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On-The-Farm Swine Selection

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on-the-farm
Swine Selection

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COOPERATIVE EXTENSION SERVICE
SOUTH DAKOTA STATE COLLEGE
U. S. DEPARTMENT OF AGRICULTURE
Figure 1. This picture indicates the areas to check when selecting meat-type animals.
In attempts to make selection more effective, swine breeders have become increasingly conscious of the importance of a good swine breeding program and of the part that heredity plays in improving performance and carcass quality.

Breeders no longer select breeding stock on the basis of sight alone. Modern selection programs emphasize performance records and carcass cut-out values. This is desirable because research has indicated that visual inspection alone cannot identify animals which are genetically superior.

Good feeding and management can result in larger, faster growing litters. However, 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 obtained through systematic testing and record keeping.

SELECTING BREEDING STOCK

You don’t create new inheritance in animals. You merely devise ways of finding animals that are superior in the desired traits because of their genetic makeup, and then mate these animals to combine the best qualities of both into the offspring.

Variations in livestock occur because of both heredity and environment influences. The problem is to determine which one is largely responsible. Heritability estimates for various traits give a general idea of this.

Differences in growth rate of pigs up to 5 months is about 30% heritable. This means that approximately 30% of the variation in growth rate among animals in the herd is due to differences in inheritance and approximately 70% is due to differences in environment.

Variations due to environment are not transmitted from parents to offspring, but they may conceal variations due to heredity. Therefore, you must keep environmental conditions as constant as possible when comparing prospective breeding animals.

Pay the most attention to the highly heritable traits in the breeding program. 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 hereditary differences. Heritability estimates are made after removing as many causes of environmental variation as possible. When we say percent of ham is 60% heritable, we mean about 60% of the ham weight variations in a herd is due to heredity differences and 40% is due to environment.

Heritabilities are usually referred to as being high, medium, or low. The key to greatest improvement for lowly heritable traits is improved management. Crossbreeding and mating less closely related parents are also likely to improve traits of low heritability.

The average estimated heritabilities for some economically important traits in hogs are shown in table 1.

<table>
<thead>
<tr>
<th>Level of</th>
<th>Characteristic</th>
<th>Average percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcass length</td>
<td>High (based on carcass weight)</td>
<td>60</td>
</tr>
<tr>
<td>High</td>
<td>Percent fat cuts (based on carcass weight)</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Backfat thickness</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Loin eye area</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Percent lean cuts (based on carcass weight)</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Feed efficiency</td>
<td>30</td>
</tr>
<tr>
<td>Medium</td>
<td>Growth rate (weaning to market)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Five-month weight</td>
<td>25</td>
</tr>
<tr>
<td>Low</td>
<td>Weaning weight</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Number farrowed</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Birth weight</td>
<td>5</td>
</tr>
</tbody>
</table>

The estimates show that sow production traits are of low heritability, so improvement of these traits by selection is slow. Improvement in management will be most effective in improving sow productivity traits.

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

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

To use heritability information to predict expected progress through selection, assume that the loin eye area for your present pig crop is 3.9 square inches at 200 pounds, and the replacement gilts selected for your breeding herd from this group average 4.5 square inches of loin eye area. These gilts are mated to an on-the-farm tested boar from your herd raised under similar conditions. The boar measured 4.9 square inches of loin eye area. (Measurements determined by Sonoray animal tester.)

The gilts saved had 0.6 square inch more loin eye area than the herd average (4.5-3.9==0.6), and the boar had 1.0 square inch more (4.9-3.9==1.0). 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 more loin eye area, a breeder attempts to increase the loin eye area of his herd. In the case of loin eye area, only 60% of the selection differential is heritable and could be expected to transmit to the offspring.

The predicted average loin eye area for the next pig crop resulting from these matings is calculated in this manner:

\[
\begin{align*}
\text{Predicted avg. sq.in. loin eye area} & = \text{Present pig crop average of traits} + \frac{(\text{Selection differential of traits of gilts} + \text{Selection differential of traits of boars}) \times \text{Heritability}}{2}
\end{align*}
\]

<table>
<thead>
<tr>
<th>Present pig crop average of traits</th>
<th>Selection differential of traits of gilts</th>
<th>Selection differential of traits of boars</th>
<th>Heritability</th>
<th>Predicted avg. sq.in. loin eye area</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.9</td>
<td>0.6</td>
<td>1.0</td>
<td>0.60</td>
<td>4.38</td>
</tr>
</tbody>
</table>

TRAITS TO CONSIDER IN SELECTION

Sow productivity, gain and feed efficiency, 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. Get litter weights at an age that fits your management procedures and your breed association's production registry programs.

