventive measures are: Cultivation crosswise of prevailing winds, preferably with a machine like the disc harrow that leaves the ground slightly ridged; the planting of a few rows of corn, or other heavy forage crop, at intervals of a thousaud yards or so, crosswise of prevailing winds; the use of a few loads of straw or manure where blow-outs are just starting at certain points. The basic means of preventing blowing is through the increase of the humus content of the soil. The decayed organic matter coming from the use of a proper crop rotation furnishes the fiber and cement which binds the soil particles together into small masses or kernels, thus preventing blowing. Continued wheat cropping has steadily reduced the humus content, so that blowing is becoming worse and a good mulch is much harder to form.

For soil-mulching, the smoothing harrow alone is not sufficient, as it does not work deep enough and tends to make the mulch too fine. The disc harrow should be used occasionally in alternation with the



Alfalfa in cultivated rows. (U. S. Dept. Agri.)

spike-tooth harrow and weed killers. The spring-tooth weeder has proven an excellent machine for rapid cultivation during the early stages of growth, both on row crops and broadcasted crops. For row crops the chief surface tillage implement is the riding two-row cultivator of either the knife or small shovel type. With this machine, snallow, flat cultivation is the object.

Thorough summer tillage of the summer fallow land will increase the yield for two years following. By this means in many parts of Eastern Oregon, two crops may be raised in three years and "summer fallowing" with thorough tillage once in three years may take the place of "summer fallowing" every other year.

The cost of such thorough tillage, far from being prohibitive, is, on the contrary, inviting, when compared with the probable return. At the outside, such thorough tillage would require but three extra discings and four extra harrowings, at a total cost of about $1.50 per acre, resulting in some cases on record in an increase of ten bushels of wheat

per acre the first year following the summer fallow, and an extra crop of some spring-sown grain or forage the second year after the summer fallowing.

On this basis a tillage program for the three years would be somewhat as follows:

FIRST YEAR.—Double-discing after harvest. Fall plowing. Double-discing in early spring. Harrowing two or three weeks later. Harrowing after the next heavy rainfall. Harrowing in June. Discing in July. Harrowing in August. Weeder in September.

SECOND YEAR.—Press drilling wheat in fall after first rain, but not later than the first of October. Harrowing wheat in spring.

THIRD YEAR.—Double-discing after harvest. Double discing early the next spring. Harrowing in two weeks. Harrowing before seeding. Press drilling barley, or emmer, or field peas, or corn, or kaffir corn in rows. Harrowing young crop with weeder and cultivating row crops later.

The use of a press attachment with the drill is a necessary accompaniment of the thorough tillage system. By firming the soil directly over the seed, it aids in causing a vigorous germination and deep rooting, particularly in a dry seed bed or with small seeds. The double press wheel is even better than the single. Where the press wheel attachment is used the type of furrow opener is less important.

The harrowing of winter grain in the spring to break the crust formed through the winter is a point not to be overlooked. Two, or even three harrowings are often beneficial. The crust formed over winter is not only broken, but a thick stand is often advisedly thinned by such harrowing and, on the oher hand, a thin stand may often be thickened through the better stooling caused by breaking the crust.

CROPS FOR THE DRY FARMER.

With more thorough tillage methods a greater variety of profitable crops may be added to the Eastern Oregon dry farmer's list of money makers.

CEREALS.—Wheat will always be the chief crop of this area, but much remains to be done in increasing its production through more thorough tillage; through soil-building rotations, and through the use of better varieties and purer seed. In any dry farming territory winter varieties have the advantage in yield. The Turkey Red wheat, notwithstanding its beards and shorter straw, and the poor quality of the seed used so far, has gained great favor in Eastern Oregon. From the success that Turkey Red has found in every other dry farming territory it is believed that it will eventually prove the leader in this region, but it will be necessary to become familiar with its peculiarities and to get purer and hardier seed, grown at high elevations, such as that produced in Montana. Among spring varieties of wheat the Durum or Macoroni type, such as the Kubanka, is finding increasing favor because of its great drouth resistance. Both Turkey Red and Durum rank high with the millers when once they have become established on the market.

