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IMPROVING SWINE THROUGH BREEDING

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AGRICULTURAL EXTENSION SERVICE • U. S. DEPARTMENT OF AGRICULTURE

IMPROVING SWINE THROUGH BREEDING

Greater profits through more efficient production of quality pork should be the immediate goal of every Minnesota swine producer.

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Although improved breeding practices have increased the meatiness of hogs produced in Minnesota, much of the pork we produce still does not meet consumer acceptance. Proper breeding methods can make hog operations more profitable and help produce a product more suitable to the consumer. The purpose of this bulletin is to outline some basic principles and to recommend breeding practices for more efficient swine production.

Good feeding and management can result in larger, faster growing, meatier litters. But these improvements in nutrition and management do not become a part of a hog's inheritance and are not automatically transmitted to the next generation. Lasting improvement is brought about by selecting parent stock with the best inherent makeup. This type of improvement depends on the use of performance information through systematic testing and recordkeeping.

Most of the important economic traits in hogs can be improved through breeding. Such improvement, though often slow, is important because it is permanent in the sense that a portion of it is passed on to future generations.

Practical Considerations

By selecting for only one trait at a time we can expect to make the most rapid improvement in that single characteristic. But in practice it is necessary to select for a combination of traits that will result in the efficient production of quality pork. The axiom *"first things first"* becomes very important because the more traits included, the less improvement can be expected in each trait. Concentrate on the most important traits and leave those of minor importance strictly in the background—or ignore them completely.

In deciding which traits are most important in the breeding program, consider:

1. Economic Importance—Emphasize traits which will increase profits. It is futile to spend time and money to improve a particular trait that does not make hog raising more profitable.

2. Heritability—Pay most attention to the highly heritable traits. Heritability is the portion of the average superiority of selected parents that is passed on to their offspring. It estimates the proportion of the total variation in animals that is due to heredity and environment. Heritability estimates are made after removing as many causes of environmental variations as possible. When we say that carcass length is 60 percent heritable we mean that about 60 percent of the variation in a herd is due to heredity and 40 percent is due to environment.

Heritabilities are usually referred to as being high, medium, or low. When a trait is highly heritable, mating the best to the best will result in improvement of that trait in the offspring. But the key to greatest improvement for lowly heritable traits is improved management. Crossbreeding or mating less closely related parents is also likely to improve traits of low heritability.

The average estimated heritabilities for some economically important traits in hogs are given in table 1. The estimates show that sow production traits are of low heritability. So improvement of these traits by selection is slow.

Growth rate and feed efficency have moderate heritabilities and are easier to improve than sow productivity traits.

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Table 1. Heritability estimates

Level of heritability	Characteristic	Average percent
High	Carcass length	60
	Percent ham (based on carcass weight)	60
	Percent fat cuts (based on carcass weight)	60
	Backfat thickness	50
	Loin eye area	50
Medium	Percent lean cuts (based on carcass weight)	35
	Feed efficiency	30
	Growth rate (weaning to market)	30
	Five-month weight	25
Low	Weaning weight	15
	Number farrowed	10
	Number weaned	10
	Birth weight	5

Measures of carcass merit are the most highly heritable traits in hogs. This is demonstrated by the rapid progress made by progressive breeders in developing meat-type hogs.

How heritability information is used to predict progress expected through selection:

Assume that the backfat thickness for your present pig crop is 1.7 inches at 200 pounds, and the replacement gilts selected for your breeding herd from this group averaged 1.3 inches backfat. These gilts are mated to an on-the-farm tested boar from your herd raised under similar conditions. The boar probed 1.1 inches backfat at 200 pounds.

The gilts saved have 0.4 inches less backfat than the herd average (1.7 − 1.3 = 0.4), and the boar 0.6 inches less (1.7 − 1.1 = 0.6). This difference between the selected breeding stock and the average of the herd from which they were selected is called the *selection differential.* Comparisons of selection differentials are valid only when pigs are from the same population and are raised under similar conditions.

By selecting breeding stock with less backfat, a breeder attempts to decrease the backfat thickness of his herd. In the case of backfat thickness, only 50 percent of the selection differential is heritable and could be expected to transmit to the offspring.

The predicted average backfat thickness for the pig crop resulting from these matings is calculated in this manner:

Present pig crop average	Selection differential of breeding stock saved	Heritability of trait	Predicted average backfat of next pig crop

$$1.70 - \left[\frac{(\underset{\text{gilts}}{0.4} + \underset{\text{boars}}{0.6})}{2} \times .50\right] = 1.45$$

From the selection shown above, the next pig crop should have 0.25 inches less backfat than the average of the herds from which the boar and gilts were selected. Figures within the brackets (average selection differential times heritability) determine the change expected. This change is added or subtracted from the present average, depending on the direction in which selection is practiced.

3. Correlations Among Traits—Often the traits selected are correlated or related. This means that selection for one trait will automatically change the other. These correlations may be positive (beneficial), negative (detrimental), or zero.

If two traits are postively correlated it means that as one increases or decreases through selection the other also increases or decreases.

When traits are negatively correlated it means that as one is increased through selection the other decreases, or vice-versa.

If there is no correlation between two traits, selection for one will not influence the other. This is sometimes good because a breeder can select for either or both without fear of influencing the other adversely.

The desirable situation is where two traits are beneficially correlated, whether the relationship is positive or negative. This means that selection for one trait influences the other in the desirable direction.

From limited information regarding the genetic correlations between different traits, it appears that most relationships tend to be compatible and do not seriously handicap selection for a desirable combination of traits. The general relationships for some production traits in hogs are presented in table 2.