Rate of Gain and Feed Efficiency

Faster gaining pigs reach market weight at an earlier age which in turn should reduce production cost.

Heritability of rate of gain is moderate and permits reasonable improvement by selection. For example, if boars and gilts that weigh 30 pounds above the herd average at 5 months are selected (25% heritable), 7.5 pounds improvement can be expected in their offspring.

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. By selecting the fastest gaining individual you indirectly select the most efficient one. This method is considered more practical than direct selection for feed efficiency.

When possible, keep the farm feed conversion records on a litter basis or on a representative sample of the herd. Entering representative samples of pigs by the same boar at the swine testing station to be fed out under uniform conditions has also provided helpful feed efficiency information.

Carcass Merit

Backfat thickness, loin eye area, yield of lean cuts, and length are associated with carcass merit. Average heritability for these carcass traits ranges from 35 to 60%, indicating that considerable progress can be made through proper selection.

Backfat thickness and loin eye area can be measured quite accurately on the live hog. Probing the pig at 200 pounds gives a good indication of backfat thickness. Recent use of ultrasonic equipment on live hogs at approximately 200 pounds indicates that there is also a good possibility of determining loin eye area to the extent that this measurement will be helpful in making selections for herd replacements.

Yield of lean cuts and carcass length can be measured and appraised only on slaughter hogs, so carcass merit measurements must be made on relatives to stock selected for breeding.

Soundness

Consider underlines, feet and legs, and freedom from abnormalities in selecting breeding stock.

Mammary development characteristics are heritable. Consider number and spacing of nipples 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 saved.

Straight, well placed, sound feet and legs are a must especially where hogs are 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 abdominal) or cryptorchidism (one or both testicles retained in abdomen) occur often enough to deserve attention. Breeders concerned with these abnormalities should cull both parents and the litter in which the condition appears.

**HOW TO PROBE**

Wrap your knife or scalpel blade with tape ⅛ inch from the point to keep it from going too deep. Then hold the hog in a squeeze chute or with a nose holder and pierce skin at (1) mid-point of shoulder above elbow, (2) at last rib, and (3) halfway between last rib and base of tail. Make all probes 2½ inches to the side of the midline of back and crossways to the pig.

![Figure 2. Probing tools include a snare, a knife or scalpel, and a thin steel ruler graduated in tenths of an inch.](image)

![Figure 3. Probe at midpoint of shoulder above elbow, at last rib, and halfway between last rib and base of tail. Make all probes 2½ inches to the side of the midline of back and crossways to the pig.](image)

Insert steel ruler in cut (one probe should be measured before another is cut) and slant bottom end toward middle of pig’s body, forcing ruler through fat down to the muscle. Push the clip of the ruler against the skin, remove the ruler, and read the measurement.

**WHEN TO PROBE**

Probe at weight from 175 to 225 pounds when hogs are on a standard finishing ration of grain and supplement. Probes will not be as reliable in predicting gilt and boar performance if taken when they are on a restricted ration, or if they weigh less than 175 pounds or more than 225.

**USING PROBE AND AGE AT 200 POUNDS FIGURES AFTER SELECTION**

**Commercial Herds**

First sort gilts from the barrows. Identify and sort off obviously poor ones. Collect the probe and weight figures on the remaining gilts and adjust using the probe and age at 200 pounds adjustment tables.

After the figures are standardized, arrange the gilts in the order of their weights with the heaviest at the top and the lightest at the bottom. Then cull the low 40% of those weighed. Keep the leanest half of the remaining 60%.

**Purebred Herds**

Cull unsound boars. Probe and weigh all sound boars. Cull the gilt herd visually; then probe and weigh the remaining gilts. Adjust the age at 200 pounds and backfat measurements. Use the same procedure with the gilts in purebred herds as with commercial herds.

Boars are leaner than either gilts or barrows, and...
giltss are leaner than barrows. Therefore, in order to produce lean barrows, you must use leaner boars and gilts.

Remember, the most effective selection will be made under full-fed conditions. A limited-fed boar which measures 1.3 inches backfat is genetically a fatter boar than he measures.

**WHAT IS YOUR GOAL IN SELECTION**

Putting your records to use in selecting the right boars and gilts is your ultimate goal.