Barley—the highest yielder of the grains and of especial value as a fattening feed—should be more widely grown for this purpose. The Mansury, Oderbrucker, and White Hulless are the most promising of the spring varieties for high yield, and the Hulless for early maturing. The development of winter barleys is to be encouraged.

Emmer, because of its greater drouth resistance, makes an excellent substitute in the dryer sections for oats as a barn feed. This grain is generally spring sown, but the black emmer is showing promise of success for fall sowing.

In oat varieties the Kherson, Siberian, Sixty Day, Banner, and Black American have been most successful in the dry farming states.

Thin seeding of the grains has much to do with successful yields under dry farming conditions. The most successful rates are: Wheat, three pecks; Durum wheat, five pecks; barley, six pecks; Hulless barley, four pecks; oats, six pecks; emmer, six pecks.

Corn is one of the best of the dry farming cereals. It uses relatively little moisture and permits cultivation which conserves moisture and destroys weeds. On account of the cold nights the hardier, earlier-maturing varieties must be used.

CORN GROWING IN EASTERN OREGON.

Field corn thoroughly cultivated may profitably replace, every third year at least, the bare summer fallow in Eastern Oregon. Corn may be grown either for grain, fodder or silage. Minnesota No. 23, a dent variety, is believed to be the best yet found for Eastern Oregon conditions.

The grain stubble should be double-disced immediately after the harvest and then deeply plowed in the fall. Early in the spring it should be thoroughly disced and harrowed frequently before planting time to conserve the moisture and kill the weeds. Where spring-plowed, the land should be double-disced early—then plowed and packed or rolled.

The corn should be planted about May 1st in rows three feet apart, at the rate of one grain every 18 inches. Planting may be done preferably with a lister or with a grain drill, or by replowing the ground shallowly in the spring and dropping three grains to a hill three feet apart in every third furrow and following the plowing with a harrow. For fodder or silage the grain may be planted more thickly in the row, a kernal every nine inches, using a grain drill with part of the holes stopped up, or the lister or one-horse drill.

The success of the corn crop depends very largely upon the thoroughness of cultivation. The first two cultivations may be given with the spring-tooth weeder of the Hallock type, or with the common smoothing harrow. As the corn gets higher either a knife or six-shovel cultivator should be used, and the crops should receive at least three shallow cultivations with this machine before it is laid by.

The corn field should be disced and fall-plowed after the crop is taken off.

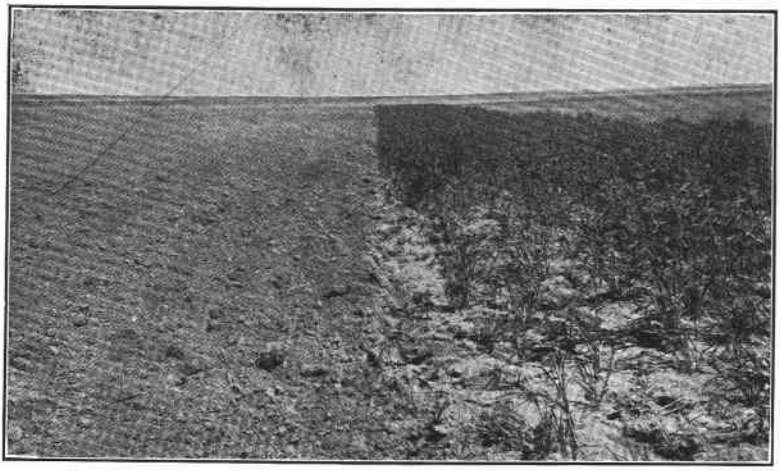
FORAGE CROPS.

