

SWINE PRODUCTION

in Michigan

By V. A. Freeman



MICHIGAN STATE COLLEGE :: EXTENSION DIVISION

EAST LANSING

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SWINE PRODUCTION IN MICHIGAN

By V. A. FREEMAN*

Pigs fit into the farm production program in many different ways in Michigan, but the largest number of them are raised from sows and fattened for market on the same farm. The practice of purchasing feeder pigs to follow steers, consume garbage, or utilize surplus grain is followed by some producers. Others raise weanling pigs to sell, using their feed mainly for brood sows. This practice has been particularly profitable in areas close to suburban districts where owners of many small farm homes desire one or more pigs for the home meat supply and for the consumption of table scraps and garden surpluses. The range in different swine growers' projects in this state is from a single pig to sow-and-litter herds where 500 or more spring pigs are raised and marketed as fat hogs.

Purebred swine breeders supply much breeding stock for the commercial producers. Some of them sell largely for breeding purposes, and others keep only a few hogs of their best stock for breeders and market the main crop for slaughter. A greatly increased interest in swine growing has resulted in 829,000 head being reported on Michigan farms in January 1941, as compared with 512,000 head in 1935, and an average for the last 10 years of 654,000 head.

The purpose of this bulletin is to cover the more important problems of the commercial producer throughout the year's management of breeding stock, and the problems of feeding from birth to market. Part, or all of it, should be useful to every swine grower, the part most useful depending upon each grower's type of project.

ADVANTAGES OF SWINE

The hog is the most efficient of all farm animals in converting grain crops into meat for human consumption. His efficiency as a meat producer is almost double that of cattle. Surplus grain fed to swine has consistently produced more value in live pork than the sale value of the grain.

Pigs utilize many of the otherwise wasted by-products from the farm, such as undigested grain in the feed-lot, waste in fields, vegetables, dairy by-products and garbage.

Sows are very prolific, usually farrowing from 6 to 10 pigs per litter, and they raise two litters each year. Returns come quickly, inasmuch as young sows can be bred to farrow at the age of one year and

*The author acknowledges the assistance rendered by Ralph May and William Ljungdahl, graduate assistants in Animal Husbandry, in the preparation of this manuscript.

200-pound pigs can be marketed in the relatively short period of 5 to 8 months of age. Less than one year is required between mating a sow and marketing her litter.

Swine raising is very important in a diversified program of agriculture. Enough feed and by-products are wasted on most farms to feed enough pigs to supply the family with pork. A few pigs will increase the annual income on the average farm.

The type of swine project to select should depend largely upon feeds available and the location of the farm. Raising weanling pigs to sell is profitable only when necessary housing conditions, favorable for saving the new-born pigs, are available and when there is usually a local demand for the pigs. Surplus grain produced on the farm may be profitably supplemented by purchased feeds rich in protein and minerals. Pasture should be available for summer feeding and good quality legume hay in winter. On farms located so that buttermilk or some other valuable pig feed can be procured at low cost in proportion to its feeding value, most of the concentrates fed may be purchased. As a rule, pigs are best used to market surplus feed and the size of the project should be governed by the amount of grain and other feed available.

SELECTION OF BREEDING STOCK

CHOOSING A BREED

There is no best breed of hog for all conditions in Michigan. The choice of breed is largely a matter of personal preference. If there is no marked preference, it would seem advisable to select the breed which is already most prevalent in the locality, for it is probable that the popularity of such a breed is due to sound economic reasons. Ordinarily, more depends upon the strain within the breed, than upon the breed itself. Choosing a breed already in the community makes possible the easy exchange of breeding stock and cooperation with owners of valuable sires.

It is best to select the breeding stock from a reliable breeder whose records are complete.

There are three ways to determine the value of an animal as a breeder: first, by individuality; second, by pedigree; and third, by progeny. Progeny is the most dependable index of breeding value, but animals two years old and more are seldom purchased for breeding purposes. Wherever possible, purebred animals should be purchased for the foundation stock, or at least a purebred sire should be used. If it is not possible to begin with purebred sows, crossbred or high-grade animals of good constitution, quality and conformation may be selected and mated to purebred boars. By continued upgrading with succeeding boars of the same breed and careful selection of gilts, a grade herd unsurpassed for commercial production can be developed.

The purebreds will usually breed more uniformly to type if proper selection is followed, and uniformity in a herd of feeding hogs is well worth consideration. Sales of outstanding purebred individuals for higher than market price are advantages the purebred breeder may realize.

A crossbred is the offspring of a purebred sire and dam, each of different breeds. For years, stockmen and feeders have considered crossbreds better feeders than either purebreds or high grades. Recent tests, particularly those at the Minnesota Agricultural Experiment Station, have indicated that crossbred gilts make valuable sows for commercial herds. Using boars of one of the heavy-boned, rapid-growing breeds, such as the Poland China or Duroc Jersey, to mate to sows of the lighter, more active breeds, such as the Yorkshire or Hampshire, noted for their pig-raising ability, is a popular crossbreeding plan.

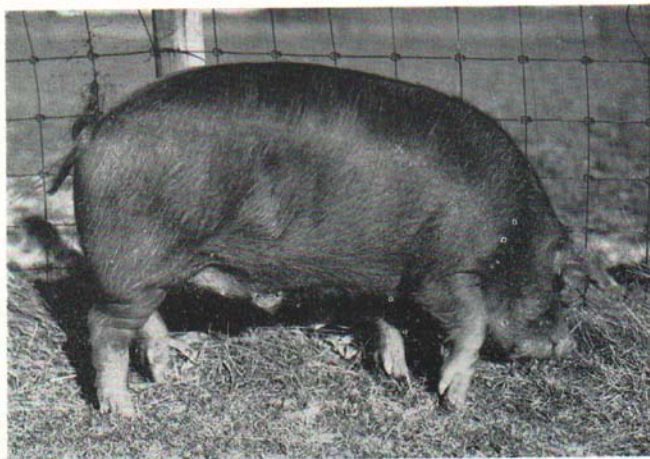


Fig. 1. A good market type barrow.

The final end or purpose of all swine selection and breeding is a combination of economical gains with ideal form, finish and quality in the market hog.

The "crisscross" system of breeding seems to offer the most promise to the average crossbred producer. For example, cross a Berkshire boar on a Poland China sow, then breed the crossbred gilts to a Poland China boar and in turn use a Berkshire boar on the second-cross gilts. In other words, boars of the breeds involved in the original cross would be alternated for each succeeding generation. Any two breeds may be used in the "crisscross" system. The same system of alternating breeds of boars may be used with a three-breed cross. This plan is not recommended to small producers who normally would need only one boar, unless they sell all of their old sows each year and raise all of their pigs from young sows.

TYPE TO SELECT

It is a generally accepted fact among breeders, feeders, and packers that the present-day medium or "meat"-type hog is a more profitable kind than either the short, "chuffy" type of 30 years ago or the more recent extreme "big type". The present-day type is a fairly "growthy," deep-sided, smooth hog of medium width that is capable of putting on ample finish at from 180 to 220 pounds. It is difficult to obtain the desired finish on the extremely large, rangy-type hog at a weight under 225 pounds, and both poorly-finished lightweight and heavy-weight hogs are discriminated against on the market. The thick, "chuffy" type is not suitable from the producer's standpoint because such swine are usually lacking in prolificacy and vitality and they are not as efficient users of feed in the feed-lot especially when fed to weights above 200 pounds. Their carcasses yield a high percentage of lard and, consequently they seldom top the market.

Selection of Brood Sows—Prolificacy and production records are the important factors to keep in mind when selecting a sow herd. Sows should be selected that will produce good-feeding, rapid-gaining pigs that will fatten at a marketable weight and be of a type that will command top prices. Uniformity of type and color markings and similarity of bloodlines are important.

The ideal type of brood sow should be large, deep-bodied, strong-backed, and show femininity and refinement about the head. Her hams should be large, deep and full, but not flabby or soft. Her back and loin should be long and of even width with her shoulders and hams. Her entire top should be uniformly arched and her sides long, deep, even and smooth. She should have a sound udder with 10 to 14 well-developed and evenly-spaced teats. She should stand on strong, straight legs and feet, having a good quality of bone and be short and strong of pasterns. The hair coat should be smooth, straight and refined.

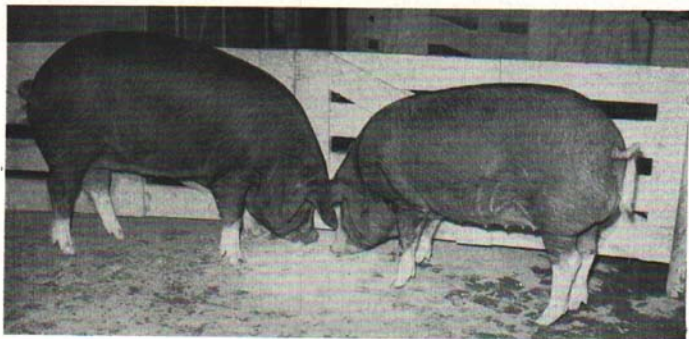


Fig. 2. Two Poland China gilts (Medium and Large Type).

The gilt on the right is shorter-legged, deeper-bodied and thicker-meat in the base of her hams. Though slightly short and steep in her rump, she is likely to produce pigs that will grow rapidly and fatten more readily at 200 to 225 pounds.

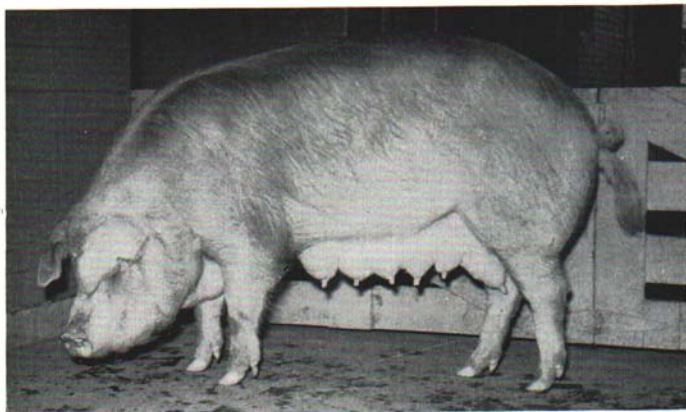


Fig. 3. Chester White sow.

This is the same sow as shown on the title page. Her udder development and femininity indicate her high-producing ability.

The disposition is very important, inasmuch as the nervous, fretful sow seldom raises a large litter of pigs. The sow should be of a quiet nature and gentle disposition. Production records on all sows are the best guides for eliminating the poor producers and excitable sows from the herd, and also for selecting gilts from the best-producing sows. The feeding qualities of a sow's litter are good indications of her value as a brood sow. Comparison of the number and weight of pigs in the litter at weaning time is the most dependable and practical basis of selection.

A practice which has proved very desirable among many commercial hog producers is to breed their gilts at 8 months of age, raise one litter of pigs, and finish the young sows for market after the pigs are weaned. The advantage of this system is that the sow is still growing and will make economical gains. Part of the feed during the gestation period is paid for by increased weight rather than charged to maintenance. A fat, young, smooth-bellied sow weighing around 350 pounds will sell much better than an older, "seedy" sow that is showing more roughness and is heavier in weight. Gilts are more active and raise a larger percentage of their pigs. Spring gilts are particularly adapted when only one crop of pigs per year is desired. If they farrow in late spring, conditions for saving large litters are at their best. The pigs are weaned and the sows can be ready for market about August when the market averages best of the whole year. When two litters per year are desired, fall gilts may be kept over and bred for their first litter the next fall, rebred for a second litter in the spring and then sold at an advantageous time. Compared with the cost of pigs from mature sows, the growth and increased weight of the young sows used in either of these systems pays for considerable feed. All the feed used

to maintain older sows must be charged as part of the cost of producing their litters at birth. The disadvantage of depending entirely upon gilts raising but one litter is the fact that all the sows are sold young and it is impossible to build up a sow herd by keeping the best producers. Mature brood sows farrow larger litters with heavier pigs at birth and they milk heavier, starting their pigs toward market weight slightly faster than yearling sows.

Selection of the Herd Boar—The selection of a herd boar is extremely important because the herd sire is half of the herd, and the most economical improvement is brought about by the use of well-bred sires. There is no excuse for the use of a scrub boar, inasmuch as there is always a surplus of good boars available that can be purchased at a reasonable price. The selection of a boar should not be made until he is at least 4 or 5 months old, which is ample time for any serious defects to develop. Again it is advisable to check the ancestry for prolificacy and conformation in order to determine his probable qualities as a breeder. A sire should be valued by the level of his get even more than by his individuality.

The boar should be somewhat similar in type to that of the sow except that he should have more width of body, be somewhat larger, heavier of bone, and show masculinity and ruggedness rather than the refinement of the sow. However, extreme coarseness and wrinkles are objectionable. The sex organs should be well-developed. A good disposition is desirable, although cross boars can be safely handled with good equipment and cautious management.