Table 2. Some general relationships among production traits in hogs

Traits	Type of relationship*
Backfat thickness and:	
Carcass lean	+++
Daily gain	−
Feed efficiency	+
Daily gain and:	
Carcass lean	−
Feed efficiency	++

* + indicates a beneficial relationship and − indicates a detrimental relationship. The intensity of this relationship is represented by the number of symbols.

Crossbreeding

Crossbreeding has gained widespread popularity among commercial producers in Minnesota. The fact that about 90 percent of Minnesota's market hogs show some evidence of crossbreeding indicates that many producers find crossing beneficial.

The basic goal of crossbreeding is to increase profits for commercial hog production through hybrid vigor (*heterosis*). Hybrid vigor results from crossing genetically different lines or breeds. It may be defined as the superiority of crossbred offspring over the average of their parents. Crossbreeding also

Table 3. Average advantage of crossbreds over purebreds

Trait	Percent advantage
Number farrowed	12
Number weaned	14
Weaning weight:	
Pig	10
Litter	35
Five-month weight:	
Pig	14
Litter	40
Feed efficiency	negligible
Meatiness	none

allows a breeder to utilize the strong points of different breeds.

Crossbreeding has its greatest advantage in those traits exhibiting the most hybrid vigor (generally the traits which have the lowest heritability). This means that crossing should be most effective for sow productivity traits.

Carcass traits are not improved by crossbreeding. If the crossbred is to produce a good carcass the parents must be meat-type individuals. The average advantage for crossbreds over purebreds based on available research is given in table 3.

Crossbreeding can increase

- ★ litter size (crossbred sows farrow and wean larger litters)
- ★ livability (ruggedness and survival)
- ★ growth rate.

Crossbreeding will not

- ★ substantially increase feed efficiency
- ★ increase meatiness
- ★ cover up poor management.

Systems of Crossbreeding

If crossbreeding is to be worthwhile commercially, crossbreds must excel both parental breeds in total performance. To realize the full benefits from crossing, breeders must follow a well organized, systematic plan. A successful crossing program depends on the merit of the parent stock, regardless of breed. Both sows and boars must be meat-type and have good performance records. Identifying superior stock through test station evaluation and on-the-farm testing can greatly strengthen your breeding program.

Many systematic crossbreeding programs are used effectively, but the single-breed cross, two-breed cross, and the three-breed rotational cross are the more commonly used systems.

Single-Breed Cross

A single cross is made by crossing two breeds. For example, Yorkshire sows mated to Hampshire boars, or Landrace sows mated to Poland China boars. When replacement females are needed, purebreds are either produced by the sows in the herd or they are purchased from another breeder.

The pigs produced from the single-breed cross exhibit hybrid vigor, but this system does not take advantage of vigor in crossbred sow productivity because "straight-bred" sows are used. This may not be a serious loss, providing the sow breed is carefully chosen for large litter size and for good mothering and milking ability.

The boar should be chosen from a rapid, efficient gaining breed with good carcass performance. This system is particularly adaptable to producers who wish to purchase all their breeding stock.

Two-Breed Cross (Backcross)

The two-breed cross uses boars of two different breeds in alternate generations. Crossbred herd replacement gilts are retained and mated to boars from one of the two parent breeds. Gilts or sows are always mated to a boar of the breed farthest away in their pedigrees. This means that the crossbred females are always bred to boars of the same breed as their grandsire on the dam's side (see figure 1).

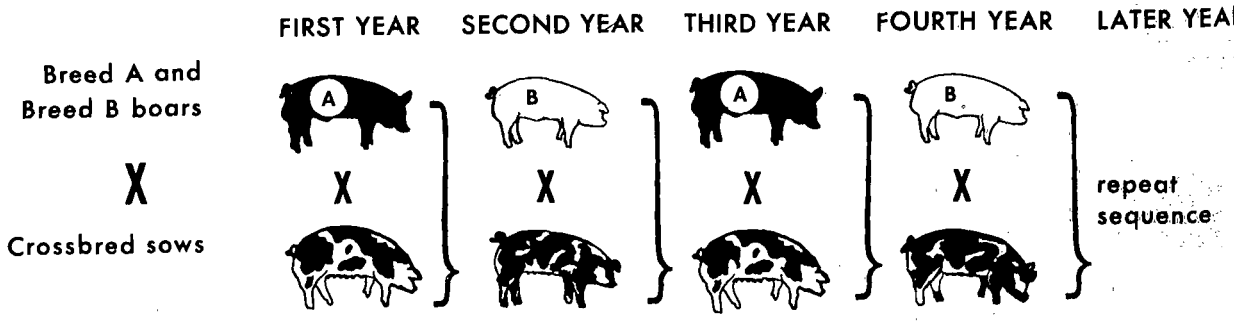


Figure 1. Two-breed cross using purebred boars and crossbred sows.

Under this system both sows and gilts are crossbred after the first crossing, and should yield more hybrid vigor in sow productivity than the single-breed cross. Hybrid vigor should result in increased litter size, livability, and growth rate.

Careful selection of boars and gilts is also an important part of this program. Gaining ability, litter size, meatiness, and length should be superior characteristics of at least one of the parent breeds. The other breed should have a respectable average in gaining ability, litter size, and length. Good records of meatiness and efficiency are required of both breeds. Breeds should be fairly similar in type and conformation to prevent extreme variation in later generations.

Three-Breed Rotational Cross

The three-breed rotational cross is perhaps the most widely used crossbreeding system in Minnesota. It is rather easy to follow, and many breeders notice some advantage in favor of three-breed over two-breed crosses. The third breed can strengthen certain performance characteristics in the rotation and slightly increase the vigor.