Under the more intensive farming system the production of forage for live stock feeding is a primary requisite. At present the grain hays are most commonly used, and these, as a rule, are cut too ripe. Their highest nutritive value is obtained when cut in the soft dough stage. A large number of other crops may be better used for this purpose, however. The value of corn for fodder, green feed, or silage, has already been suggested. The drouth-resistant brown Kowliangs, durra and kaffir corn drilled in about May 15th, four pecks per acre, either broadcast or in rows and cultivated, are also high yielding forage. Fall-sown rye makes excellent spring pasture for early green feed. Artichokes have proven an unusually good hog pasture. Thousand-headed kale started early in cold frames and then transplanted and thoroughly cultivated makes a good summer greed feed for cows. Cow squash may also be successfully grown. Broom-corn millet has shown value as a hay crop in the dryest seasons.

For permanent pasture or hay, some of the hardier grasses sown in the early spring on a shallow, well packed and finely pulverized soil

previously summer fallowed, have made excellent succeesses. Smooth brome grass alone, 20 pounds per acre, or a mixture of brome grass twelve pounds and alfalfa six pounds, or of six pounds each of smooth brome, slender wheat grass, tall oat grass and alfalfa, is recommended. Samples of grass seed should be sent to the Experiment Station for purity and germination tests before sowing.

The most important additions to the forage crop list of Eastern Oregon, however, are the alfalfa and field peas, not only because of their high feeding value, but because of the great necessity for them in rotations for restoring the fertility that the cereals so rapidly consume. These two crops, through their nitrogen-gathering faculty, enrich the soil both chemically and physically because of the high nitrogen humus they leave in it. In addition to this they form a substitute for the summer fallow in that they make use of moisture not available to other crops—alfalfa through its deep-rooting system, and field peas through their maturing so early as to permit summer tillage after they are harvested. Both crops may also be grown in rows and cultivated, thus conserving moisture and, where harvested for seed,



Thorough summer tillage against weedy summer fallow. (Montana Exp. Sta.)

producing an unsurpassed money crop.

GROWING FIELD PEAS IN EASTERN OREGON.

Over the larger part of the dry farming area of Eastern Oregon the field pea crop may be profitably substituted for the bare summer fallow. Field peas restore the nitrogen and humus depleted through continuous wheat-farming and make a most valuable hay, a splendid hog and sheep fattener, or a highly profitable seed crop.

The grain stubble should be double-disced immediately after the harvest and deeply plowed, preferably in the fall, and left rough-plowed over the winter. At the earliest possible date in the spring the fall-plowed ground should be disced and worked down and at once seeded to the field peas at the rate of two bushels per acre, press-drilled to a depth of three inches with any grain drill that will not split the peas. Where spring-plowed, double-discing should first be

done, then plowing, followed with the sub-surface packed or corrugated roller. The peas should be cut for hay with the mower (advantageously with a pea-harvester attachment) when the first peas on the vine ripen.

For hog-fattening turn in the hogs when the peas begin to get too hard for table use.

For seed, cut when the bulk of the pods are ripe, and thresh with a bar concave with most of the spikes removed and cylinder run at low speed to avoid splitting. For seed production the peas may also be grown in double-drill rows 2½ feet apart and cultivated.

Peas may also be cut green as a soiling crop for cows.

It is very important that the pea field be thoroughly disced as soon as the pea crop is off the ground, summer tilled, and then fall plowed.

ALFALFA IN EASTERN OREGON.

Grown for seed production, alfalfa is destined to become one of the greatest money-makers of the Eastern Oregon dry farming belt. It is also a great hay, pasture, and soiling crop, and is unexcelled as a restorer of soil fertility.

The common variety of seed should be used, preferably dry-land grown in Eastern Oregon, Montana, Utah, or Kansas.

Good clean wheat land with a deep soil that has been in well-cultivated summer fallow should be selected. This land should be double-disced, then deeply plowed in the fall and left rough over winter. Where spring plowing is done it should be very early and more shallow, and should be preceded by double-discing, then plowed and thoroughly firmed with a sub-surface packer or corrugated roller. In either case thorough cultivation and frequent harrowings should be given till seeding time, to conserve moisture, kill weeds, and prepare a finely pulverized seed bed.