**Table 2. Suggested Guide to Use for Selecting Breeding Stock**

<table>
<thead>
<tr>
<th>Boars</th>
<th>Gilts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feet and legs</td>
<td>Feet and legs</td>
</tr>
<tr>
<td>Wide stance, both</td>
<td>Wide stance, both</td>
</tr>
<tr>
<td>fore and rear, short</td>
<td>fore and rear, short</td>
</tr>
<tr>
<td>pasterns and adequate bone</td>
<td>pasterns and adequate bone</td>
</tr>
<tr>
<td>Less than 320</td>
<td>Less than 340</td>
</tr>
<tr>
<td>Pounds of feed required per</td>
<td>Probed backfat thickness</td>
</tr>
<tr>
<td>cwt. gain</td>
<td>Less than 1.3 in.</td>
</tr>
<tr>
<td>at 200 pounds</td>
<td>at 200 pounds</td>
</tr>
<tr>
<td>Cut-out information on relatives</td>
<td>Loin eye area</td>
</tr>
<tr>
<td>weighing 200 pounds or less</td>
<td>At least 4 sq. in.</td>
</tr>
<tr>
<td>Carcass length</td>
<td>Carcass length</td>
</tr>
<tr>
<td>29 in. or more</td>
<td>29 in. or more</td>
</tr>
<tr>
<td>Backfat thickness</td>
<td>1.6 in. or less</td>
</tr>
<tr>
<td>1.6 in. or less</td>
<td>Backfat thickness</td>
</tr>
<tr>
<td>Loin eye area</td>
<td>Loin eye area</td>
</tr>
<tr>
<td>At least 4 sq. in.</td>
<td>At least 4 sq. in.</td>
</tr>
<tr>
<td>Percent lean cuts (ham, loin,</td>
<td>Percent lean cuts (ham, loin,</td>
</tr>
<tr>
<td>picnic, and Boston butt)</td>
<td>picnic, and Boston butt)</td>
</tr>
<tr>
<td>Live weight</td>
<td>Live weight</td>
</tr>
<tr>
<td>36% or more</td>
<td>36% or more</td>
</tr>
<tr>
<td>Carcass weight</td>
<td>Carcass weight</td>
</tr>
<tr>
<td>52% or more</td>
<td>52% or more</td>
</tr>
<tr>
<td>Percent of ham and loin</td>
<td>Percent of ham and loin</td>
</tr>
<tr>
<td>Live weight</td>
<td>Live weight</td>
</tr>
<tr>
<td>25% or more</td>
<td>25% or more</td>
</tr>
<tr>
<td>Carcass weight</td>
<td>Carcass weight</td>
</tr>
<tr>
<td>36% or more</td>
<td>36% or more</td>
</tr>
</tbody>
</table>
The above guide is the ultimate in selection possibility. It may be necessary to settle for replacement animals that have slightly lower performance standards. Set your goals in light of what you know about your herd. If you wish, use this standard for selection: select or keep no boars or gilts with 180-day weight less than 200 pounds.

**Butcher Animals**

Yields of lean cuts (ham, loin, picnic, and Boston butt) determine the type of butcher hogs produced. Table 3 lists the percent requirements needed for the various types (grades) of butcher hogs on a live and carcass basis. All carcasses should measure 29 inches or more in body length.

Table 3. Determining Butcher Hog Grades by Percentage of Four Lean Cuts in Live and Carcass Weights

<table>
<thead>
<tr>
<th>Types (grades) of butcher hogs</th>
<th>Percent of 4 lean cuts based on live market weight</th>
<th>Percent of 4 lean cuts based on carcass weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat-type</td>
<td>36 and up</td>
<td>52 or more</td>
</tr>
<tr>
<td>Good or average</td>
<td>34-35</td>
<td>48-52</td>
</tr>
<tr>
<td>Fat hogs</td>
<td>Less than 34</td>
<td>Less than 48</td>
</tr>
<tr>
<td>Medium and culls</td>
<td>Lean but lack muscling and quality</td>
<td></td>
</tr>
</tbody>
</table>

Figure 7. 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 next to the backbone. Backfat is measured opposite the first rib, last rib, and last lumbar vertebrae. The average of the three backfat measurements is used.

Figure 8. A band saw is the ideal implement with which to cut the loin between the tenth and eleventh ribs. Start cut at end of tenth rib. Cut the loin at a right angle—straight across. Do not follow rib. The tenth rib should always be marked before the loin is removed as usually three ribs are left in the shoulder when it is severed.