In this system boars of three different breeds are continually rotated in succession on each generation of crossbred sows produced in the program. This system is diagrammed in figure 2. It is a continuous rotation of boars from three breeds, mating the gilts and sows in each generation to boars of the breed farthest removed in their pedigree.

The sows and pigs are crossbred and thus hybrid vigor is expected in litter size, livability, and growth rate. Selection standards for purebred boars from the three breeds used should be as rigid as in the two-breed cross. Because boars from all these breeds will sire market pigs, they should be selected for soundness, gaining ability, feed efficiency, and meat-type conformation.

The three-bred rotational cross may be expanded to a four- or even a five-breed cross in order to introduce the desirable features of different breeds. But it is unlikely that the use of more than three breeds will have any particular advantage. The principal disadvantage of using more breeds is the extra trouble and difficulty of finding well-bred stock of so many breeds.

Contrary to common opinion, multiple-breed crossing programs do not deteriorate or "run out" if superior sows and boars are selected from breeds which cross well. Careless selection, poorly planned systems, or disease and management problems probably account for this false impression.

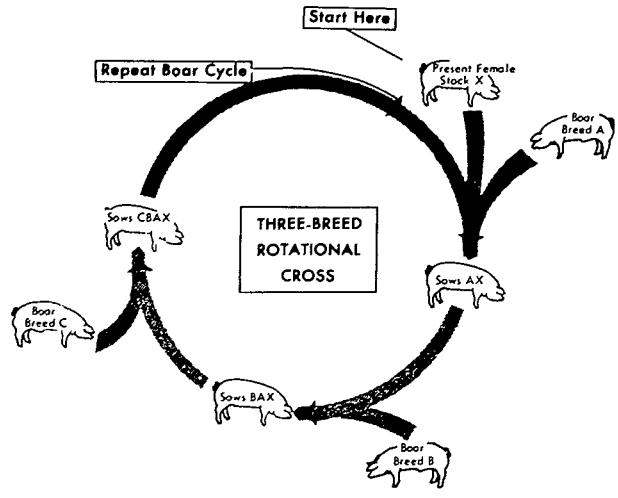


Figure 2. Three-breed rotational crossbreeding system. Breeds A and B are crossed. Replacement A x B gilts are saved and mated to boars of breed C. Gilts from this cross are saved and mated to boars of breed A, these daughters are mated to breed B, and so on.

Traits to Consider

A sound breeding program should emphasize only the important traits in hog production. There is no need to spend time and effort to select for a highly heritable trait that has no economic importance. Sow productivity, feedlot performance, carcass merit, and soundness are generally considered to have the greatest economic importance in hog production.

Sow Productivity

Sow productivity is a measure of reproductive ability (*prolificacy*), milking ability, and mothering ability. Number of pigs farrowed and weaned and individual pig and litter weight at weaning are the most common measures of sow productivity. Perhaps litter weaning weight is the best single measure.

Litter weights at 3 to 5 weeks of age are a better measure of milking ability than weights at 6 to 8 weeks. But the important thing is to get litter weights at an age that fits individual management procedures and your breed association's production registry programs. Figures 3 and 4 are charts to adjust weaning weights to a 21-day and 56-day weight basis, respectively.

A sow's production record for one litter often is not a good indication of what her next litter will be like. Because of this low repeatability for size and weight of different litters, and because of the low heritability of single production records, selection for sow productivity is more effective when more than one record by the same sow is considered.

Rate of Gain

Faster gaining pigs reach market weight at an earlier age, and are usually a cost-cutting factor. If hogs can be marketed 10 days earlier on the average, it means that for 100 hogs, 1,000 hog-feeding days will be eliminated. However, the economy of feeding hogs fewer days must be figured on an individual farm basis depending on feed costs, labor, interest on investment, depreciation, increased risk of death, and the marketing outlook.

Rate of gain is often used as an indirect measure of efficiency of gain. Faster gaining pigs usually require less feed per pound of gain. It is often impractical to measure feed conversion directly on prospective breeding stock, but by selecting the faster gaining individuals one indirectly selects the more efficient ones. This indirect selection, while less accurate than direct selection for feed efficiency, often is the most practical method.

Heritability of rate of gain is moderate, and permits reasonable improvement by selection. For example, if boars and gilts that weigh 20 pounds above the herd average at 5 months are selected (25 percent heritable), 5 pounds improvement can be expected in their offspring.

Of the many ways to measure growth rate, age at 200 pounds probably is the most convenient. This weight is obtained when pigs are approaching market weight, and takes into account both before- and after-weaning gains. The chart in figure 6 estimates age in days at 200 pounds.

Regardless of the method used to express growth rate, a scale is essential. It strengthens your breeding program by aiding you in getting necessary production records, and greatly facilitates systematic marketing of hogs.

Feed Efficiency

Less feed needed per pound of gain means lower costs in getting pigs to market. Improved feed utilization results in greater net profit, or smaller net loss in bad price years. But the benefits of improved efficiency are often an unseen saving. They go unnoticed unless accurate feed records are kept, because the saving occurs as unused feed.