Seeding should be done from April 1st to 15th at the rate of ten pounds per acre of good seed, put in with a press-drill to a depth of about two inches, then rolled and lightly harrowed. No nurse crop should be used and it is of vital importance that the seed be tested for purity and germination.

The crop should be clipped several times the first year with the cutter bar set high, to keep down weeds and induce root growth, and the clippings left on the ground as a mulch unless very heavy. It should be lightly harrowed after clipping. Stock should not be turned on the field the first year. The second year, and thereafter, cultivation should be given every spring with the disc harrow set straight, followed by the smoothing harrow. Alfalfa should be cut for hay when beginning to come into bloom.

For seed production alfalfa should be press-drilled in double rows, 2½ feet apart, on ground prepared as outlined above. The ordinary grain drill may be used by stopping up part of the holes and setting the grass-seeder attachment to sow at the rate of 24 pounds. This will deposit about eight pounds of seed per acre in double-drill rows, 2½ feet apart. The second year this stand may be thinned by cross-harrowing or other means so as to leave about one plant to every eight inches. Where soil-blowing is bad the rows should be drilled cross-wise of the prevailing wind, and possibly a row of barley drilled in between the rows of alfalfa. With the first cultivation the barley will be taken out. Thorough cultivation should be given the alfalfa rows with regular two-row cultivator, leaving the soil surface as flat as possible. The first crop should be harvested for seed. Where the first crop makes too much stem growth for good seed production it may be set back by an early clipping when the growth is about six inches high.

ROTATIONS.

With this list of crops to draw upon, all the essentials of a good rotation may be obtained—cultivated crops to conserve moisture and destroy weeds, legumes to store atmospheric nitrogen and humus in the soil, grasses and manures to increase its humus content and moisture-holding capacity. Summer fallowing need be done only where the rainfall is so scanty as to make it necessary to conserve moisture and grow grain crops in this expensive way.

For Dairying.

To illustrate how a good rotation may maintain fertility and at the same time greatly reduce the acreage necessary for an excellent farm income, let us see how the crop requirements for feeding twenty producing dairy cows may be satisfied in the dry farming belt. Feeding thirty pounds of green feed, twenty pounds of hay and seven pounds of grain per day per cow, twenty cows would require ten tons of green feed, six tons of hay and two tons of grain per month. It is more than possible that a three hundred and twenty-acre farm in the dry farming region of Oregon can take care of a herd of this size.

GREEN FEED:	
Early fall-sown rye (fed green) the first month (probably April or May)	10 acres
Peas and oats, (fed green), second month	5 acres
Alfalfa, (fed green), third and fourth months	10 acres
Corn, (fed green), the fifth month, and (as silage) from the sixth to the twelfth month inclusive	15 acres
HAY:	
Pea and oat hay	40 acres
GRAIN:	
Barley and oats	30 acres
Total	110 acres

Even if all of this acreage were summer fallowed it would utilize only two hundred and twenty acres out of the half section, and with the peas and alfalfa to alternate with the grain crop, and the corn to consume the barnyard manure and allow thorough cultivation for weed elimination, these crops rotated over the various fields would rapidly increase the most important soil component, the humus supply. But summer fallowing would not be necessary for all of the crops named above, hence an ample acreage would remain on the half section farm to provide feed for the teams and growing dairy stock and grain for the pigs and chickens which would naturally be required to make the best use of the skim milk.

A good dairy cow should produce a hundred dollars worth of butter fat per year. This half section crop would bring then a gross yearly income of two thousand dollars from the butter of twenty cows. The skim milk fed with a small amount of grain and green feed to the pigs and chickens would make a considerable addition to this income. When it is recalled that a ton of butter (market value $600) takes from the soil only 70 cents worth of plant food while a ton of wheat (market value $25) takes $7.86—the effect of this rotation system upon fertility is obvious. The butter produced by the twenty cows would take a total of $2.33 in plant food from this farm each year, while wheat from it on the summer fallow plan would take $754.56 each year in the grain alone. Even from a purely business standpoint, continuous wheat farming is ruinous.

For Hogs.