EAR MARKING AND RECORDS

Accurate records are essential for proper management. A record of the breeding date, date of farrowing, the number and sex of pigs farrowed, and the number and sex of pigs raised, is vitally important to the purebred breeder.

A system of identification of each litter is advisable whether the pig be a purebred or a grade. This system enables the producer to check carefully the productivity of each sow at weaning time, which is the most efficient means of culling the herd.

Several systems of ear marking may be followed. Aluminum tags with numbers may be put in the ear but the disadvantage of such a tag is that it is frequently lost or torn out, and thus the identification is completely destroyed.

One of the most satisfactory methods is to ear-notch the pigs when only a few hours old. If the herd is small almost any plan will do. However, if the herd is large, a definite system should be followed. The following system is very satisfactory for most herds:

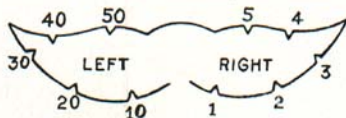


Fig. 4. Ear notching.

The use of a notch in a definite location on the left ear or right ear will represent a given number.

Each pig in the litter is given the same mark. Using one or more of the notches illustrated in Fig. 4 will permit numbering up to 100 litters.

CARE AND MANAGEMENT OF THE BREEDING HERD

BREEDING TIME

Under Michigan conditions the producer may plan to raise either one or two litters per year. With suitable equipment and housing, the spring litters should be farrowed during the latter part of March and early April. The fall litters should come early so as to get the pigs well started on pasture, not later than the latter part of September or early October (the earlier, the better). Later spring pigs, to be farrowed in more favorable weather, are sometimes desired, but this interferes with breeding the sows in time for early fall litters. Late spring litters are usually farrowed by gilts that raise only one litter and are then fattened and sold. It is necessary to raise two litters per year from mature sows to keep down the maintenance cost per pig. Early spring and early fall pigs, when full-fed and rushed to market weight in 6 months, reach market at the most favorable average price periods of the year.

THE GESTATION PERIOD

The average sow will farrow 114 days after she is bred. In only a few instances will her gestation period be less than 112 or more than 116 days. A successful pig crop must be planned and breeding started so as to produce the pigs at the desired time. With carefully kept breeding records, the producer will know the approximate farrowing date for each sow and can make arrangements accordingly. The gestation table (Table 1) is based on a period of 114 days. In the first column, the reader may note the date the sow is bred, and directly opposite that date he can determine the date when she is due to farrow.

Several sows intended for rebreeding to one boar should be weaned from their pigs only in small groups at a few days' intervals. Sows usually "come in heat" 3 to 5 days after weaning their pigs. The duration of the heat period is about 3 days and occurs every 20 or 21 days in open sows. Sows will accept boars only during the heat period. It is believed that larger litters result from mating late rather than early in the period. Unless interrupted, one service is as effective as several and is recommended on the second or third day after the first symptoms of oestrus.

THE AGE TO BREED GILTS

The age at which to breed gilts depends upon the development and maturity of the individual. A well-developed young sow can be bred safely at the age of 8 months. Gilts less than 5 months old may begin "coming in heat," but never should be bred before they weigh 180 pounds and are 7 months old. Breeding too young may cause small litters, weak pigs, and trouble at farrowing time. In order to get maximum growth, purebred breeders often delay breeding until gilts

Table 1. Gestation Table Showing Dates of Breeding and Farrowing for Sows.
(Based on 114-day Period.)

Date Bred	Date Due	Date Bred	Date Due
Jan. 1	Apr. 25	July 1	Oct. 23
Jan. 10	May 4	July 10	Nov. 1
Jan. 20	May 14	July 20	Nov. 11
Jan. 30	May 24	July 30	Nov. 21
Feb. 1	May 26	Aug. 1	Nov. 23
Feb. 10	June 4	Aug. 10	Dec. 2
Feb. 20	June 14	Aug. 20	Dec. 12
Mar. 1	June 23	Aug. 30	Dec. 22
Mar. 10	July 2	Sept. 1	Dec. 24
Mar. 20	July 12	Sept. 10	Jan. 2
Mar. 30	July 22	Sept. 20	Jan. 12
Apr. 1	July 24	Sept. 30	Jan. 22
Apr. 10	Aug. 2	Oct. 1	Jan. 23
Apr. 20	Aug. 12	Oct. 10	Feb. 1
Apr. 30	Aug. 22	Oct. 20	Feb. 11
May 1	Aug. 23	Oct. 30	Feb. 21
May 10	Sept. 1	Nov. 1	Feb. 23
May 20	Sept. 11	Nov. 10	Mar. 4
May 30	Sept. 21	Nov. 20	Mar. 14
June 1	Sept. 23	Nov. 30	Mar. 24
June 10	Oct. 2	Dec. 1	Mar. 25
June 20	Oct. 12	Dec. 10	Apr. 3
June 30	Oct. 22	Dec. 20	Apr. 13
		Dec. 30	Apr. 23

are past one year old or breed early and then raise only one litter the first year.

FLUSHING THE SOW

Ten days before breeding time, the daily allowance for thin sows should be increased so as to get the sows into a rapidly-gaining, thriving condition. Unless on good pasture, include $\frac{1}{2}$ pound daily per sow of protein concentrate. This flushing or extra good feeding of the sow previous to breeding will increase the size of the litter.

A heavy milk-producing sow is usually thin at weaning time. She should not be heavily fed for 2 or 3 days while drying up. After weaning her spring litter, it is usually best to mate for the fall pigs as early as possible, leaving no time for flushing. It is more important to get the fall litter farrowed early than to have it especially large in number. There is often a chance to pass over the first estrum after weaning the fall pigs and flush the sow before breeding on the second period.

BREEDING BACK FOR EARLY PIGS

A method of shortening the time between litters without weaning the pigs too young is to separate the sow from the pigs overnight after they are 3 or more weeks old, returning the sow each day. A large percentage of sows will mate successfully about the fifth day of this treatment, with no ill effects on the nursing litter.

THE BOAR PEN

The boar lot should be located apart from the rest of the herd so that no hogs will be in adjoining lots. It is best that he have quiet, cool surroundings. The lot should include $\frac{1}{8}$ acre or more to provide for pasture and exercise. If a breeding crate is to be used, it should be located in or near the boar's quarters.

Individual boars vary greatly in their habits. Young boars sometimes refuse their feed and pace in front of the fence, lose flesh and become gaunt. If continued fits of temperament are permitted, he may fail to settle sows satisfactorily. Penning the boar entirely separate



Fig. 5. Methods of holding hogs.

The rope snubbed to a post works best for tusking and "staging" boars. A home-made holder of gas pipe and wire is convenient for holding sows for ringing.

from other hogs, especially sows, may help to keep him quiet. Feeding with a barrow or with a gilt that he has settled in pig stimulates appetite by competition at the feed trough. If such methods fail to quiet a boar once started "ranting," it is advisable to confine him in a small, dark, quiet pen, letting him out for only short periods until he starts feeding and becomes quiet.

With yearling or older boars it is advisable and much safer to remove or clip their tusks twice a year, before each breeding season. This may be done by putting a rope around the upper jaw, just back of the tusks (see Fig. 5) and snubbing to a post. Use a pair of bolt cutters or a pair of large pincers.

NUMBER OF SOWS TO BREED

The boar pig may start mating before 5 months old, but should not be depended upon before 7 months old. The boar's vitality can be conserved by bringing the sows to a breeding pen when ready and allowing only one service for each sow. A well-developed boar 8 months old may be used for two sows the same day, but should not be bred to more than five sows per week. Older boars frequently mate three sows successfully in one day, but should not usually average more than three sows in 2 days. In hot weather it is best to breed the sows either in the morning or evening, before feeding the boar.

FEEDING THE BOAR

As the breeding season approaches, the boar should be kept in moderate flesh and fed on pasture, if possible. During the breeding season, he should receive a ration that will supply plenty of energy, protein, vitamins and mineral. A good feeding mixture for the boar is composed of corn 40 pounds, ground oats, barley and wheat middlings 15 pounds each, and 15 pounds of 40-per cent protein supplement. Ten pounds of tankage may be substituted for the 15 pounds of supplement or 3 to 5 quarts of skimmilk may be mixed and fed with the grain as a slop twice daily. If pasture is not available, 5 per cent of alfalfa hay should be included. During the heavy breeding season, he should get all he will take of the above-mentioned ration twice daily. Less protein supplement and less feed daily are required if only a few sows are to be bred.

The feed allowance should be adequate to maintain the boar's weight or keep young boars growing during the breeding season. Over-fatness is more detrimental to mature boars than a thin condition. Large boars in high condition are less useful for breeding young and small sows than the same boars in thin but vigorous condition.

When the breeding season is over, the mature boar need only be kept in good, thrifty condition. A small amount of grain and plenty of pasture will do this most economically. Young boars use to good advantage such mixtures as are recommended later for growing pigs.

FEEDING THE SOW

During gestation, the sow should gain in weight gradually. Young gilts should carry more flesh than older sows at farrowing time. Gilts and older sows that are in thin condition should be fed separately from old sows in good flesh, so that the daily feed allowance can be so regulated in amount as to keep them gaining steadily, usually about 0.6 to 1 pound daily during pregnancy, without causing any of the sows to become too fat. As a rule, brood sows should receive from 1 to 1 $\frac{1}{4}$ per cent of their weight in grain daily, and gilts from 1 $\frac{1}{2}$ to 2 per cent of their weight. The sow should come to farrowing in a smooth condition, but not loaded with fat. Fat sows have more udder trouble, are more clumsy and lose more pigs.

An adequate supply of protein, minerals, and vitamins should be provided for all sows, but a deficiency affects the strength of pigs from growing gilts more than from mature sows. A simple mineral

mixture should be kept available for all sows. As soon as sows are off pasture, green, leafy legume hay, such as second-cutting alfalfa, should be included in their ration. It may be fed in a rack where they can help themselves or ground and mixed with their grain. Mature sows fed a limited feed of concentrates will take enough hay from a rack. Gilts under one year of age can be forced to consume more alfalfa by grinding and mixing it with their grain than they will take from a rack. In seven trials at the Michigan Agricultural Experiment Station, satisfactory results were obtained by feeding pregnant gilts a mixture of 2 parts corn and 1 part ground alfalfa without other supplements, except minerals (see page 31). Grain mixtures, including oats, wheat

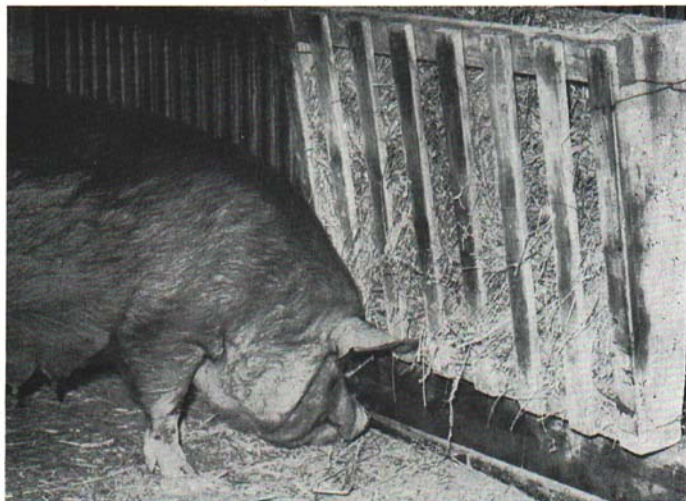


Fig. 6. Alfalfa rack—A good way to furnish $\frac{1}{4}$ to $\frac{1}{2}$ of the pregnant sow's feed.

or barley, are satisfactory if available. Gilts bred for their first litter should receive $\frac{1}{4}$ pound daily of some protein supplement if corn is the only grain and alfalfa is fed in a rack. Older sows (in the trials mentioned above) made enough better use of the ground alfalfa to pay for the grinding, which may have been true because of less wastage. If a liberal supply of high-quality legume hay is not available for sows, they should receive $\frac{1}{4}$ to $\frac{1}{2}$ pound daily of tankage, 2 to 5 quarts of buttermilk or skimmilk, or comparable amounts of other protein supplements.

Inadequate supplements during the gestation period are frequently the cause of sows eating their young pigs. This depraved appetite is attributed to a lack of exercise or a ration deficiency in protein and

minerals during the pregnancy period and can usually be prevented by proper feeding during pregnancy. Sows that start eating their pigs may be checked by adding a liberal amount ($\frac{1}{2}$ pound) of meat scraps or tankage to their feed for a few times. Sows having the pig-eating habit should be culled from the breeding herd.