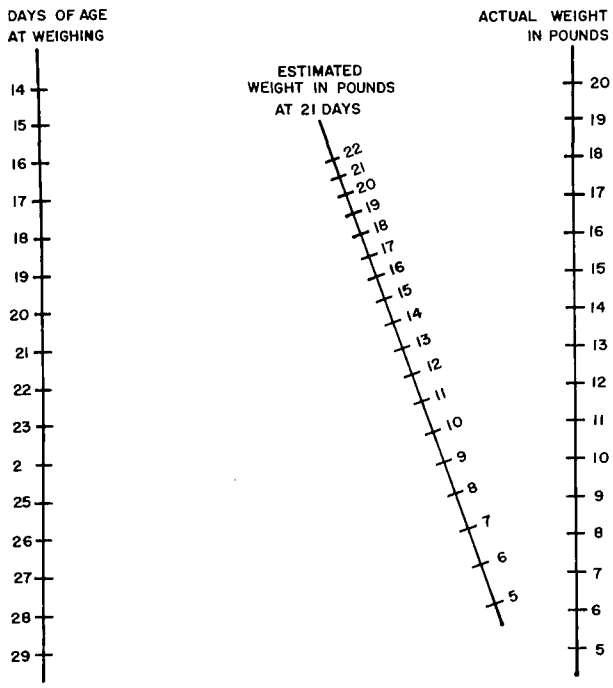


Figure 3. Adjusted 21-day weight chart. Lay a ruler or any straightedge from a point on the left scale which represents the age of the pig, to a point on the right scale which represents the pig's weight. The intersection of this line and the center scale shows the estimated weight of the pig at 21 days of age.

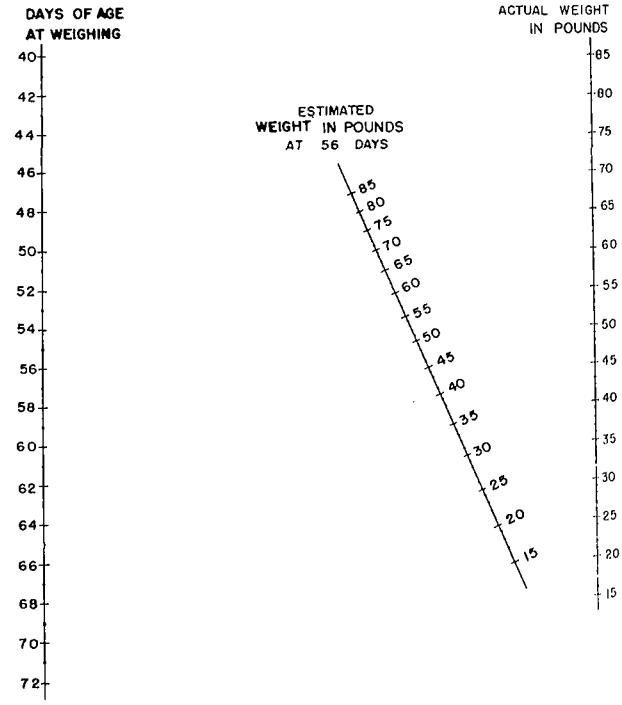


Figure 4. Adjusted 56-day weight chart. Lay a ruler or any straightedge from a point on the left scale which represents the age of the pig, to a point on the right scale which represents the pig's weight. The intersection of this line and the center scale shows the estimated weight of the pig at 56 days of age.

Figure 5. Weighing pigs at a swine testing station. Pigs are started on test when the pen of four averages 60 pounds, and remain on test until each pig reaches 200 pounds.

Feed conversion is about 30 percent heritable, high enough to make selection effective. But feed utilization is more difficult to measure than rate of gain. It requires individual feeding and additional equipment.

When possible, on-the-farm feed conversion records should be kept on a litter basis or on a representative sample of the herd. These should be supplemented by entering representative samples of pigs by the same boar at the swine testing station to be fed out under uniform conditions. Some breeders have found test-station feed efficiency records and on-the-farm growth records adequate for feed efficiency selection in their herds.

Meatiness

A meatier pig has a higher percentage of quality meat at 200 pounds. This in turn means:

- ★ A higher value product
- ★ Less surplus fat on the market
- ★ Sustained market demand for pork.

Backfat thickness, loin eye area, yield of lean cuts, and length are associated with meatiness. Average heritabilities for these carcass traits range from 35 to 60 percent, indicating that fairly rapid progress can be made through selection. But except for backfat thickness, these traits can only be measured and appraised on slaughtered hogs. So carcass merit measure-

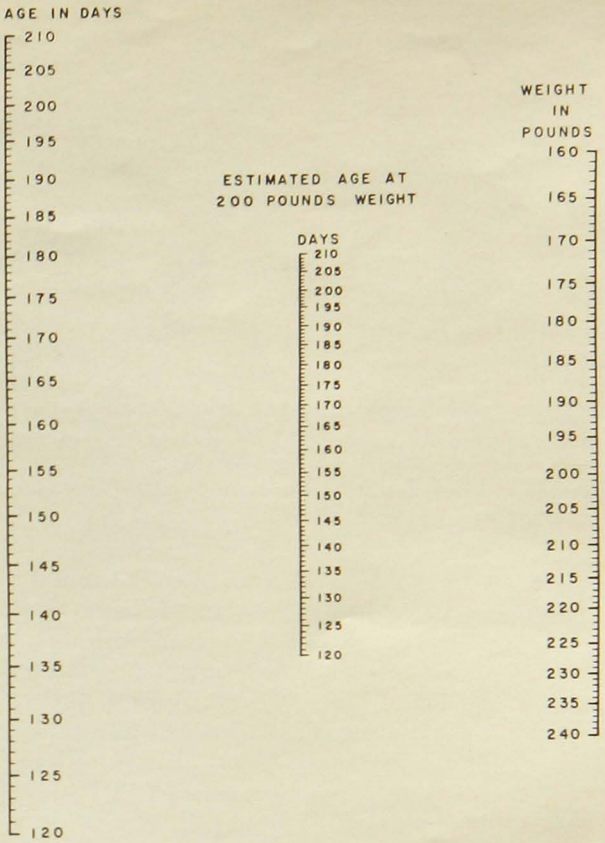


Figure 6. Chart for estimating age at 200 pounds. Lay a ruler or any straightedge from a point on the left scale which represents the age of the pig, to a point on the right scale which represents the pig's weight. The intersection of this line and the center scale shows the estimated age of the pig when his weight is 200 pounds.