If hogs were made the main product from the half section farm, the following series of crops could be grown: First, fall-sown rye for early spring pasture; next, field peas for late spring pasture; then a small field of artichokes or alfalfa for pasture to go with the gleaning of the grain stubble; then corn in the dent for "hogging off"; and, last, barley to complete the fattening of the hogs. These crops in the order named would furnish feed from farrowing time in the spring to fattening time in the fall, and a small amount of alfalfa, field peas and barley additional would carry the brood sows all winter. With chickens and a few head of horses each year as a secondary product this crop series for hogs grown in suitable rotation will not only produce a handsome income from the half-section farm, but will have approximately the same effect upon fertility as the rotation for dairy cows named above.

For Grain.

Although in any permanent farming system the marketing of the crop in the shape of animal products is advisable, yet good rotations are available for the improvement of fertility without livestock. The chief crops for rotation with the grain are field peas, alfalfa, potatoes and corn, all of which may be raised for seed production. Many favorable arrangements of these crops may be made. To illustrate—taking a half section farm again—put forty-five acres of alfalfa in cultivated rows for seed, moved to a different field every three years—then the rest of the farm (except five acres) in a three year rotation of

1—Wheat, 80 acres, and potatoes, 10 acres.
2—Field peas in cultivated rows for seed, 45 acres.
Pea and oat hay, 45 acres.
3—Cultivated summer fallow, 90 acres.

The pea and alfalfa straw would, of course, like the wheat straw, be returned to the land, and this with a small amount of commercial fertilizer would maintain fertility successfully, and considerably increase production per acre. Oregon dry farm potatoes are generally of exceptional quality. With thorough cultivation such varieties as Early Bird, Carmen No. 3, and Early Eureka will produce approximately 100 bushels per acre in the rotation described above, while the yields of high quality dry farm field pea and alfalfa seed, for which there is so large a demand, will make this rotation a money maker.

AN ADDITIONAL WORD TO THE CENTRAL OREGON FARMER.

On the irrigated lands of Central Oregon where a good depth and quality of soil and proper elevation have been secured, these same rotations may be followed with minor exceptions and, of course, on a much smaller acreage owing to the higher yields under water. Roots such as mangles and carrots may be added to the list of succulents. The Central Oregon irrigation farmer, however, must use excessive pains to avoid over-irrigation, as the evil results of this are very great —leaching out of soluble plant foods, accumulation of alkali, lowering of soil temperature, prevention of quick maturing and uniform quality of crop, deadening of the soil through exclusion of air from the root area, etc.

The Central Oregon dry farmer also may get excellent results from the crops and methods outlined, but owing to the newness of his land and slightly sandier character of soil should use the cultivated summer fallow every alternate year until his land is fully subdued. It is especially important that the new settler in Central Oregon should select lands having soils at least five feet in depth and free from alkali or

hardpan. These new lands, when dry farmed, should not be seeded at once after clearing, but should be thoroughly cultivated at least a year before seeding, so that sufficient moisture may be conserved to bring a fair first crop.

DAIRY COWS AND ALFALFA.

F. L. Kent.

"You haven't been telling the people of Central Oregon to keep dairy cows, have you"? said a prominent State Board of Health official to the writer as we were returning from the big railroad celebration at Redmond, Crook county, last September. "Well, why not"? we replied. "With butter at forty cents per pound and alfalfa hay at $6.00 per ton, with a yield of four tons or better per acre, it strikes us that dairying should be a very profitable line of agricultural effort".

We believe that the irrigated sections of Central Oregon are better suited to dairying than any other form of agriculture. Irrigated lands are high priced lands when properly developed, and high priced agricultural lands, with few exceptions, are devoted to either dairying, horticulture, or truck gardening. Truck gardening to be commercially successful, must have a near-by large market. The altitude and consequent danger from frost, is a serious drawback to successful commercial fruit growing in Central Oregon. But the success which has been achieved in the growing of alfalfa and clover, carrots, beets and turnips, all of which are food stuffs that when liberally supplied, bring joy to the heart of the dairy cow and cause her to respond generously at the milk pail, demonstrates that nature has done her part in the dairy equipment of Central Oregon. If man will now do his part the prosperity of this section is forever assured.