Just before farrowing and from 4 days to one week after, use light laxative feeds, such as equal parts of bran or ground alfalfa and middlings or ground oats, or mixtures including small proportions of corn, rye, wheat or barley. These may be fed as a thin slop and warmed in cold weather.

Sows should have water, but not be fed for 24 hours after farrowing and then only a small amount of a fairly light ration, such as one pound of bran, ground alfalfa or ground oats.

Over-feeding or feeding of heavy, fattening feeds soon after farrowing often causes udder trouble, and the feverishness resulting may cause sows to lie on pigs. Sows in poor condition should have feed increased sooner after farrowing than the fat ones. Usually, it is best to allow 7 days in which to return the sow to a normal feed. The grain allowance should be increased as it is seen that the pigs 2 or 3 weeks old can take more milk. Guard against such heavy feeding that the pigs become fat, short, and chubby, for this, along with lack of exercise, causes thumps. With large litters, 3 weeks old, and if the sow is getting plenty of exercise, she usually should be fed as much as she will consume. The best method is to self-feed both sows and pigs the rest of the nursing period. Feeds to use are suggested in the feeding section of this bulletin.

WINTER QUARTERS FOR SOWS

Portable houses with an open door are satisfactory for winter quarters for the sows. Several may sleep in one house, but they should not be crowded, especially as they approach farrowing. The house does not need to be warm, if dry and free from drafts. Burlap may be hung over the door if desired. Avoid high door sills, crowding and running with other stock that may trample or scare the sows and cause them to pile up in narrow doorways.

Daily exercise should be required of all pregnant sows. Sleeping quarters may be located 10 to 20 rods from the feeding place or feed may be scattered so as to require the sow to exercise by traveling or staying on her feet every day. Tests have shown that lack of exercise is a greater factor than over-fatness in reducing the sow's ability to raise pigs.

Water for sows is too frequently neglected in cold weather. Feeding a thin warm slop, or including a small amount of skimmilk in the drinking water, will induce greater water consumption. Reduced water consumption may cause constipation and poor farrowing results.

CARE OF SOW AND PIGS

The sow should be confined to her farrowing quarters about 3 days before due to farrow. Before moving the sow, the farrowing house should be properly cleaned and repaired. To clean the quarters, remove all debris, bedding and filth, sweep the floors and walls, scrub the entire premises thoroughly with a solution of lye, and flush with scalding, hot water. The house or pen should be warm and free from dampness and at least 7 by 7 feet in size. Large sows need larger pens. Guard rails should be constructed about 8 or 10 inches above the floor and 6 or 8 inches out from the wall on the inside of the farrowing house or pen. After drying, the quarters should be bedded with clean, bright straw, preferably wheat or rye, the amount depending upon weather conditions. When the sow is ready to farrow, the coarse bedding should be replaced by a small amount of chaffy or chopped straw.

The sow should be washed thoroughly with warm water and soap until all filth and mud has been removed, before moving into her cleaned farrowing quarters. As farrowing time approaches, the sow will become nervous and the milk flow will start. If breeding dates are not available, the sows about ready to farrow can be detected by stripping their teats each feeding time. The milk flow starts about 12 hours or more before farrowing. When the milk first appears upon gently massaging the teat, there is still time to wash the sow and place her in the farrowing pen though she is more likely to be nervous than if placed there earlier.

McLEAN COUNTY SYSTEM OF SANITATION

The above-mentioned suggestions for thorough cleaning of the pen, and washing the sow, especially her sides, belly and legs, just before moving her into the clean pen, are a part of the McLean County sanitation system that has proved very successful for preventing roundworm infestation and many little-pig diseases. In case of extremely cold weather and no satisfactory place for the sow to dry, a thorough brushing with a good stiff brush will be of much value. Every particle of dirt and dust on the sow is likely to carry roundworm eggs or disease germs. The remainder of the sanitation system is provision for new pasture, plowed and seeded since any hogs have used the same ground. The sow and litter should be hauled in clean crates or boxes to this pasture and not allowed to travel dusty or muddy old hog lots or lanes that will expose the pigs to roundworm eggs and germs.

CARE OF NEW-BORN PIGS

As the pigs arrive, the attendant should dry them and place them in a cloth-lined basket or box unless the sow is very quiet or is irritated by a man's presence. In cold weather, the pigs may remain in the basket with a jug of warm water to prevent chilling. They should be allowed to nurse every two hours and if the sow's milk flow has not begun, they may be fed on small quantities of straight cow's milk. A nipple or eye-dropper is very handy for feeding cow's milk to small pigs.

LITTLE-PIG ANEMIA

Little-pig anemia is a common ailment of young pigs (receiving only their mother's milk) confined on cement or wooden floors more than 2 weeks. It is due to a deficiency of iron and copper and is associated with low hemoglobin content of the blood.

External symptoms are paleness of the skin, lack of vigor, roughness of the hair coat, and later a loss of flesh and tendency of the skin to wrinkle. A large percentage of affected pigs die, many of them before the external symptoms become pronounced, and recovery for those that survive is slow, requiring 2 or 3 months.



Fig. 7. Alfalfa is the most favored swine pasture in Michigan because of its long season, persistent growth in dry weather, and palatability.

Feeding the sow minerals is not sufficient to prevent anemia in young pigs, because it is important to get the iron and copper directly to the pigs as early after birth as possible. Nature takes care of this problem when the pigs are reared on pasture by having provided traces of these elements in the soil eaten by the pigs. Sod put in the farrowing pens every few days as long as the pigs are kept inside is very effective as a preventative. It is advisable to encourage the pigs to eat from a mixture of grain and protein supplements as young as is practical. One of the easiest ways of getting the minerals directly to the pigs is to swab or spray the sow's udder daily with a solution of $\frac{1}{2}$ pound of copperas (ferrous sulphate) in one quart of water.

ORPHAN PIGS

If a sow dies shortly after farrowing or becomes seriously sick, the problem arises as to how the pigs may be reared. The best plan is to induce sows which have litters of about the same age or younger to adopt the orphans. This same method may be used to "even up" the

number of pigs in various litters, pigs being taken from a sow that has too many pigs to nurse adequately and added to a small litter of about the same age. No special precautions are necessary to get the sow to adopt the pigs if her own litter is not more than 1 or 2 days old. If she notices the difference in the pigs, the sow should be taken out of the pen when the orphans are added to her litter, and the pigs should be allowed to run together for 1 or 2 hours before the sow is returned to the pen. Sprinkling a weak solution of stock dip over all of the pigs just before her return will make it difficult for the sow to distinguish the new arrivals because she depends upon her sense of smell. No difficulty will be experienced from changing pigs of different colors.

When sows with litters of about the same age are not available, orphan pigs may usually be raised successfully by hand, if the herdsman has enough patience. It is best to feed the pigs whole warm sweet cow's milk at 2- or 3-hour intervals or at least 5 or 6 times daily until they are 3 or 4 weeks old, when the number of feedings may be reduced to 3 a day. Frequent and regular feedings of small amounts are best for starting the pigs. Some herdsmen use a nursing bottle at the start, but with patience even very young pigs can be taught to drink milk from a shallow dish. The pig's mouth and nose are pushed into the milk, but care is taken not to continue the process so long that the pig is strangled.

If young pigs do not get the colostrum, or first milk from a sow, it is more difficult to rear them, for the colostrum protects them against various infections and has some laxative effect.

A maximum of one quart of whole milk a day is enough per pig, if the pigs are supplied with a suitable concentrate mixture as soon as they are ready to eat solid food. When using concentrates and pasture, skim milk may be substituted gradually for whole milk and increased to as much as they will clean up 3 times daily as they approach the usual weaning age. Care should be taken to supply fresh water at all times. It is not advisable to add cream or sugar to whole milk for orphan pigs.

USE SELF-FEEDERS OR CREEPS

When the pigs are 4 weeks old, unless self-fed with their dams, they should be eating all they will take from a separate trough or self-feeder placed in a "creep" (Fig. 8) where only the pigs have access to it. Thus, they are started on feed so that they grow continuously with no "set-back" at weaning time. It is best to use tempting feeds at first. When it seems necessary to use such unpalatable feeds as cull beans (cooked) or ground rye, such feed should be started in small proportions with plenty of tempting feed and the amount increased very gradually. It is not profitable to use so much unpalatable feed in the ration that the pigs eat lightly, and consequently gain slowly. Cracked corn, coarsely ground wheat or barley and middlings are good feeds for starting pigs at the "creep," but more protein should be included in their mixture as they approach weaning time. A good feed mixture to use in the "creep" and at weaning time is:

Corn	200 pounds
Middlings	100 pounds
Finely ground oats	100 pounds
Tankage	25 pounds
Soybean oil meal	25 pounds
or	
Ground barley	200 pounds
Ground wheat	200 pounds
Tankage	25 pounds
Soybean oil meal	30 pounds

If the pigs have as much skim milk as they will consume twice daily, tankage may be omitted from the mixture.

The daily allowance of feed for pigs from this time on will depend upon circumstances. If plenty of feed is available, it is usually profitable to feed for rapid gains, thus making a quick turnover of the investment. With early pigs, this usually means a higher selling price. The price paid for light hogs on the Chicago market for the last 10 years has averaged \$8.15 for the months of August and September, compared with an average for the same years of \$6.64 for the months of November and December. Shotes that can be finished at a weight of 180 pounds or more and marketed between August and October often net a greater profit than they would if held until later.

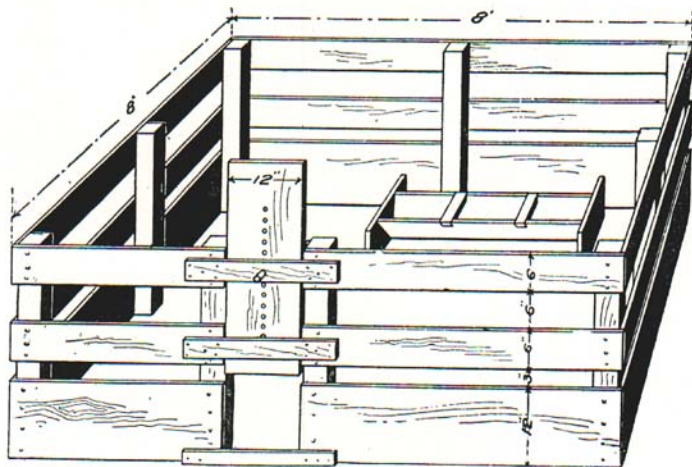


Fig. 8. Feeding pen for small pigs.

(Courtesy, U.S.D.A., Bulletin 1490, Hog Lot Equipment.)

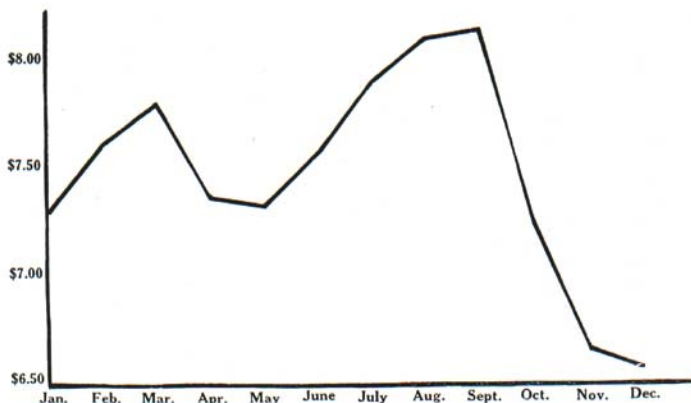


Fig. 9. Market hog prices.

Average price of light hogs by months (Chicago 1930-39).

SUPPLEMENTS USUALLY ARE PROFITABLE

Spring pigs are fed usually for the most economical gains on grain and pasture. Producers differ in opinion as to whether it is profitable to feed liberally the higher-priced protein supplements, such as tankage. Feeding trials at the Michigan Agricultural Experiment Station reveal some information on this subject. Tankage included in the ration with corn or wheat full-fed on good pasture has saved more than enough grain in feed required per hundredweight gain to pay for the tankage. In some trials with barley, tankage has been profitable, but not always, especially with pigs weighing more than 90 pounds. The less protein supplement fed, the more pasture is consumed by the pigs, and somewhat less self-fed grain is consumed daily than by comparable pigs full-fed on both grain and protein concentrate. The most important economic effect of limiting the daily allowance of the protein concentrate has been that the resulting slower growth and gain cause the pigs to be marketed later in the fall, when the average market price is lower than that of August and September. Probably it never is profitable to limit the amount of supplement when starting weanling pigs on a full-feed of grain. When feeding grain mixtures (including considerable proportions of barley and oats) with excellent pasture and supplements are unusually high in cost, supplements may not be profitable. This is likely to be true if 100 pounds of a good grade of 50-per cent tankage costs more than the value of 300 pounds of corn, or with late spring pigs that are to be carried through for a winter market. With pigs fed in a dry lot or on poor pasture, it is usually profitable to use some protein supplement with corn, wheat, barley and rye. The direct results are thriftier, more uniform and

rapid-growing pigs, less feed for each pound of gain, and less risk of death loss.