Figure 9. A plainimeter is used to measure loin eye area. Loin eye area is measured between the 10 and 11 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 muscle and not the adjacent lean area is included in this measurement.

**Loin Eye**

Loin eye area measured between the 10 and 11 ribs is a common measure of carcass meatiness. Figure 9 shows how loin eye is measured and figures 10 and 11 are actual size loin eyes ranging from approximately 2.80 square inches to 6.08 square inches.

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). 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 over emphasized 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.

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 litters which are superior meat hogs. These testing programs are not hit and miss tangents that have little practical or profit making value. They are sound proven plans that provide tools to help each producer make continued progress and earn extra dollars. The plans outlined below may not fit all needs, but the producer who follows as many phases as are possible will be providing the means for today's most modern and useful swine selection program.

What a breeder must do:

At Farrowing
1. Identify each animal (follow breed notching plan).
2. Nominate litters for production registry.

At Weaning
1. Weigh litters at weaning or at time specified by breed association production registry program.
2. Enter pigs into South Dakota Swine Evaluation Station.
3. Keep feed requirement records at home on separate litters or sire groups.

Figure 10. An approximately 2.80 square inch loin eye area, actual size.

Figure 11. An approximately 6.08 square inch loin eye area actual size. The actual size of the muscle can be altered by careless handling. Extra care is necessary for accurate measurement.
Keeping feed records. A feeding test properly set up, can provide additional useful sire and dam information to supplement probing and weighing in final selection. You can set up to handle individual pigs, pairs, litters, or groups from several litters, kept together.

Equipment. Pen area, waterers and feeders should be alike so that all the pigs have equal opportunity.

When to pen the pigs. Place pigs in the testing area a few days before the test is to begin. Let them become accustomed to the new surroundings and to the feed and feeder before they go on test.

Starting the pigs on test at 45 to 60 pound weight. Weight of pigs in a pair, a litter, or a group should be nearly equal if you are feeding pairs, litters or groups.

Feeding the pigs. There are two easy ways to keep feed records. One is to sack the feed in 80-pound units and keep track of the number of sacks fed. Record the feed weight on a small card attached inside the feeder each time you put in feed. This should be about once a week. Keep a duplicate record in a notebook.

The other way is to place a weighted amount of feed in bulk in a barrel or large box. Each lot has its own feed storage. When the barrel or box gets empty, put in another weighed amount of feed and record it. At the end of the test, weigh back the unused feed from the feeder, plus the feed remaining in the storage barrel or box.

Subtract this amount from the total feed you weighed into the container. This would probably be the simplest way to keep the records, especially if a complete ration is fed.

At 200 Pounds.
1. Participate in breed association meat type certification program.
2. Weight (figure weight for age)
   200 pounds at 150 days or less for boars
   200 pounds at 165 days or less for gilts
3. Probe and Sonoray (if Sonoray animal tester is available) all hogs that may be used for breeding.
4. Select replacement breeding stock on basis of litter production, rate and efficiency of gain, backfat thickness, meatiness, and overall soundness.

Next Farrowing Continue to Follow Testing Program

PLAN II: PROCEDURE FOR COMMERCIAL PRODUCERS

The modern day, progressive commercial producer insists on obtaining a boar from a purebred herd that has performance records available on those traits that are most important for continued improvement in his herd. This information determines whether or not the boar he selects is superior to the average of his present herd. By selecting a boar that is superior to the average of his herd and by selecting replacement gilts in the same manner, the producer can then expect continued progress. He is combining those improved traits of both animals selected into the offspring that are produced. To assist in evaluating his herd and to aid in selecting the most productive gilts, a commercial producer might consider the following plan:

At Farrowing
1. Identify pigs in outstanding litters and record litter birth date.

At Weaning
1. Keep feed requirement information on representative group or groups of hogs on the farm (follow the “keeping feed record plan” listed under Plan 1 for purebred herds). All gilts being considered for replacements should be handled under the same environment so that selection can be made on existing genetic differences.

At 175 to 200 Pound Weight Range
1. Sort ear-notched gilts from market herd. Cull all off-type and unsound gilts.
2. Weigh prospective herd replacement gilts. Figure weight for age (200 pounds at 165 days or less).
3. Probe herd replacements.
4. Obtain carcass cut-out information on at least 10 head. Pairs of littermates sired by the same sire would make a good representative sample of the herd.
5. Determine final selection on basis of available records and soundness.

Next Farrowing Continue to Follow the Above Recommended Selection and Testing Program