"What shall we feed"? and "How many cows can we keep on a given acreage"? are very pertinent questions in this connection. Alfalfa or clover hay, stock beets or carrots, and chopped barley will make a most excellent combination. For a cow producing daily twenty-five pounds of milk testing 4 per cent (equal to one pound of butter fat daily) we would suggest the following:

Hay (alfalfa or clover)	20 lbs.
Roots (carrots or beets)	20 lbs.
Barley (chopped)	5 lbs.

Heavy milkers should have additional grain in the proportion of about one pound of grain for each five pounds of milk produced. In feeding for records it is the practice to feed about one pound of grain or mill stuff for each three pounds of milk produced, but at present prices of grain, and with first class hay and roots, it is doubtful if such heavy feeding of "concentrates" is advisable. The proper amount to feed may be simplified by supplying concentrates as just indicated, using 20 to 30 pounds of roots, and all the hay the animals will eat.

If bran can be obtained at a reasonable price, say $25.00 per ton or less, about equal parts of bran and barley will make an excellent grain mixture. Chopped oats may be used instead of barley, but oats do not have quite so high a feeding value as barley, pound for pound.

The use of alfalfa hay for dairy cow feeding is becoming more general each year. For instance, Wisconsin dairy farmers are shipping in alfalfa hay from Kansas and Colorado at $16.00 to $18.00 per ton, and are also meeting with some success in growing the crop. If the Wisconsin farmer can afford to purchase alfalfa hay at $16.00 per ton

and sell his butter fat at about 28c, there certainly should be profit for the Central Oregon farmer in converting his $6.00 per ton hay into 35c to 40c butter.

Regarding the number of cows that can be carried on a given area, it seems probable that one cow could be easily carried for practically each one and one half acres. Slightly more acreage might be required at first, but if the manure is saved and properly applied to the land, crop production should increase rather than decrease. This estimate is based upon the following computation:

½ acre alfalfa for hay	2 tons
½ acre alfalfa for green feed	6 tons
½ acre barley	25 bu.
⅛ acre roots	2½ tons
Total area 1⅝ acres.	

This estimate does not consider any pasture. The alfalfa for green feed would be cut and fed in the barn or feeding lot. It would be highly desirable to have at least a small pasture in which the animals would have a clean place for exercise, as well as to get some food naturally, but it is entirely practical to handle dairy cows without pasture.

If we accept this basis of reckoning we find that it is practical to carry twenty cows on every forty acres of irrigable land, and have seven and one-half acres left for buildings, garden, and other stock than the dairy cows. A good cow should easily produce a gross income of $100.00. And an average family should easily be able to handle the work in connection with a herd of twenty cows. With a good garden, a few chickens, and milk, cream and butter produced right at home, each forty acres devoted to dairying should return a net annual income of $1,000.00 to $1,500.00.

To get the above results it will be necessary to have good cows, in fact considerably better than the average, but there are many Oregon herds that are producing better than $100.00 per cow gross income annually. Perhaps the greatest difficulty in starting a dairy herd at the present time is the securing of desirable cows. The best that are available should be purchased. Not necessarily high priced registered show animals, but high grade animals with a good working capacity. Then head the herd with a pure bred sire whose dam is known to be a heavy producer. Keep a record of the production of each cow, save the heifer calves from the best to replenish the herd and take the place of the low producers. Feed liberally, milk regularly, treat the animals kindly, properly utilize the by-products, produce clean milk and milk products, and dairying will be found a source of both pleasure and profit.

POULTRY PRODUCTION.

James Dryden.