CASTRATION

Boar pigs not to be kept for breeding purposes should be castrated before weaning time. The best time to castrate pigs is at the age of 4 to 5 weeks because they will shrink less and recover from the operation more quickly than at an older age. Warm, bright weather is beneficial, and quarters free from dust or mud will help to prevent infection and complication from the operation.

All that is needed for a successful operation are clean hands, a sharp knife, a brush or sponge and some good disinfectant. Usually a coal tar dip is satisfactory. Wash the scrotum and area surrounding it thoroughly with the disinfectant before beginning the operation. Make the incision fairly long, well toward the lower end of the scrotum, parallel to and about $\frac{1}{2}$ inch from the seam or middle line of the scrotum. A single stroke should cut through the membranes and into the body of the testicle. Force the testicle out through the incision, cut the membrane from the end of the testicle and gradually pull the testicle and cord out and, if necessary, scrape the cord lightly causing it to break next to the body of the pig. No treatment is necessary after the removal of the testicles. Ridglings and ruptured pigs should be sold as roasting pigs without attempting the castration, unless the operator is very skillful. Directions are available in U. S. D. A. Farmers' Bulletin 1357.*

RINGING THE PIGS

When the pigs become large enough to damage the pasture crop by rooting, they should be ringed. Care should be taken to get the ring just back of the cartilage on the nose and not against the bone. If the hogs are too large to hold by hand, a hog twitch (see Fig. 5) or a breeding crate may be used as a means of restraint while ringing.

AGE TO WEAN PIGS

Producers differ in opinion on the age at which pigs should be weaned. Pigs are weaned at all ages ranging from 5 to 12 weeks. If two litters are to be raised each year, the pigs should be weaned at about 8 weeks of age in order to re-breed the sow for the following litter. If only one litter per year is to be raised, it is better for the pigs to be weaned at 9 to 12 weeks of age. A good brood sow should have a heavy milk flow for at least 10 weeks, and ordinarily pigs will wean themselves at about that age. Pigs weaned at 5 or 6 weeks of age, and not supplied with skimmilk, are not able to consume ample feed for the first few weeks to continue their growth at the rate they would have, had they been left with the sows.

The sows should be removed from the pigs at weaning time rather than removing the pigs from their familiar feeding grounds. Unless self-fed, increase the feed for the pigs, but do not let slop or milk accumulate in troughs and sour or become moldy.

*Available only from Superintendent of Documents, Washington, D. C.

Udder troubles may develop if the sows are over-fed at weaning time. It is a good practice to reduce the sow's feed a few days prior to the weaning date. If sows and litters are self-fed, build a creep around the feeders 2 or 3 days before weaning time to keep the sows away.

Trouble often results if the breeder attempts to wean a few of the pigs at a time, because the milk flow continues and some of the parts of udders are not used. If the udders become caked and hard, the sow can be put with the pigs for a few minutes in order to prevent severe injury. This will not be necessary more than one or two times because the udder will then dry up satisfactorily.

WATER

Hogs will not thrive without sufficient water, and gains are more costly when it is not supplied abundantly. Clean drinking water, which is not contaminated by surface drainage, is important in the prevention of disease and parasites. Self-watering devices that furnish a continuous supply have proved satisfactory. If troughs are used, they should be constructed so as to keep the pigs from lying in them.

FEEDS AND FEEDING

Feed consumed by swine usually accounts for more than three-fourths of the total cost of producing pork and, when feeds are high-priced, often amounts to 85 per cent of the cost. The quantity of feed required for a unit of gain in weight varies greatly under different conditions, and is materially lessened when one has healthy, thrifty pigs, and when he provides good pasture and suitable supplementary feeds. It is of utmost importance to use efficient management and such combinations of feed that a minimum amount will be required for gains.

Grains and factory by-products from grain, compose the main part of swine rations. Feed prices have almost as much effect on profits in pig feeding as do hog prices. Grains are valued higher on many Michigan farms than in districts producing a surplus of corn, barley or other grain feeds. This is because many communities in Michigan feed more grain than they produce and grain on the farm is valued at the cost of replacing it. Chicago grain prices plus freight and handling costs—rather than central market values, less those charges—are the prices used by many farmers in estimating their feed costs.

To overcome the handicap of high-priced feed, Michigan farmers restrict their production of hogs to such numbers as can be produced by making use of certain local advantages over cornbelt producers. Some of these advantages are: (1) a large supply of dairy and other by-products for use as supplements to grains; (2) better sanitation and health conditions due to smaller numbers, and (3) ability to finish pigs for marketing during periods of light market receipts and higher prices.

The supply of feed for Michigan swine, whether home-grown or purchased, varies greatly as to kind, quality, price, and combinations available in different seasons. Only the more important factors that aid in evaluating these different kinds and combinations of feeds are suggested here.

Table 2. Composition of feeds.

Feed	Digestible Protein	Total Digestible Nutrients	Nutritive Ratio 1:—	Crude Fiber	Water	Mineral Matter	Crude Protein	N-Free Extract	Fat
Barley, common, not including Pacific Coast states	9.3	78.7	7.5	5.7	9.6	3.0	11.8	68.0	9.0
Barley, light weight	9.7	73.1	6.5	8.5	10.2	3.0	12.3	63.7	7.3
Corn, dent, Grade No. 1	7.3	82.5	10.3	2.3	12.6	1.4	9.6	70.0	3.9
Corn, dent, Grade No. 3	7.0	79.0	10.3	2.2	16.5	1.3	6.7	67.0	3.8
Corn, dent, Grade No. 5	6.6	74.2	10.3	2.0	21.5	1.2	8.6	63.0	3.6
Hominy feed	7.8	85.2	9.9	4.9	9.7	3.6	12.0	60.5	4.1
Oats, not including Pacific Coast states	9.4	71.5	6.6	10.6	8.9	3.6	12.0	60.2	4.2
Oats, light weight	7.8	60.6	6.8	15.4	8.7	4.5	12.3	54.4	4.7
Oat berms, without hulls	14.6	93.9	5.4	1.9	18.3	1.9	16.2	65.3	6.4
Rye, grain	13.2	70.1	4.8	2.0	19.8	2.0	12.2	71.7	1.7
Rye middlings	13.2	77.1	4.8	5.0	17.2	3.0	12.2	71.5	1.4
Beans, field	19.9	75.6	2.8	3.5	11.8	4.3	22.9	56.1	1.4
Pea seed, field	20.2	79.6	2.9	6.2	9.5	3.1	23.8	56.2	1.2
Wheat screenings	13.7	63.6	5.4	3.0	10.2	2.0	13.1	70.0	1.7
Wheat standard middlings, all analyses	14.4	78.4	4.4	6.8	10.0	4.2	17.4	56.1	3.5
Wheat flour middlings	15.0	79.5	4.4	4.4	10.4	3.4	17.0	50.9	4.9
Wheat bran, all analyses	13.1	70.2	4.4	9.5	9.4	6.0	15.8	54.3	5.0
Wheat bran, low grade	17.0	67.6	3.7	0.5	11.2	1.3	15.1	69.1	2.5
Bread, stale	7.3	68.8	7.7	0.7	33.8	1.3	7.9	35.4	0.7
Molasses, beet	2.5	58.8	22.5	—	19.4	10.3	7.7	62.6	—
Potatoes, tubers	1.1	17.3	14.7	0.4	78.8	1.1	2.2	17.4	0.1
Apples	0.2	14.4	71.0	1.3	82.1	0.4	0.5	15.3	0.4
Artichoke tubers	1.0	16.1	15.1	0.8	79.5	1.7	2.0	15.9	0.1
Pumpkins, field	1.3	9.0	5.9	1.6	89.6	0.9	1.7	5.2	1.0
Brewers' grain, wet	4.6	16.5	2.6	3.6	76.1	1.0	5.7	11.9	1.7
Tankage or meat meal (60% protein grade)	56.4	78.0	0.4	1.4	7.8	19.2	61.3	1.5	8.8
Fishmeal, 88-95% protein	48.8	67.7	0.4	0.8	7.8	19.8	60.2	3.9	7.5
Cottonseed meal, 43% protein grade	35.0	75.5	1.2	10.6	6.5	5.5	43.2	27.0	7.2
Linseed meal, old process, all analyses	30.6	78.2	1.6	8.0	8.7	3.6	35.2	36.3	6.3
Flaxseed	21.4	108.7	4.1	5.9	6.4	3.6	23.5	24.2	36.4
Soybean oil meal, hydraulic or expeller process, 43-48% protein	37.6	82.8	1.2	5.2	8.1	5.5	44.2	31.5	5.6
Soybean oil meal, solvent process	39.4	77.6	1.0	5.9	8.4	6.0	46.4	31.7	1.6
Soybeans	32.8	86.2	1.6	4.5	9.8	5.3	36.9	26.3	17.2
Milk, cow s	3.3	16.2	3.9	—	87.2	0.7	3.5	4.9	3.7
Skim milk, centrifugal	3.5	8.6	1.5	—	90.4	0.8	3.7	5.0	0.1

Feed	Digestible Protein	Total Digestible Nutrients	Nutritive Ratio 1:—	Crude Fiber	Water	Mineral Matter	Crude Protein	N-Free Extract	Fat
Skim milk, dried	33.1	84.1	1.5	—	6.2	8.0	34.8	50.1	0.9
Buttermilk	3.3	9.1	1.8	—	90.6	0.8	3.5	4.5	0.6
Buttermilk, condensed	10.7	27.3	1.6	—	70.1	3.7	11.3	13.3	1.6
Whey, from American cheese	0.9	6.4	6.1	—	93.4	0.7	0.9	5.0	0.3
Alfalfa hay, all analyses	10.6	50.2	3.7	29.0	6.6	8.3	14.7	36.4	2.0
Alfalfa hay, very dry (Less than 25% fiber)	13.4	53.7	3.7	22.6	10.0	8.7	16.5	39.5	2.7
Alfalfa hay, steamy (More than 34% fiber)	8.2	47.5	4.8	36.0	9.6	7.8	12.1	33.1	1.4
Alfalfa leaves	16.9	57.0	2.4	14.1	11.0	10.2	21.9	39.8	3.0
Alfalfa stems	5.1	40.8	7.0	36.6	11.4	6.6	10.0	34.2	1.2
Glover hay, red, all analyses	7.0	50.6	3.4	28.4	11.5	7.3	14.8	37.0	3.3
Swainson's alfalfa hay	11.3	48.7	13.4	6.9	71.7	1.7	2.3	16.5	0.9
Corn silage, dem., well-matured, all analyses	1.3	18.7	13.4	6.9	71.7	1.7	2.3	16.5	0.9
GREEN ROUGHAGES:									
Alfalfa	3.4	14.7	3.3	7.0	74.6	2.4	4.6	10.4	1.0
Red clover	2.6	15.4	4.9	6.8	75.0	2.1	4.0	11.2	0.9
Rape	2.6	13.0	4.0	2.6	83.5	2.2	2.9	8.1	0.6

These data were taken from Morrison, F. B.: *Feed and Feeding*, 20th edition, by special permission of the Morrison Publishing Company, Ithaca, N. Y.

RELATIVE VALUE OF DIFFERENT FEEDS

The value of a feed may be estimated from a knowledge of (1) its chemical analysis and digestibility; (2) the requirements of swine fed for different purposes; and (3) the adaptability of the feed (and desirable proportions) for combining with other feeds.

Chemical analysis will show whether a feed is rich in fattening nutrients or proteins and also whether it is a concentrate or a bulky feed due to water or fiber. Because of his small digestive tract, a pig cannot use bulky feeds extensively, and can use them only in very small proportions when fed for rapid growth, or for fattening. He can use more bulk from water than from fiber. Most of the grains and grain by-products adapted to pig feeding are rich in fattening nutrients, mainly carbohydrates, and need to be supplemented with feeds carrying protein, minerals, and vitamins. The percentage of digestible protein is a good indication of a feed's value as a protein supplement and the total digestible nutrients constitute a good basis for comparing the feed's fattening value.

Corn, for instance, as shown in Table 2, is very low in protein, but ranks high in total nutrients, indicating that it is a good basis for a fattening ration. Tankage has 61.3 per cent total protein as compared with 17.4 per cent for wheat middlings. As a source of protein, tankage is indicated by the analysis to be worth more than three times as much per pound as middlings, if one disregards the value of the fattening nutrients. The value of the total nutrients may be estimated by comparing what they would cost if such grains as corn were used as the basis of calculation. Though there are factors of value that are not revealed in the chemical analysis, there is no better indication of an untried feed's probable value. Occasionally, brood sows may use a feed mixture containing 10 to 12 per cent fiber; however, the pig's ration should not contain more than 5 to 7 per cent. A comparison between the fiber content of leafy and stemmy alfalfa hay reveals why leafy hays are suggested for swine feeding. The analysis of some common feeds used for swine are shown in Table 2. The first two columns give the digestible protein and total digestible nutrients which are based on digestion experiments as well as upon chemical analysis.