Figure 7. Accurate feed records are an essential part of the swine testing program. For control of wastage and ease of recordkeeping, the rations are pelleted and delivered to the stations in 50-pound paper sacks.

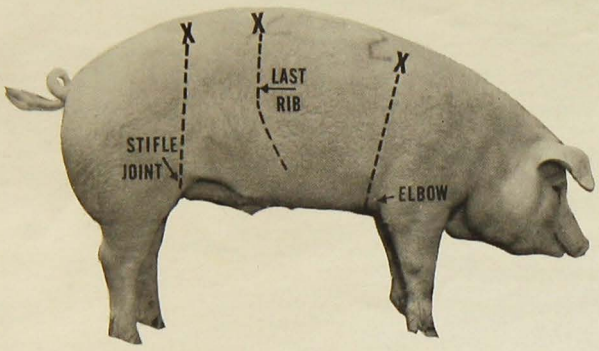


Figure 8. Probing sites on live hog. Insert the probe at points marked X: just back of the shoulder and directly above the elbow joint, at the last rib, and at the last lumbar vertebra directly above the stifle joint. Make probe measurement 2½ inches off midline.

ments must be made on relatives of stock selected for breeding.

Probed backfat thickness, a good indication of carcass backfat and overall meatiness, can be measured on the live animal. The only equipment needed is a snare to catch the hog, a sharp knife or scalpel blade, and a narrow 6-inch metal ruler with 1/10-inch graduations. Make a small incision in the skin, insert the ruler, and push it through the fat layer. A layer of connective tissue ("false lean") is often present about halfway through the fat layer, particularly over the shoulder. Extra pressure is needed to penetrate this layer. Figure 8 shows the probing sites on the live hog.

A *leanmeter* can also be used to measure backfat thickness on the live hog, but the blade and ruler

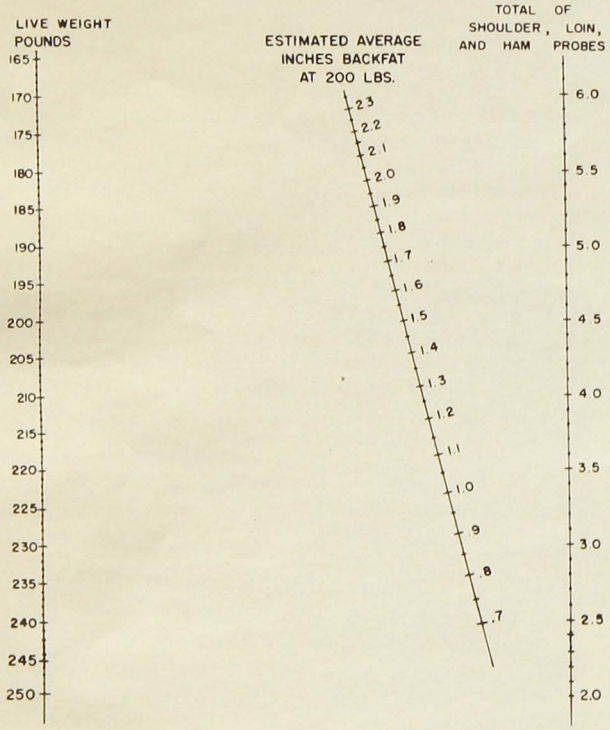


Figure 9. Backfat probe adjustment chart, 200 pounds live weight. Lay a ruler or any straightedge from a point on the left scale which represents the weight of the pig when probed, to a point on the right scale which represents the total of the three probes. The intersection of this line and the center scale shows the estimated average backfat thickness at 200 pounds.

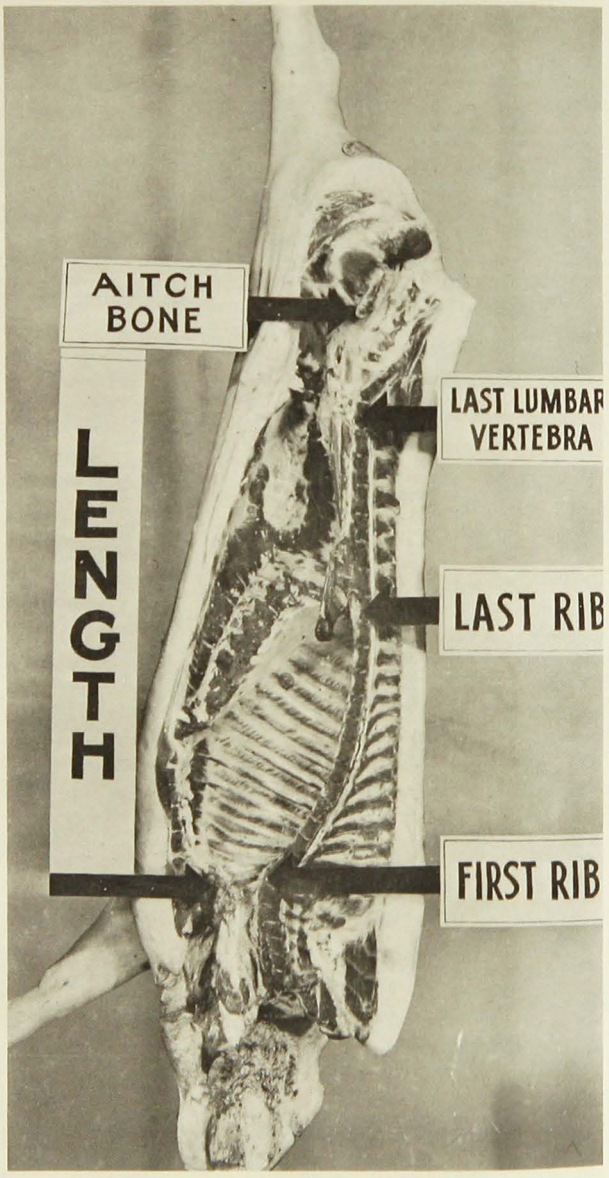


Figure 10. Carcass length and backfat thickness measurements. Length is measured from the lower point of the aitch bone to the forward edge of the first rib. Backfat is measured opposite the first rib, last rib, and last lumbar vertebra. The average of the three backfat measurements is used.

method is less expensive and quite accurate. Ultrasonic measurements may be used in the near future to evaluate muscling in live hogs.