There are several reasons why the farmer should give greater attention to the production of poultry and eggs. First, there is the question of profits; poultry will add to the revenues and profits of the farm. There is no question but fifty or a hundred or two hundred hens on a general farm are highly profitable when given reasonably good care. Second, the state of Oregon is losing a large amount of

money every year because the farmers do not produce sufficient eggs and poultry to meet the home demands. Probably a million dollars a year is sent out of Oregon to the farmers of Kansas and Nebraska for poultry and eggs. That money, if kept at home, would mean considerable to the state. Third, the consumers of the cities are unable to secure fresh eggs and poultry during the winter season except at prohibitive prices to the majority. Fourth, a nice flock of fowls that produces a basketful of fresh eggs every day, is an attractive feature of every farm, especially to the young, and there is urgent need that the farm be made as attractive as possible to the young people in order to stop the exodus to the cities. On some farms the poultry yards are not much of an attraction to anybody, but that is not the fault of the poultry. Under proper conditions, the poultry feature of the farm might be made an inducement for at least some of the boys to stay on the farm.

This matter, then, of greater attention to poultry-keeping on the farm, concerns the welfare of the farmer, of the farmer's boy, of the consumer, and of the state.

There is no reason why the farms of eastern Oregon should not be producing large quantities of eggs and poultry and help meet the demand at home.

HOW SHALL THE FOWLS BE HOUSED? On most farms we believe the movable colony house will give best results. One of the dangers that confronts every poultry-keeper is that of impure ground on which the fowls too often run and feed. More diseases and lack of vigor in the stock are probably due to keeping the fowls on the same yards year after year without any systematic attempt to keep them clean, than to any other one thing. It is impossible to keep chickens on the same yard continuously year after year and keep the yards clean and sanitary at the same time. For most diseases fresh ground is the best medicine.

By using movable houses the poultryman can get away from the danger of impure ground. If the fowls are not confined in yards, but are given free range, the ground will not soon become impure, even though the house may be stationary. Or if yarded, and each flock is given two yards, so that the vacant yard may be cleaned and purified by a growing crop every year, this danger may be largely overcome. Yarding means considerable expense in fencing, however, and some expense in cultivating small yards. Where, however, it is necessary to keep the fowls confined in yards, it is a good plan to provide two yards for each flock, even though the two yards may not be any larger in area than one single yard.

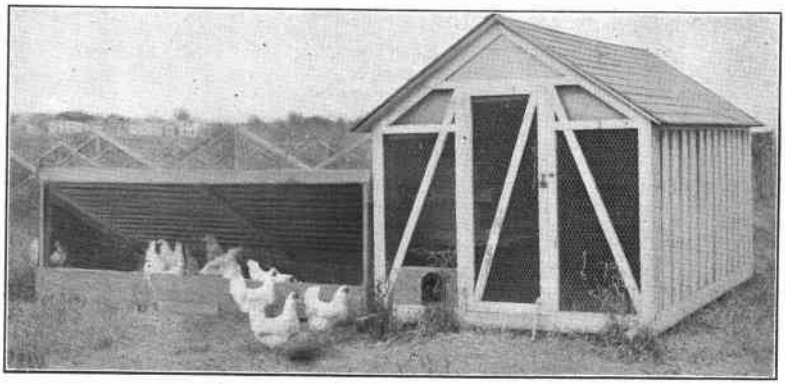
On the general farm, however, yards are seldom necessary. There may be a conflict sometimes between the garden and chickens, and it may pay better to fence in the garden rather than the chickens. The garden does not need exercise; the chickens do. The cabbage or melon will grow just as well with a fence around it as not; the chickens will do better without a fence. A flock of fifty fowls is worth more than the ordinary garden. Activity is the life of the hen, and free range solves the problem of exercise. Fowls will never suffer from lack of exercise where they have the liberty of the fields.

But the chickens may get into the wheat field and eat the wheat. Why not let them eat it? They won't eat any more than is necessary to produce eggs and flesh, and wheat when converted into eggs and poultry meat is worth more than it is in the raw. Then if they eat a few bushels of wheat you will be saved the expense of threshing. Grain eaten by the fowls isn't wasted; but if you shut them up and half starve them, the wheat you do feed them will be wasted, because

there will be neither eggs nor added flesh on half rations. I would let them help themselves in the wheat field. A hen won't eat much more than a bushel of wheat in a whole year; in a month, while the grain is ripening, she will eat but a few pounds. Then when the grain is harvested she will make eggs from the waste wheat in the stubble fields. With the colony house, the fowls may be moved, if necessary, to the wheat and stubble fields.