Feed requirements vary, depending upon the age of the swine and the purpose for which they are fed. Growing pigs require a much larger proportion of protein than do fattening shotes. A dry brood sow requires much less feed per day, can use cheaper feeds containing much more fiber, and requires a much smaller proportion of protein than the same sow during the nursing period. The third column in Table 2 gives the nutritive ratio which is the ratio of the digestible crude protein to the fattening nutrients (digestible carbohydrates plus $2\frac{1}{4}$ times the fat). In other words, the third column gives the number of pounds of fattening nutrients present in a feed for each pound of protein. This ratio of the ration should be 1:4.5 or less for best results for weanling pigs and should average about 1:6. However, an economical fattening ration may have a ratio of 1:8 or more. All cereal grains have such wide nutritive ratios that supplementary sources of protein must be fed with them for the highest efficiency of young pigs.

Other supplements needed by pigs but sometimes neglected are

minerals and vitamins. The minerals most likely to be deficient are common salt, calcium and phosphorous. A simple mineral mixture supplying these substances costs but little and should usually be kept where all hogs can feed on it at will. The rations for growing pigs and nursing sows are often deficient in vitamins. Most likely to be needed by swine are Vitamins A and D, and both are most satisfactorily supplied by pasture in summer and well-cured green, leafy legume hay in winter. Five per cent of high-quality alfalfa included with the pig's grain mixture will prevent disastrous results from these deficiencies, but 10 to 30 per cent or more may well be included for pregnant sows.

The adaptability of a feed depends upon the other feeds in the ration and other factors that are not shown in the chemical analysis. Many feeds have failed, by experience and experimental work to correspond with their chemical analysis. Oats are of less value if they compose a large part of the ration, than when they do not exceed one-third of the ration. They are worth more when fed with corn than when fed with barley. Cull navy beans have 71.9 per cent of total digestible nutrients and 18.8 per cent of digestible protein, which is 1.5 per cent more total nutrients and almost twice as much protein as that contained in oats, but they usually are not worth so much as oats for swine feeding even with no charge for cooking the beans. Skimmilk is an excellent feed to combine with corn and all other grains, particularly for starting pigs, but it has less value for older hogs and less value when large daily allowances of it are fed. Feeding results at the Michigan Agricultural Experiment Station with corn self-fed on rape pasture to three lots of growing, fattening pigs fed 3 pounds of skimmilk per pig per day in one lot, 6 pounds per pig in the second, and all they would consume in the third, indicate diminishing returns for larger amounts of milk, as shown in Table 3.

Table 3. Gains and feed costs with varied amounts of skimmilk.

(Average Results of 4 Trials)

Feeds Used: Corn self-fed. All lots on rape pasture.	Skimmilk 3 lb. per day	Skimmilk 6 lb. per day	Skimmilk Unlimited
Number of pigs (total in four trials).....	47	47	47
Initial weight of pigs.....	52.9 lb.	53.4 lb.	52.9 lb.
Final weight of pigs.....	177.7 lb.	180.0 lb.	179.7 lb.
Average daily gain per pig.....	1.10 lb.	1.20 lb.	1.37 lb.
Feed Consumed per Cwt. gain:			
Corn.....	328 lb.	299 lb.	245 lb.
Skimmilk.....	272 lb.	495 lb.	939 lb.
Feed Cost per cwt. gain:			
Corn at \$1.60 per cwt.....	\$5.25	\$4.78	\$3.92
Skimmilk at 40 cents per cwt.....	1.09	1.98	3.76
Total, except pasture.....	6.34	6.76	7.68
Return per cwt. milk: (Assuming gain worth \$6.34 per cwt. in addition to pasture and labor and other costs).....	0.40	0.32	0.26

FEEDS FOR SWINE

Corn is the richest in fattening food nutrients of our farm-grown grains, and when properly supplemented a smaller quantity of corn than that of any other grain except wheat will produce 100 pounds of gain. Experimental data prove that under ordinary circumstances it is not profitable to shell, grind, soak, cook, or otherwise prepare corn for swine feeding, except in the case of old, dry corn or flint corn. Corn is very deficient in protein, vitamin D, and minerals, and requires supplementary feeds for good results. White corn also is low in vitamin A, which is easily supplied by green feed or leaves of well-cured legume hay. Factory by-products of corn, rich in protein do not satisfactorily supplement corn.

Rye and barley should be ground. They are both fattening feeds, but require much less protein supplement than does corn. Neither rye nor barley gives so rapid or economical gains, from the standpoint of pounds of feed consumed per pound of gain, as does corn. Because of the irritating nature of the barley hulls, a large proportion of barley in a ration may cause digestive troubles in young pigs. Ground barley is worth 90 to 95 per cent the value of shelled corn for hogs. Rye is not so palatable to the pig as corn or barley and, though concentrated in food nutrients, it produces slower and more costly gains unless combined with other feeds that tempt the pig's appetite. Ground rye produces from 70 to 90 per cent the gain produced by an equal weight of shelled corn, but when used for one-third or less of the ration, with palatable feeds, may approach the value of corn. Rye containing ergot should not be fed to bred sows because it may cause abortion. Large amounts of ergot may harm hogs of any age.

Oats are of less value for hog feeding than the other common grains. Their hulls average about 30 per cent of their weight, a percentage that varies greatly between light and heavy oats. Oats with a high percentage of kernel, usually indicated by heavy weight per bushel, are more valuable than chaffy oats because of the latter's fibrous and bulky nature. Oats are better utilized in a mixture not exceeding 25 per cent of the ration and mixed with low-fiber grains such as corn, wheat or rye. They can make up a larger percentage of the ration for stock hogs and dry sows than for full-fed growing pigs, fattening hogs or nursing sows. Value of oats varies from 65 to 90 per cent of the value of corn per hundredweight.

Less protein supplement needs to be fed with oats than with other grains because of the higher protein and lower total nutrient composition of the oats. Except for young pigs, oats may be added to other feed mixtures without changing the proportions of the other feeds. Grinding ordinarily saves more than enough feed to pay the cost, and fine grinding makes the grain more palatable. Oat kernels are an excellent feed and well-adapted to young pigs, but the cost of hulling and loss of weight makes hulled oats too expensive.

Spelt is about equal to oats in feeding value and takes about the same place as oats in feed mixtures for pigs.

Wheat and wheat middlings are relished by swine and are good additions to most rations when not too high-priced. Middlings are a

source of both fattening and growing nutrients in such proportions that they have just about the right nutritive ratio for weanling pigs. They are required in large quantities as a protein supplement for corn, rye, and barley. Their relative cost to fattening grain, as well as to other sources of protein, must be considered. They are particularly desirable for part of the ration for young pigs. When wheat is worth no more than middlings it can be substituted for middlings in pig feeding mixtures but the addition of extra protein supplement is required. Wheat does not have to be ground for good results if self-fed. It takes the place of corn or barley in mixtures and requires only one-half as much protein supplement as corn. It is equal to, or only slightly superior to corn in value per pound as a hog feed.

Skimmilk and buttermilk furnish protein and are unexcelled for supplementing fattening feeds. They are of about the same value and are particularly efficient for starting young pigs and growing shotes. Daily allowances of 3 or 4 pounds per pig on pasture and 6 to 8 pounds in the dry lot supply the protein deficiencies for a full-feed of corn. When available, larger amounts of milk may profitably be fed to pigs, but the greatest return is obtained when a proportion of less than 3 pounds of milk to 1 pound of grain is used. (See Table 3, page 25.) About 20 times as much weight of skimmilk as tankage is required to balance a ration, though the milk affords better results especially with young pigs and usually proves about 1/10 as valuable per pound as tankage.

Tankage is an animal by-product which furnishes an excellent source of protein and minerals for supplementing grains and gives good results in experimental hog feeding. High-grade tankage (from 50 to 60 per cent protein), even at a high price per hundredweight, usually furnishes protein at a low cost per pound. Dry-rendered tankage (meat scraps) testing 50 per cent protein may equal in feeding value 60 per cent wet-rendered tankage. Either furnishes but little nutrient other than protein and minerals and serves best when a concentrated protein supplement is desired. Fishmeal has about the same value as tankage. Tankage, fish meat and dairy by-products furnish protein of animal origin which is especially valuable as part of the supplement to grains.

Linseed oil meal, soybean oil meal and ground soybeans are all vegetable sources of protein which are decidedly lacking in minerals. Until mineral feeding in conjunction with these feeds became common they usually gave results much inferior to the animal sources of protein. Because of their lower percentage of protein and higher content of fattening nutrients, about $2\frac{1}{4}$ times as much linseed oil meal as tankage is required to balance a given ration; about $1\frac{1}{3}$ times as much soybean oil meal; and nearly $2\frac{1}{2}$ times as much of the ground soybeans. Soybean oil meal has a higher value than soybeans as a source of protein. The oil meal is more palatable, and does not produce soft pork. The expeller meal or a brown roasted meal is more satisfactory for pigs than the white new-process meal. As a rule, these feeds have given better results on pasture than in the dry-lot, and they have proved better when used as only a part of the protein supplement and fed with some protein-rich feed of animal origin. Either linseed oil

meal or ground soybeans are unsatisfactory as the only protein supplement to grains for pigs.

Field peas are excellent feed and are relished by swine of all ages. They are rich in protein and are about the best home-grown supplement for northern Michigan conditions. They are usually so high in price that other feeds can be purchased that will furnish protein more cheaply, except in communities where they grow well.

Cull beans are often a cheap feed for fattening hogs. They are rich in protein but are not very palatable to swine and have to be cooked to give good results. For these reasons they are not usually considered for supplementing fattening rations, but are used for as large a part of the ration as will give good results. They should not compose more than one-third of the grain ration (on the basis of their dry weight before cooking) for growing shotes weighing up to 100 pounds, but may profitably be increased later to one-half the ration, and when very cheap, may constitute the main part of the hog's feed. Too many beans reduce the feed consumed daily, produce slower gains, and give a poor finish. Pigs fed beans should receive minerals and leafy hay or pasture.

Alfalfa or clover hay should be used to supplement most winter rations. They furnish minerals and vitamins as well as protein. Second or third-cutting alfalfa is usually preferred because of its fineness and leafiness. Five to 7 per cent of ground hay may be profitably included in winter rations for pigs. When pigs have access to hay in racks where they can help themselves, they will consume to the extent of 3 to 10 per cent of their ration, and brood sows limited on grain a much larger proportion. Leafy green-colored legume hay of some kind, or pasture, should always be included in a ration to supply vitamin A when white corn is fed.

Mixed supplements often show an advantage over single feeds rich in protein. A mixture usually should include some feed of animal origin such as milk, tankage or fish meal because of the quality of their proteins. Including such vegetable sources of protein as soybean oil meal, cottonseed meal and linseed meal usually lowers the cost per pound of digestible protein. Leafy, sun-cured, high-quality legume hay is essential as a source of vitamins A and D and should always be included in the supplemental mixture for pigs not on pasture. "Trio Mixture" is composed of 2 parts of tankage, 1 part of alfalfa, and 1 part of linseed oil meal, cottonseed meal or soybean oil meal. Variation in cost will often justify changing the proportions used in the mixture. Any of the following proportions (A, B, C or D) for mixed supplements gives excellent results.

	A	B	C	D
	lb.	lb.	lb.	lb.
Tankage	40	30	50	25
Fish meal	—	10	—	—
Soybean oil meal	40	30	25	50
Linseed oil meal	—	10	—	—
Alfalfa (ground)	20	20	25	25
Approximate percentage of crude protein	40.8	41.2	40.2	38.7



Fig. 10. Rape pasture. Rape grows rapidly and ranks high among those pastures to be used the same year that they are seeded. It may cause serious sunburning of white pigs.

Good pasture should be a part of every summer ration. Alfalfa, clover, rape, sweet-clover, blue grass, and many other crops are recommended for hog pastures. Any of these are excellent during the period when they are producing an abundant supply of fresh, succulent forage. A good swine pasture is any combination so handled that it supplies fresh, growing feed from early spring until late fall, and one that does not fail in dry hot weather. It furnishes only a maintenance ration for young pigs and should be supplemented with grain to provide for gains.