Loin eye area measured between the 10th and 11th ribs is a common measure of carcass meatiness. A larger loin area means larger pork chops, and is a fair indicator of overall meatiness of the animal. Figure 11 shows how loin eye area is measured and figures 12, 13, and 14 are actual size loin eyes ranging from approximately 2.90 square inches to 6.50 square inches.

A higher yield of lean cuts means less trimmable fat and more edible meat. The aim is to get the highest proportion of the carcass in the higher priced cuts—the ham and loin. Yield is often expressed as percentage of four lean cuts (ham, loin, shoulder, and Boston butt), or as percentage of primal cuts (four lean cuts plus belly). However, percent ham and loin is more easily obtained and is presently the preferred measure for meatiness.

Carcass length also is normally included as a desirable carcass trait, but has little relation to muscling in the carcass. A medium to long carcass may be desired for other reasons, but length should not be overemphasized to the detriment of other traits.

Sex of the pig also affects muscling. On the average, gilts are longer, have less backfat, larger loin eye area, and a higher percentage of ham and loin than their littermate barrows. A comparison of 75

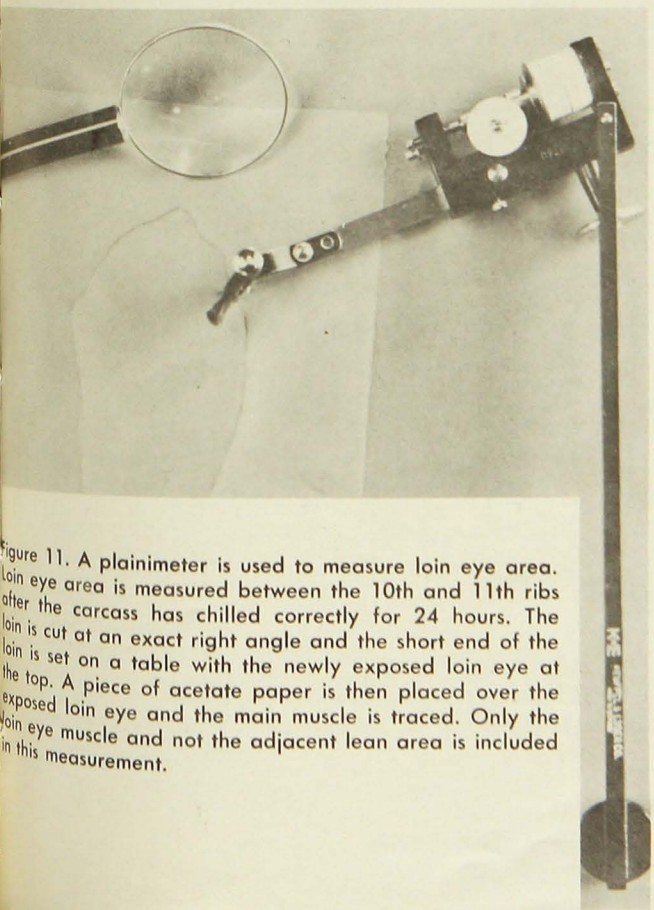


Figure 11. A plainimeter is used to measure loin eye area. Loin eye area is measured between the 10th and 11th ribs after the carcass has chilled correctly for 24 hours. The loin is cut at an exact right angle and the short end of the loin is set on a table with the newly exposed loin eye at the top. A piece of acetate paper is then placed over the exposed loin eye and the main muscle is traced. Only the loin eye muscle and not the adjacent lean area is included in this measurement.