The proper idea of poultry housing is not to furnish warmth for the fowls. All ideas about building so-called warm houses should be abandoned. It is impossible to build a poultry house with proper ventilation that will be at the same time both warm and dry, without artificial heat, and artificial heat has never been demonstrated a success. Fowls require abundance of fresh air, and if you let in the fresh air you let in the cold air, no matter how the house may be built. Double walls in a poultry house is an unnecessary expense. If you close the house up tight with the idea of keeping it warm, you will have a damp house, and dampness is worse than cold.

The real purpose of the poultry house should be not to furnish



Colony house with scratching shed at the Oregon Experiment Station

warmth, but to furnish shelter from the winds and storms and protection from wild animals.

The illustration herewith shows a colony house that has given good results at the Oregon Experiment Station. It is 12 feet long and 7 feet wide, with a 5 foot wall. One end is entirely open winter and summer. In western Oregon we think a cheap scratching shed is an advantage. This gives them shelter from the rains and keeps them busier. In most sections of eastern Oregon, with its comparative freedom from heavy rains and snow storms, this scratching shed may not be necessary.

No style of poultry house, it need hardly be said, will meet all conditions. A colony house may satisfy the conditions on one rarm; it may not on another. Fowls will do well in any style of house if it furnishes shelter from the storms and winds and plenty of fresh air.

SOIL AND LOCATION. Some attention should be given to choice of soil, especially if the fowls are to be yarded. Heavy damp clay soils are unsuitable, so are light sandy soils. The best soils are sufficiently porous to permit natural drainage, and at the same time fertile enough to grow good crops. The poultry houses ought not

to be located on high exposed ground. They should be located as much as possible where they will be sheltered from high winds. Chickens object to the winds. They seek shelter when the wind blows even on a summer day. Winds interfere with their activity.

Whatever style of house is used, do not overcrowd the fowls; that means sick, unproductive fowls. Leave the house largely open at one side or one end, and face it away from the prevailing winds. Provide scratching room, when the weather is such that it interferes with their ranging over the fields. If possible, move the house onto fresh ground occasionally.

CONSTRUCTION OF THE COLONY HOUSE. The runners are made of 3"x6"x14' rough material and act as side sills for the house. They should be beveled at ends in order to slide easily.

The cross sills are 3"x4"x7'. They are set 2" into the runners, and 12" from the ends, and fastened with ½" bolts.

When the siding is put on vertically, there is no studding used.

The plates are 2"x3"x12', halved at each end.

To the plates are nailed the 1"x12"x5' side boards, and these are battened with 1"x3". The siding is nailed flush with the top of plate and laps 3" on runners.

The roof is 1-3 pitch, or 2' 4" at peak from top line of plates.

There are five pairs of rafters, cut with 1" plum cut at plate.

The roof boards are 1"x3" material, set 3" apart.

The roof is shingled and laid 5" to the weather.

The front is covered with 1" mesh wire.

The cornice is made of 1"x8" boards and projects 5" outside of walls. The frieze board, 1"x4", is nailed up tight against the cornice.

The door is 2'x6' and made from 1"x3" material.

The nest platform is two feet from the ground. It is nailed to a cleat on the side of the house and braced from top of runner. The platform is 22"x5'.

The nests are made of 5-gallon oil cans, the top and part of front being cut out; 2" is left of front to hold in nest material, and a small strip at top which acts as a brace.

Over the nests is fitted a sloping top, which keeps the fowls from standing on nests, and helps to darken them.

The dropping platform is made of 1"x8" ship-lap, is 2' from the floor in front and 2' 3" in rear. The slope permits the board to be cleaned more readily. For the same reason the boards should be put on from front to rear.

The perches are made of 2"x2" material. They should also be level and about 10" from dropping board in front. The roosts are set 18" apart, three for forty fowls.