GOOD PASTURE CROPS FOR MICHIGAN

Kind of pasture	When to sow	Seed per acre	When at its best	Other crops best-suited to supply pasture the remainder of the season
Alfalfa (Michigan or other northern-grown variety)	Spring or summer of previous season	8 to 10 lb.	Throughout growing season	None. Best results obtained if pastured lightly and some hay cut
Red clover (domestic-grown)	Spring of previous season	6 to 8 lb.	Spring, summer (Except during dry season) and fall	Rape or sweet clover
Rape (Dwarf Essex)	Early spring to mid-summer of same season	3 to 6 lb.	Summer and fall	Clover and blue grass
Sweet clover (Biennial White)	Early spring in grain crop	12 to 15 lb.	Late summer and fall of same season and very early spring to late summer of next	None if reseeded every year, more palatable if kept down to 6 or 10 inches high
Blue grass (June) (Permanent pasture)	Early spring with grass seed mixture two seasons before	3 to 5 lb. in a mixture	Spring and fall	Rape, sweet clover or alfalfa

Pasture:

1. Helps to balance a ration of home-grown grains.
2. Reduces the grain necessary per pound gain.
3. Lessens amount of high-priced protein feed needed in the grain ration.
4. Increases health and vigor of the swine.
5. Produces better pigs for hogging down corn.
6. When properly rotated, aids in sanitation and roundworm prevention.
7. Helps maintain soil fertility.

For further information concerning grass and pasture mixtures, request Special Bulletin S-130 from the Michigan State College Bulletin Room.

PROTEIN REQUIREMENTS

The feeds commonly used for swine may be roughly divided into two classes: fattening feeds, such as corn, barley and rye that are rich in carbohydrates or fattening nutriment, but which do not carry a sufficient proportion of protein to meet swine needs; and growing feeds, rich in protein. Those of the second group are usually higher in price than those of the first. Adding suitable protein feed to the fattening feeds reduces the amount of feed required per unit of gain and improves the thrift and vigor of the animals.

Even if the protein feed is much higher priced than the fattening feed, a small proportion of it usually results in cheaper gains. Adding unnecessary amounts of protein concentrates increases the cost of production. The problem is to feed the proportion which pays best. Young pigs require more protein than do the older ones. Returns from growing shotes and nursing brood sows will justify the use of more protein feeds than will fattening hogs or dry brood sows. The amounts of protein feeds given in the following examples of successful feed mixtures for hogs of different ages are such that increasing the proportion of protein feed would not materially reduce the total feed requirements for 100 pounds of gain. As the average weight of the pigs approaches the heavier weight stated for each group, the proportion of protein supplement might profitably be cut down toward the proportion given in the next group.

FEEDING MIXTURES FOR PIGS OF DIFFERENT WEIGHTS

	1. Weanling Pigs, 30-50 lb		2. Growing Pigs, 50-100 lb.		
	A	B	A	B	C
	lb.	lb.	lb.	lb.	lb.
Corn.....	100	—	100	—	—
Barley.....	—	100	—	100	—
Rye.....	—	—	—	—	100
Wheat middlings.....	50	50	50	50	50
Oats.....	50	50	50	50	50
Tankage.....	28	22	15	10	8
Skim milk } or (.....	500	400	300	200	160

The small amount of tankage is required because of its concentration of protein. Because of its water content and extra carbohydrates, about 20 times as much skimmilk by weight is required to balance the same amount of grain. The milk would add more total feed and produce more gain. More of either of these supplements is needed with corn than with barley or rye. Any of the mixed protein supplements listed on page 30 could be substituted for the tankage in these mixtures by increasing the weight used by one-half:

	3. <i>Shotes, 100-150 lb.</i>			4. <i>Hogs, 150-225 lb.</i>		
	A	B	C	A	B	C
	lb.	lb.	lb.	lb.	lb.	lb.
Corn.....	100	—	—	100	—	—
Barley.....	—	200	—	—	220	—
Rye.....	—	—	260	—	—	330
Tankage.....	12	12	12	9	9	9
Skimmilk or.....	200	200	200	150	150	150

The protein-rich portion of the mixture may be reduced by $\frac{1}{2}$ in any of the above-mentioned mixtures if the pigs are on a good pasture.

Small pigs eat less total feed per day but require a larger proportion of protein supplement than older pigs. As they approach market weight and the daily consumption of feed increases, proportionately less protein-rich feed is needed in their feed mixture. Nearly the same daily allowance of protein supplementary feed is needed from weaning to market weight with pigs on a full-feed of ordinary grain mixtures. Approximately $\frac{1}{3}$ pound of tankage, $\frac{1}{2}$ pound 40% protein supplement or 6-8 pounds of skimmilk per pig daily, or $\frac{1}{2}$ of these amounts on good pasture, meet the pigs' requirements for efficient gains on a full-feed of grain.

Self-feeding the supplement free-choice with a good grain mixture for market hogs is about as satisfactory as mixing and hand-feeding or self-feeding the mixed grains and supplements. The pig's appetite guides him in choosing the most efficient proportions of fattening and growing feeds.

Growing breeding swine, or sows with suckling pigs requires just about the same proportion of feeds recommended for shotes (Group No. 3). It is necessary to hand-feed and limit the feed as soon as the growing boars and gilts show indications of becoming too fat, usually at weights above 150 pounds. Nursing sows may be self-fed after their pigs are 10 days old.

Mature sows between suckling periods need only about $\frac{1}{2}$ as much supplementary feed as do shotes and growing swine. Their protein needs are well-satisfied when on good pasture or when alfalfa is ground and mixed (1 part to 2 parts of grain) or even when excellent legume hay is kept where the sows can pick the leaves from a rack at will.

When protein feeds are as cheap as fattening feeds, somewhat more protein may be fed without affecting the efficiency of the ration. When they are extremely high in proportion, it is sometimes profitable to

feed slightly less protein, even though more total feed is required per unit of gain.

On good pasture, the amount of the protein-rich feed used with any of the corn rations may be reduced one-half, and with barley or a combination of rye and oats, it may not be profitable to use a supplement, except with young pigs up to 100 pounds in weight. For fattening swine, weighing 150 pounds or more, and for carrying dry brood sows on good pasture, when protein feeds are very high as compared with corn, supplements may not be profitable, even with corn, but they do increase the rate of gain.

MINERAL REQUIREMENTS

Our grains are all lacking in mineral matter needed for the pig's requirements. Pasture helps to correct this deficiency, as do skim milk and tankage, but even with these supplements, some additional minerals usually pay. A supply of minerals should be kept before swine at all times. This is especially important when pigs are not on good pasture or when one is using protein supplements of vegetable origin. Equal parts of finely ground limestone, bonemeal, and salt have given good results in experimental work.

SUGGESTED MINERAL MIXTURES

	A	B	C
Pulverized limestone (pounds)	33	30	40
Special steamed feeding bonemeal (pounds)	33	45	40
Salt (pounds)	33	25	20

Hardwood ashes may be substituted for limestone.

Salt may be omitted from all mixtures and fed free-choice.

Iodine deficiency in the sow's ration is indicated by the birth of hairless pigs. This trouble can be guarded against by feeding the brood sows iodine during pregnancy. A good method is to dissolve one ounce of potassium or sodium iodide in one quart of water. One ounce of the solution should be fed each week. The iodine should be fed sows throughout the gestation period.

Vitamins—Vitamins A and D are of great importance in swine feeding. Good pasture and sunlight furnish these vitamins during the summer. Well-cured, green, leafy alfalfa hay and sunlight furnish these vitamins during the winter.

In addition to making sure of the protein, carbohydrate, mineral and vitamin needs just discussed, a successful feeder must consider several other factors. Cost of purchased feeds and value of feeds produced are of first importance. Home-grown feeds are usually most economical as the main part of the ration. For any feed under consideration for which experience and experimental data showing its value are lacking, a comparison with other feeds similar to it as to

the cost per pound of crude protein and the total nutrients (shown by analysis) is the best guide. Avoid too bulky combinations for swine on a full-feed, such as growing pigs or nursing sows. Refuse to pay high prices for mixed feeds that carry more than 8% of crude fiber. A good grade of hay has less than 30% of fiber and usually costs $\frac{1}{4}$ to $\frac{1}{5}$ as much as grain. Keep your ration palatable by liberal use of such feeds as corn and skim milk, if less desired feeds such as rye or raw soybeans are to be included. Avoid more than small percentages of feeds high in oil, such as soybeans or peanuts, which produce soft pork. Use neither insufficient nor excessive quantities of bulky feeds, nor combinations that otherwise disturb the normal physical condition of the digestive tract. Neglect of adequate water supply may ruin the results from an otherwise profitable ration. Supplying all of the essentials in a normal feed mixture is much cheaper and more dependable than purchase of stock tonics and proprietary mixtures.

PARASITES AND DISEASES

SANITATION

Sanitation in hog production requires the adoption of methods that prevent disease and conserve health. It is really a part of herd management and must be combined with the necessary veterinary service to maintain the health and thriftiness of the herd.

Hogs are frequently forced to live in small, crowded, filthy quarters which are contaminated with disease-producing organisms. It is much more economical to prevent disease by sanitation, rotation of ground, and use of portable equipment than to attempt to maintain health under such conditions.

The buildings and exercise lots should be located on a clean, dry slope if possible rather than on poorly-drained ground. Old straw sheds may be infested with lice and disease germs. Lots surrounding the buildings should be plowed often and the manure, corn-cobs and litter burned or removed.

Muddy hog wallows are unnecessary and should not be maintained except as an emergency in extremely hot weather. They are a source of infection. If the hog enterprise is of sufficient size to justify the expense, a cement wallow, fitted with a drain to allow cleaning may be practical. Hogs can withstand considerable heat if they have a wallow and it will reduce the amount of shade that is needed.

Sunlight and drying kill many disease germs. The doors and windows should be sufficient in number and located so that the sun will shine directly over as much of the floor as possible at some time during the day. The use of pastures is another means of getting pigs to drop their worm eggs where the sun and heat will kill many of them.

One of the most popular and effective methods of eradicating and controlling swine diseases is known as the "McLean County System of Sanitation," which was discussed in the section on "Care of the Sow and Pigs". This method protects the young pigs and has proved very satisfactory. It increases the number of pigs per litter raised,

reduces the number of runts and shortens the time required for the hogs to reach marketable weight. After the hogs have been removed from the field, it should be plowed and reseeded before being used again for pigs.

LICE AND MANGE

Lice or mange usually appear first on young pigs a little while before weaning time. The pigs will begin to rub or scratch and an examination will usually reveal one or both of these parasites. The louse is an external parasite which lives by sucking the blood or lymph from the hog. They can be seen crawling over the hog's body, especially on the flanks, and back of the ears. Numerous eggs may also be seen, as they are attached to the hairs, very close to the body. Because the louse is a sucking insect, a contact insecticide is needed rather than a stomach poison. One of the most widespread and economical means of control is the use of crude oil or used crankcase oil diluted somewhat with kerosene. The problem is to get the pig completely covered. Crowd the hogs into a small pen in a corner; then, pour the oil over their backs, using either a sprinkling can or an old broom. The excited pigs will jump upon each other until the oil has entirely covered them. Freshly-oiled pigs are very susceptible to overheating and sunburn and should not be driven far in hot weather or placed on pasture without plenty of shade.

Mange is a contagious skin disease caused by a small parasite that burrows under the skin causing severe itching. The condition spreads rapidly as the reproduction cycle for the mites is only about 12 to 14 days. The itching causes the hogs to rub and scratch which spreads the mite and infects all hogs running together. The skin becomes rough and thick and reduces the value of the hog carcass. The greatest loss, however, is due to the slower rate of gain and increased feed costs.

Oil treatment for lice has some value for mild cases, but when the mange is widespread in the herd, it is most satisfactory to dip the infected animals. Probably the most common and effective dip is liquid lime-sulphur, the same as is used by orchardmen. Use one gallon of liquid lime-sulphur to 25 gallons of water. The temperature of the dipping vat should be 100° F. and the hog kept in the dip for 2 minutes. It is necessary to repeat the dipping a second time in 10 to 14 days. One-fourth pound of dry lime-sulphur to 3 gallons of crankcase oil drainings may also be used and applied by the same method as used for lice. The quarters and rubbing posts should be cleaned and disinfected at the time of each dipping or oiling.

ROUNDWORMS

The most widespread and detrimental swine parasite in Michigan is the *Ascaris suis*, more commonly known as the roundworm, the prevention of which was mentioned under the topic, "Care of the Sow and Pigs," page 15. It is a large worm about the thickness of a lead pencil, usually found in the small intestine, although they often do much damage in the lungs before reaching the small intestine the second time. The life cycle is illustrated in Fig. 11.