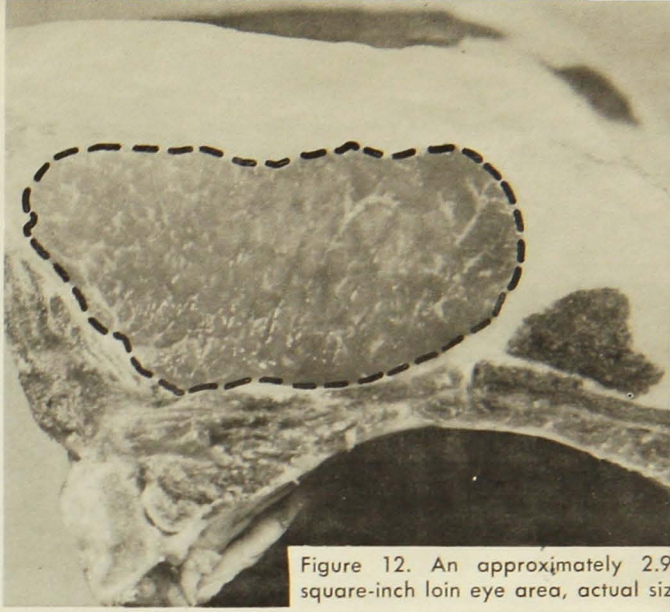


Figure 12. An approximately 2.9 square-inch loin eye area, actual siz

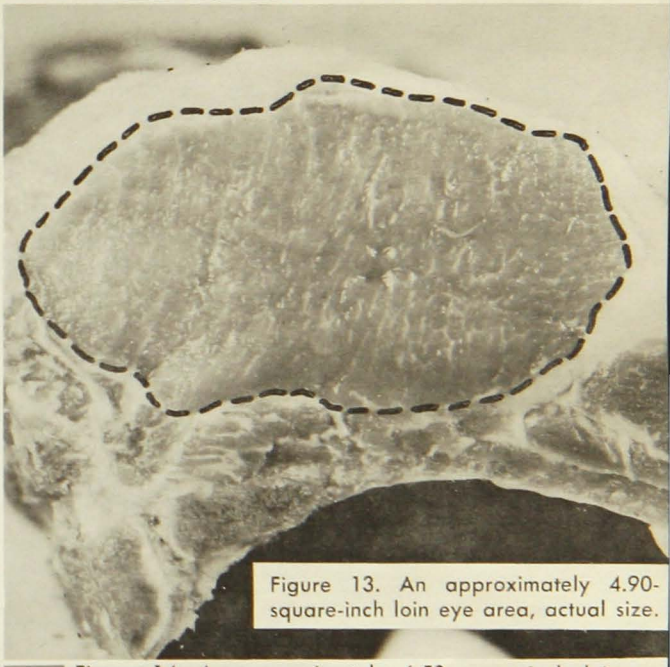
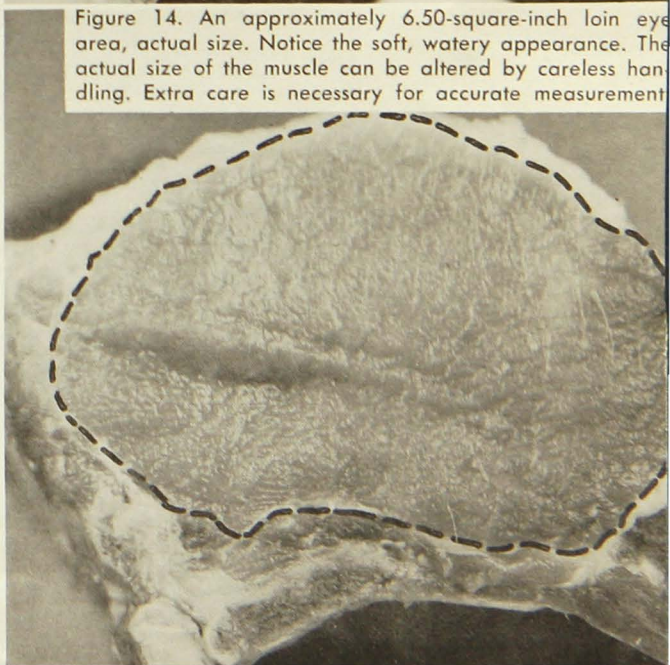


Figure 13. An approximately 4.90-square-inch loin eye area, actual size.

Figure 14. An approximately 6.50-square-inch loin eye area, actual size. Notice the soft, watery appearance. The actual size of the muscle can be altered by careless handling. Extra care is necessary for accurate measurement



barrow-gilt littermate pairs tested at Minnesota Swine Evaluation Stations during 1962 is given in table 4.

Soundness

Performance records are not a substitute for sound management. Underlines, feet and legs, and freedom from abnormalities must be considered in selecting breeding stock.

Mammary development characteristics are heritable. Number and spacing of nipples must be considered in selecting *both* boars and gilts. Most breeders consider 12 well spaced and well developed nipples a minimum. Breeding stock with inverted or blind nipples should not be selected. Eventually this characteristic may occur in so many of the offspring that many females will have little value for breeding purposes.

Figure 15. Litter record card. This card is available from your county extension office. Use it to record all the production information necessary for a sound breeding program.

Table 4. Performance of barrow-gilt littermate pairs at Minnesota swine evaluation stations

	Barrows	Gilts
Number of littermates compared	75	75
Daily gain, pounds	1.87	1.67
Age at 200 pounds, days	154	162
Carcass length, inches	29.7	30.0
Backfat thickness, inches	1.59	1.47
Loin eye area, square inches	3.88	4.34
Percent ham and loin of liveweight	25.0	26.5

Straight, well placed, sound feet and legs are a must, especially where hogs are to be raised on concrete. Select hogs with a wide stance both fore and rear, short pasterns, and heavy bone. Much foot and leg trouble can be avoided by selecting parents sound in these respects.

Abnormalities such as shakes, hernia (either scrotal or inguinal) or cryptorchidism (one or both testicles retained in abdomen) occur often enough to deserve attention. A breeder never can be sure that his herd is free from genes responsible for these conditions.

LITTER RECORD CARD

Breeder _____ Address _____ Breed of litter _____

Sow _____ Registration No. _____ Date Bred _____ No. farrowed: Alive _____ Dead _____

Boar _____ Registration No. _____ Date farrowed _____ Date weaned _____ No. weaned _____

Pig number	Sex	Birth Notes	Weaning weight		Weight for age			Backfat probe			Test station results							Remarks
			actual	adjusted	Date	actual	adjusted	weight	unadjusted	adjusted	daily gain	age at 200 pounds	feed efficiency	carcass length	carcass backfat	loin eye area	percent ham and loin	
Total																		
Average																		

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Breeders concerned with these abnormalities should cull both parents and the litter in which the condition appears. Abnormalities can be held to a minimum through proper selection of breeding stock.

Minnesota Swine Improvement Program

Improvement through breeding depends upon a breeder's ability to select the parents for the next generation.

The first step is to decide which traits are most important and how they can best be evaluated.

The second step is to develop a practical system to obtain production information useful in selecting the best individuals.

Accurate records are essential for any swine improvement program. A suggested litter record card available from your county extension office is shown in figure 15.

Testing stations and on-the-farm testing programs were developed to strengthen breeding programs. Testing helps to locate superior individuals so they may be used more extensively in the breeding program.

Swine Evaluation Stations

Testing stations were developed for both commercial and purebred producers who seek genetic improvement in pork production. They are designed to evaluate the strong and weak points in overall herd performance and then to assist in identifying superior stock that can be used to correct any weaknesses.

The Minnesota Swine Producers' Association operates testing stations at New Ulm and Austin. The Austin station, with 30 pens, opened in the fall of 1957; the New Ulm station opened with 98 pens the following spring.

The preferred test station entry is four barrows sired by the same boar with not more than two pigs from any one litter.

Pigs under 70 days of age and weighing between 35 and 55 pounds are delivered to the station. Pens are started on test when the four pigs average 60 pounds; the pigs are self-fed a standard ration until they weigh 200 pounds. Each pig is slaughtered at approximately 200 pounds and complete carcass information is obtained.

At the end of the test each breeder receives a complete performance report on his pigs from the University of Minnesota Extension Animal Husbandry Office. These reports aid the breeder in estimating breeding value of the parents of these pigs and guide him in selecting littermates for the breeding herd.

For more information on the Minnesota Swine Improvement Programs contact your county extension office or write to the University of Minnesota Extension Animal Husbandry Office, St. Paul, Minnesota 55101.

The basic weakness of testing stations is that only a small sample of the herd can be tested and this sample may not be truly representative of the entire herd. This emphasizes the importance of testing as many pigs as possible and continuing testing year after year.

Table 5. Suggested guide for selecting breeding stock

Characteristic	Boars	Gilts
Litter size	At least 8 raised	At least 8 raised
Age at 200 pounds	150 days or less	165 days or less
Pounds feed required per cwt. gain	Less than 300 pounds	Less than 325 pounds
Probed backfat thickness	Less than 1.3 inches at 200 pounds, and preferably under 1.1 inches	Not over 1.3 inches at 175 pounds, or 1.5 inches at 200 pounds
Cut-out information on relatives:		
Carcass length	At least 29 inches	At least 29 inches
Backfat thickness	1.6 inches or less	1.6 inches or less
Loin eye area	At least 4.0 square inches	At least 4.0 square inches
Percent ham and loin:		
of liveweight	At least 25 percent	At least 25 percent
of carcass weight	At least 36 percent	At least 36 percent

On-the-Farm Testing

On-the-farm testing is designed to help swine producers select from their herds breeding stock with the ability to produce large, fast-growing, efficient-gaining litters with superior carcass value. It provides production information on the entire herd, or a large portion of it, rather than only on a small sample.

Suggested on-the-farm testing plans for the purebred breeder and commercial producer are outlined below. These programs for identifying and selecting breeding stock may not fit all needs, but a swine producer should follow as many phases of the program as can reasonably fit into his operation.

Plan I: Procedure for Seedstock Producers

Purebred breeders should adopt a testing and selection program for both boars and gilts. Breed asociations have various production registry, litter certification, and testing programs available, and breeders are encouraged to cooperate in their association's programs. On-the-farm testing should also be followed to identify the performance of breeding stock offered for sale and retained for the breeding herd. Commercial producers want boars that will sire meat-type high-yielding market pigs with good growth and efficiency. Purebred breeders should consider this system:

At Farrowing Time

1. Ear notch pigs (follow system recommended by breed association or system outlined on Animal Husbandry Fact Sheet No. 2).*
2. Participate in breed association production registry program.

At Weaning Time

1. Weigh litters at weaning or at time specified by breed association production registry program.
2. Participate in Minnesota Swine Evaluation Programs. (Pigs from each new herd sire should be entered at the testing station to determine the boar's overall breeding value.)
3. If possible, keep feed requirement records on separate litters or sire groups.

At 200 Pounds

1. Participate in breed association meat-type certification program.
2. Weigh and probe all hogs that may be used for breeding.
3. Select replacement breeding stock on basis of litter production, rate and efficiency of gain, backfat thickness, meatiness, and overall soundness.

Plan II: Procedure for Commercial Producers

Commercial producers rely on purebred breeders to produce the kind of herd boars they need. The ability to select the *right* boar largely determines a commercial breeder's progress; he must know the strong points and weak points in his herd before selecting a boar. Certification standards adopted by the various breed associations offer a good yardstick to use in selecting breeding stock (see table 5). To assist in evaluating his herd and to aid in selecting the most productive gilts, a commercial producer should consider the following system:

At Farrowing Time

Ear notch pigs in outstanding litters and record litter birthdate.

At Weaning Time

a. Enter a pen of market pigs at the testing station to evaluate feed requirement and meatiness of herd.
b. If possible, keep feed requirement information on a representative group or groups of hogs on the farm.

At 175 to 200 Pounds

1. Sort ear-notched gilts from market herd and reject the off-type and unsound gilts.
2. Weigh prospective herd replacement gilts. (Figure weight for age.)
3. If practical:
   a. Separate possible herd replacement gilts from the market pigs between 150 to 175 pounds and feed a bulky ration. *Important: Handle all herd replacement prospects alike so you can select for existing genetic difference.*
   b. Probe herd replacement gilts.
   c. Check carcass merit on representative sample of market hogs. (Breeders entering pigs at the testing station will automatically get this data.)
4. Make final selections on basis of type and available records.

* Single copies available at no charge from your county agent or the Bulletin Room, Institute of Agriculture, St. Paul, Minnesota 55101.

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