LIFE CYCLE OF ROUNDWORM

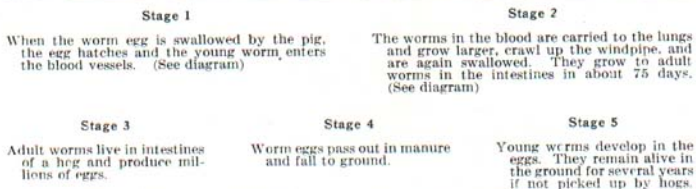
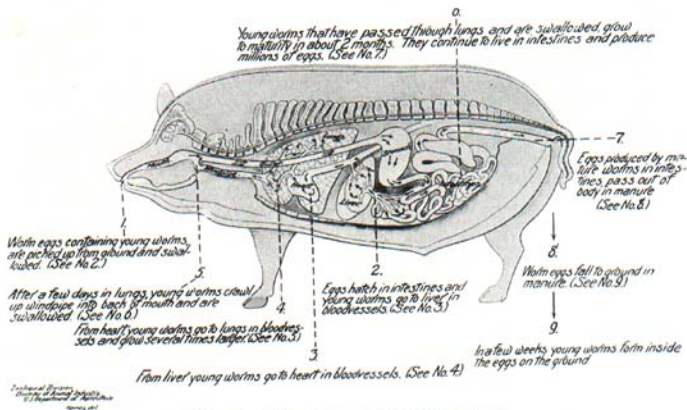
*The Roundworm's Journey Through The Pig*

Fig. 11. Life cycle of the roundworm.



Fig. 12. Drenching a pig. Skill is required to dose a pig in this manner. Details of equipment are shown in Fig. 13.

Indirectly the roundworm is the cause of many diseases, such as pneumonia or thumps, which result from the lowered resistance of the hog, along with the congested condition of the lungs. Worms have the most harmful effect on pigs weighing less than 50 pounds and if the hog reaches 100 pounds free from worms, there is little danger because the results are not likely to be serious even if they do get a few worms.

A wormy condition is characterized by some fever, digestive disturbances with scours, tucked up flanks, rough hair coat, and a general unthrifty appearance.

There are several curative methods of treatment, including the capsule or pill, the oil drench, and the slop method of feeding. Any of the treatments cause some danger and discomfort to the hogs, but with proper precautions, there should be no serious results. Whatever method is used, the hogs should be kept from feed for at least 24 hours before being treated.

One of the most effective treatments is the use of castor oil and oil of chenopodium (oil of American wormseed), giving each pig an individual dose. For sixteen 50-pound pigs, use $1\frac{1}{2}$ quarts of castor oil, and one ounce of oil of chenopodium, keeping it well-mixed. Using the jaw-spreader and dose syringe, give each 50-pound pig about 3

ounces, varying the dosage according to weight. For best results, use about 10 inches of rubber hose on the end of the syringe nozzle. One man holds the pig and the jaw-spreaders, while the other slips the rubber tube down the pig's throat and administers the dose (See Fig. 12). The hogs should then be held off feed for another 6 to 12 hours after which they should receive a light feed. It is usually well to have the assistance of a veterinarian or some experienced person the first time this treatment is attempted.

If capsules are used, they may be obtained from a veterinarian or a biological supply house. They act in about the same manner and, of course, the dosage is correct and uniform.

The third method is the feeding of a thin slop containing $4\frac{1}{2}$ grains of santonin and $2\frac{1}{2}$ grains of calomel for each 50-pound pig. If pigs are treated by this method, they should be fed in relatively small groups (15-20) of about the same strength so that all of them will get their share. Even when feeding in small groups this method is the least dependable.

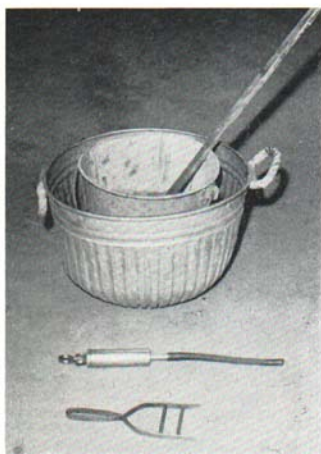


Fig. 13. Equipment for dosing pigs for worms. The castor oil and worm seed oil mixture in the pail is set in a bucket of hot water so as to make the oil flow more readily. The syringe and jaw-spreaders are handy for any dosing of pigs.

DISEASES

These suggestions are intended to aid producers in recognizing and preventing some of the common hog diseases. In all cases when disease is suspected and the value of the animals will justify the expense, a competent veterinarian should be called at once. Delay lessens the probability of bringing about a recovery and may give a contagious disease opportunity to spread.

HOG CHOLERA

Cholera is still the most destructive disease among swine. This is because swine owners often take a chance if no outbreaks have occurred recently in their community. Pigs may be vaccinated successfully at a small cost when about 6 to 10 weeks of age. To treat them later will be more expensive as they increase in weight. If the herd is to be kept immune from cholera, the pigs should be vaccinated about a week before or soon after weaning.

The single treatment or serum alone is used when only part of the herd is to be vaccinated, or when only temporary immunity is desired. Three to 4 weeks is as long a period as one can be reasonably sure of safety after the single treatment.

THE COMMON DISEASES OF HOGS

NAME, DESCRIPTION, CAUSES	SYMPTOMS	PREVENTION AND TREATMENT
<p>Bang's Disease: Caused by same bacteria that produce abortion in cattle and undulant fever in man.</p>	Animals appear normal. Sows may or may not abort. Blood reveals affected animals.	Test once each year and purchase only negative animals. If disease is present, dispose of all positive reactors and disinfect hog houses. Use new pasture for clean herd. Retest four or more times each year eliminating all animals with suspicious reaction.
<p>Caked Udder or Mastitis: A disease of the udder usually due to infection brought on by bruises, cold, damp quarters, or perhaps heavy feeding.</p>	Udder is swollen, warm, and painful. Milk secretion is suppressed. Sow is sluggish and feverish; may be constipated.	Provide comfortable, well-lighted and ventilated quarters. Give sow a mild laxative (castor oil) or an enema. Apply hot water to udder and gently massage upward. Repeat the hot water applications and massage three times a day. Udder may dry out after each application. If abscesses develop, they should be opened by a veterinarian.
<p>Constipation: Feces scanty and dry. Most frequently occurs in pregnant sows. Due to dry concentrated feeds and lack of exercise.</p>	Dullness—loss of appetite.	Induce sow to take more exercise by feeding some distance from sleeping quarters. Feed rich diet. Give slop sloppy, especially green feed or bran and some leguminous hay in winter. Give sow a dose of salts—one tablespoonful for each 100 lb. weight.
<p>Goiter in Sows: Associated with hairlessness in pigs; thought to be due to deficiency of iodine in ration.</p>	Pigs are born with little or no hair and usually have goiter.	Sows should have access to legume pastures during the spring, summer, and fall. Include legume hay in the winter ration. Dissolve one ounce of potassium or sodium iodide in one quart of water. Feed one ounce of this solution to each sow per week between breeding and farrowing.
<p>Hog Cholera: An infectious, highly fatal disease caused by a filterable virus.</p>	Hog is sluggish, feverish, may show constipation or diarrhea, is usually restless, may have vomiting and diarrhea. May be discharge from the eyes.	Avoid feeding garbage that is likely to contain scraps of pork. Keep all recently purchased hogs isolated from herd for a period of three weeks. If they are found to be infected with anti-hog cholera serum. If the simultaneous treatment is used, the entire herd should be treated.
<p>Indigestion: Thumps in pigs. Caused by improper or overfeeding with lack of exercise.</p>	In the sow, loss of appetite. May be constipation or the bowels may be loose. In pigs, a jerking of the muscles of the flanks.	Change the diet and feed sparingly for a few days on light, easily digested feed. A laxative may be given with the feed. Castor oil is perhaps the best laxative in these cases. Allow more exercise.
<p>Necrotic Enteritis: A necrotic inflammation of the intestines caused by bacteria. It is believed that a deficiency in the ration may increase the pig's susceptibility.</p>	Resembles chronic hog cholera. The animal becomes very much emaciated, diarrhea is persistent, and the animal has a perverted appetite. It will eat dirt, sand, and other abnormal substances.	If possible, separate the healthy from the diseased, placing on clean ground and adopting strict sanitation. Not much can be done for the sick animals other than good nursing and light feeding on easily digested feeds. Feeding four ounces of raw liver or dosing with 1½ grains of nicotinic acid per pig daily has given beneficial results in some experimental trials.

NAME, DESCRIPTION, CAUSES	SYMPTOMS	PREVENTION AND TREATMENT
<p>Piles:</p> <p>A condition characterized by the protrusion of a part of the rectum through the anus, caused by excessive irritation of the lower bowel; frequently associated with constipation.</p>	<p>Persistent straining with the appearance of the lining of a part of the rectum through the anus.</p>	<p>See notes concerning constipation. If the condition is not too bad, it may be relieved by overcoming the constipation, cleaning the protruded portion with clean warm water to which is added one teaspoonful of table salt to each pint of water, and pressing back into place with hand. Advanced cases require surgical operation.</p>
<p>Posterior Paralysis:</p> <p>A disease in which there is a partial or complete paralysis of the hind legs and tail, but definitely known but thought to be due to errors in diet.</p>	<p>Observed more frequently in sows during the winter. Other legs may be affected and the animal is unable to stand on hind limbs. Appetite usually remains good.</p>	<p>Include the use of forage crops in your system of production as much as deemed economical. Plan the rations so as to contain proper quantities of vitamins. See notes on constipation. Some of the best winter hay or if mill feeds are used to any great extent during the winter when green forage is unavailable, supply extra bulk and minerals in the form of legume hay and bone meal or some other combination supplying phosphorus, calcium, and magnesium.</p>
<p>Rickets:</p> <p>A disease of young animals in which there is a softening of the bones, caused by lack of minerals or Vitamin D.</p>	<p>The bones are softened and bend out of shape under the weight of the animal, irregularities in size and shape of the bones occur; deformities occur. The animal fails to develop and remains stunted.</p>	<p>Self-feed a simple mineral mixture. Pasture. 5% of sun cured leafy hay in feed mixture in winter.</p>
<p>Scours:</p> <p>A disease characterized by diarrhea and unthriftiness. May be the result of necrotic enteritis, chronic hog cholera, or errors in diet.</p>	<p>Watery discharges from bowels, loss of appetite, and unthriftiness.</p>	<p>See notes concerning Hog Cholera and Necrotic Enteritis. If due to errors in diet, change the feed and reduce the amount for the sow if the trouble is with pigs. Castor oil may be given to the affected animals with good results.</p>
<p>Stomatitis (necrotic) and Bull Nose:</p> <p>A bacterial disease characterized by sore mouth, gums, and lips, and sore nose with deformities of the nose.</p>	<p>Sores with ragged necrotic borders occur on the lips, gums, on the inside of the mouth, and in the nose with enlargement and deformity of the nose. The pigs are unthriftly.</p>	<p>Apply the same measures suggested under necrotic enteritis. Remove the scabs and necrotic tissue from the sores and swab with tincture of iodine.</p>
<p>Tuberculosis:</p> <p>A disease caused by bacteria usually acquired by hogs following tuberculous cattle or fed on dairy products from tuberculous cattle or with tuberculous chickens.</p>	<p>Symptoms are not pronounced except in advanced cases. In advanced cases, emaciation, cough, chronic diarrhea, and enlargement of the cervical glands may occur. Diagnosis best made by autopsy.</p>	<p>If tuberculosis is suspected, have your entire herd of breeding animals tested by your veterinarian with each animal tested with both acid fast and non-acid fast tuberculin. Eliminate all reactors; clean and disinfect houses and change yards if any reactors are found.</p>

The simultaneous treatment for pigs more than a month old usually produces immunity for life and is the cheapest way to protect a herd from cholera. It is cheap insurance against severe loss. Both serum and virus are injected into different parts of the pig's body. A very small dose of virus is required and costs but very little. The serum dose is proportional to the weight of the hog and so much more of it is required that the cost of double and single treatment is about the same. Pigs receiving the double treatment should be isolated from untreated hogs for 3 weeks after treatment.

It is necessary to employ a veterinarian to vaccinate hogs in Michigan because, by law hog cholera virus is sold only to them.

The following table gives the names, symptoms, prevention, and treatment of the most common swine diseases in Michigan.

EQUIPMENT

Equipment for swine raising need not be elaborate nor expensive, but it should be practical and efficient. The hogs will do better and there will be a big saving in time and labor if handy equipment is used. The swine grower should try to have facilities that will best suit his own needs and that are adapted to conditions in that locality.

LOCATION

The buildings and equipment should be located on ground having good natural drainage. A building on a southern slope with a natural windbreak behind it and a sunny exposure throughout the day is most satisfactory. The hog lots should be as near pasture as possible. All of the equipment should be far enough from the house so that odors will not reach the house.

REQUIREMENTS OF A GOOD SHELTER

Regardless of the type of hog house constructed, a number of things should be considered. Hogs do not have the ability to withstand adverse weather conditions as well as many other farm animals. Warmth is of primary importance at farrowing time. Good ventilation and sunlight both aid to maintain the health and vigor of the hog. Dry quarters are essential, for dampness promotes disease. The house should be as convenient for the herdsman and as comfortable and safe for the sow and litter as possible.

It is only good economy to obtain the equipment at as low a cost as possible. However, it should be neat and attractive in appearance and substantially constructed so as to be serviceable for many years.

HOG HOUSES

If the hog enterprise is of sufficient size to justify the construction, a large central hog house (Fig. 14) will be found very convenient for the herdsman. Lights, heat and storage for feed and equipment are more easily provided in it. A central house is usually more expensive than movable cots in caring for the same number of sows. The

use of portable cots (Fig. 15) is very practical and may furnish all the housing for small swine enterprises of about six sows and litters. A central house is sufficient if large enough for half of the brood sows with provision for moving the sows and litters to portable cots on pasture when about a week old. Even fall pigs make as rapid gains and do as well when housed during the winter in portable cots as they do in a central house.

Portable equipment can be moved for rotation of pasture on exercise lots, costs less per animal housed, can be added one unit at a time as the swine enterprise grows, and spreads the sows so that disturbance in one pen does not annoy the other sows.

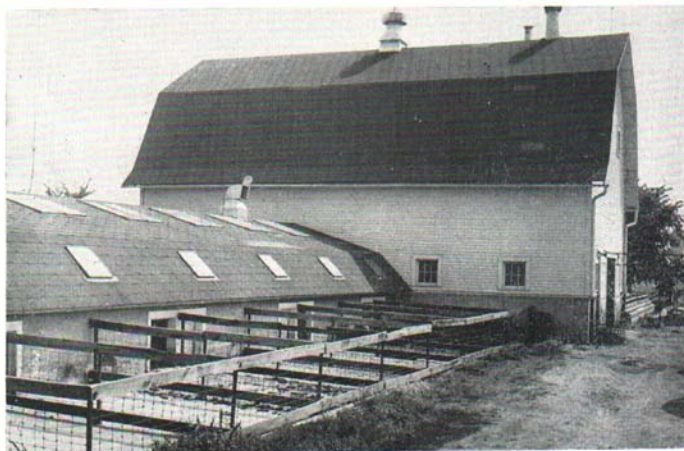


Fig. 14. Central hog house. The cost of central houses requires that their size be in proportion to the size of the swine enterprise. They are not necessary for success with only a few litters.

PIG CREEPS AND SELF-FEEDERS

Little pigs should have all the grain they want at any time. Unless the sows are self-fed so that the pigs can use the feeder also, the pig creep (Fig. 8) should be used after the pigs are 3 weeks old. The pigs may be continued on self-feeders to market weight. Self-fed hogs are likely to gain faster than hand-fed hogs. The feeder should be built to reduce waste to the minimum by protecting the feed from getting wet or rooted out or blown out of the feeder.

The first step in the construction of this self-feeder (Fig. 16) is the bottom made of 2-inch durable lumber running lengthwise and nailed to 2" x 2" joists. The bottom is fastened to the skids with lag screws through the joists so that the skids may be replaced easily. The raised center and trough edges are attached and then the 20-gauge

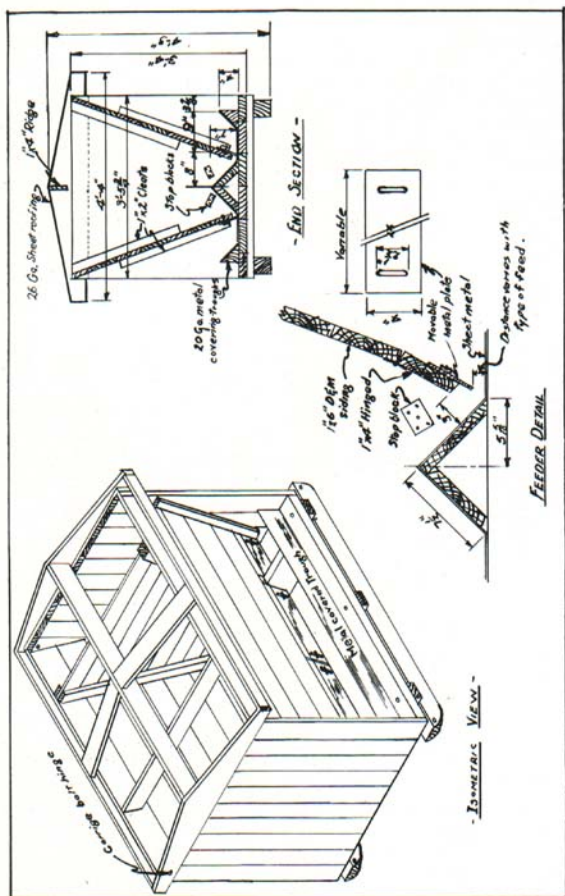


Fig. 16. Homemade self-feeder.

metal covering is nailed down, covering the trough edges and the entire bottom between them.

The partitions and sides must be set up so that the hinged sections at the bottom of the sides will swing in between the partitions to the stop blocks. The width of opening is controlled by a movable metal plate on each hinged section. If metal covers (not shown in illustration) for the trough are used, they swing from a rod placed through

the ends and supported to the sides by screw eyes between the sections of the covers.

The top is made by covering a wooden frame with 26-gauge galvanized sheet metal. The location of the bolt hinges at the back corners should be such that the cover can be raised for filling. The cover must be securely fastened down by hooks to prevent the wind from blowing it open and damaging it.

BILL OF MATERIAL FOR SELF-FEEDER

- For skids—2 pieces 4" x 4" x 5'6"
- Floor joists—3 pieces 2" x 4" x 3'6"
- Floor joists—2 pieces 2" x 6" x 5'
- Floor joists—6 pieces 2" x 8" x 5'
- Trough—1 piece 4" x 4" x 5'
- Siding—14 pieces 1" x 6" x 10'
- Trim—2 pieces 1" x 4" x 3'6"
- Cleats and blocks—3 pieces 1" x 2" x 12'
- Partition—1 piece 1" x 6" x 16'
- Partition block—2 pieces 2" x 4" x 10'
- Ridge and braces—1 piece 1" x 4" x 14'
- Cover ends—2 pieces 1" x 8" x 4'4"
- Cover sides—2 pieces 1" x 3" x 5'4"

ROOFING AND HARDWARE

- Roofing—1 piece 36" x 12' No. 26 galvanized metal
- Trough—1 piece 28" x 10' No. 20 galvanized metal
- Adjustable plates—1 piece $\frac{3}{8}$ " x 4" x 10'
- Six lag screws, 2 carriage bolts $\frac{1}{2}$ " x 4", 12 F.H. store bolts $\frac{3}{8}$ " x 2", 12 wing nuts $\frac{3}{8}$ ", and 12 hinges

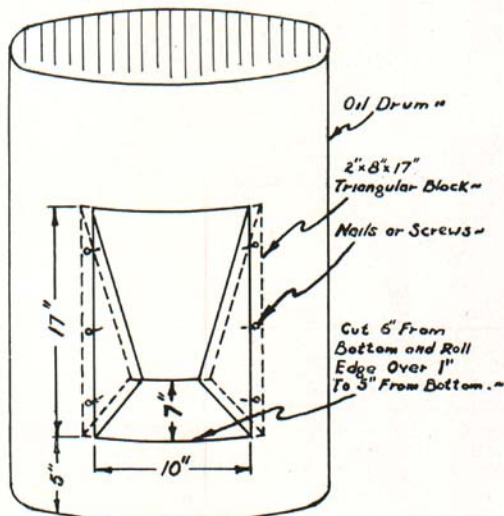


Fig. 17. An improvised self-feeder made from an old oil drum.

The oil drum feeder (Fig. 17) is cheaply constructed but very satisfactory for inside feeding. A slit 10 inches long is cut parallel to and 6 or 7 inches from the bottom. From the ends of this slit, cut up 17 inches perpendicular to the bottom. The triangular wooden blocks are nailed in place to hold the bottom of the rectangular section toward the center of the drum. Two openings on opposite sides of the drum may be made if desired.

HOG WATERER

A good hog waterer ranks next to a self-feeder in saving labor. Producers have observed much better results from self-feeders when there is also a continuous supply of drinking water. There are many good watering devices that may be purchased.

A home-made hog waterer (Fig. 18) made from a barrel and a few planks is very convenient and economical to construct. The planks are fitted together so as to form a box in which the barrel is placed. The box should be made so that there will be a 5-inch drinking space between the barrel and the side of the box. The barrel must be air-tight. A hole which is bored in the barrel about 3 inches from the bottom forms an outlet from

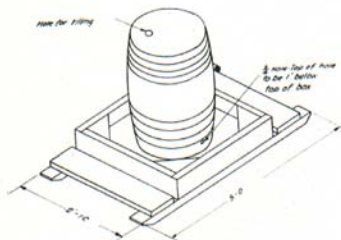


Fig. 18. Home-made barrel hog waterer.

the water supply in the drinking trough. This hole is left open at all times except when the barrel is being filled, when it would be tightly stopped. Fill the overflowing through the hole in the top; then stopper tightly and open the hole near the bottom. Water will then run out automatically so as to keep the water level just above the hole as long as there is water in the barrel.

HAY RACK BILL OF MATERIALS

Use	No. Pieces	Size	Material
Skids	2	4" x 4" x 6'-8"	White pine
Center Tie for Slats	1	2" x 8" x 6'	White pine
Side Rail	2	2" x 4" x 6'	White pine
End Rail	2	2" x 4" x 3'	White pine
Vertical Frame	4	2" x 4" x 3'-4 1/2"	White pine
Floor and End Boards	10	1" x 12" x 3'	White pine
Slats	16	1" x 3" x 3'-6 3/4"	White pine

ALFALFA RACKS

Hogs that do not have access to pasture should have all of the good alfalfa hay they will eat. Alfalfa may compose $\frac{1}{3}$ of the ration for the brood sow during the winter, and should constitute at least 5 per cent of all dry-lot rations. The feeding rack shown (Fig. 19) will eliminate much of the waste that would result if the hay were fed on the ground. Keep the rack on high, dry ground and hogs will pick up nearly all of the leaves, and waste only part of the stems.

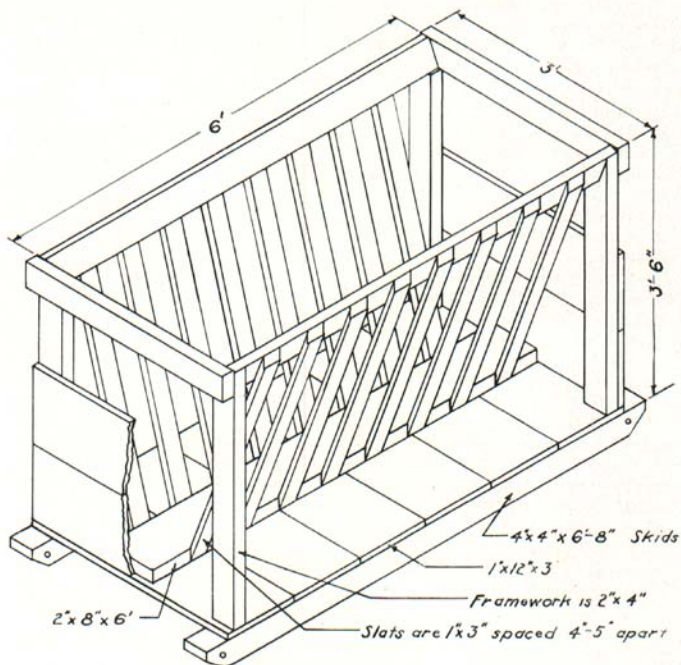


Fig. 19. Alfalfa rack for swine.

SUNSHADES

All hogs need protection from the heat during hot weather, for they cannot withstand the heat. If shade trees are not present, sunshades (Fig. 20) should be built. The shade should be about 4 or 5 feet above the ground to permit air circulation. Although sawed lumber makes a neater appearing shelter, brush, poles and straw or corn stover may be used with just as good results. Adequate shade



Fig. 20. Shade for pigs. Plenty of shade helps to prevent serious sunburn on rape pasture.



Fig. 21. Loading chute. It is easier to drive hogs through a 20-foot, gradual incline than through a short, steep one.

eliminates the need for hog wallows and is much more sanitary if rotated to new ground with the pasture each year.

LOADING CHUTE

Stationary catch pens and loading chutes are preferred by many herdsmen. A portable chute may be mounted on a pair of old implement wheels (Fig. 21) and set in any convenient place with hurdles or gates for the catch pen. In either case the bottom should have no cracks that pigs can step through, be cleated to prevent slipping, and be narrow enough that market hogs cannot turn around. Twenty to 24 inches is wide enough. The sides should be substantially braced and 30 inches high.