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Selecting Replacement Gilts

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Programs to improve swine production emphasize the importance of using superior boars. For many producers, boars are the quickest method of making genetic improvement since the boar influences the performance of the total pig crop.

For those producers using superior tested boars, a systematic gilt selection program based on performance records can improve production more rapidly. Selection, of course, has to involve some standards of performance to be beneficial. The amount of progress will depend to a large extent on the present sow level of performance and selected superiority of sires compared to the average performance of the sow herd. The fewer traits selected for, the more rapid the progress per trait.

Use Home-Grown Females

There are advantages to selecting only home-grown females for replacements. They have some immunity to disease and do not introduce new health hazards from outside sources. Select replacement gilts from sow litters, as their pigs should have higher disease resistance through passive immunity than those from gilt litters. Healthy hogs accustomed to their surrounding environment are more complacent and less likely to give problems in confined units.

Identify Prospective Replacements At Birth

A good selection program starts when pigs are farrowed. Producers need some means of identifying prospective replacements. Purebred producers have a simple individual and litter ear notching system which commercial producers can also use to identify each pig. Some commercial producers may be interested in identifying litters only. This also can be done by an ear notching system. The simplest method is to identify those prospective replacements by a litter ear notch in the right ear.

Prospective gilt replacements should come from top-producing sows that have done a good job of farrowing and raising pigs. These top sows need to be systematically identified using some type of record system. Records used to evaluate productivity of sows may vary with breeders' needs. The form shown in Figure 1 is used at the University of Missouri. This data ranks each sow primarily on number of pigs born alive and 21 day litter weight.

Select enough gilts initially to allow stringent culling from time of birth until final selection. Select about twice as many gilts initially as you will eventually need for replacement. Even at breeding time, to eliminate shy breeders and non-breeders, expose to the boar 10 to 15 percent more gilts than you will retain. If physical abnormalities appear, such as inverted nipples or ruptures, or if the sow exhibits poor mothering ability, eliminate all gilts from these litters from consideration.

Obtain Gain and Feed Efficiency Data

Obtain data on average daily gain and feed efficiency on prospective gilts. In most cases, these gilts will run with the market hogs on a self-fed ration until they weigh over 200 pounds. You can then weigh gilts, adjust the gain figures to 230 pounds weight, and select the fastest growing, best type gilt replacements. You may wish to place a minimum figure on the number of days for replacements to reach 230 pounds. Top producers are setting a goal of 160 days or less.

Feed efficiency is one of the most important performance factors determining profit in swine production. Feed costs make up 70 to 75 percent of the total cost of producing hogs to market weight. When you feed prospective replacement gilts along with market hogs, you cannot generally obtain individual feed intake and feed efficiency figures. If you keep records of total feed consumed, you can allot an average feed consumption to each animal and estimate feed efficiency based on the rate of gain of the individual gilts.

Consider a Back Fat Probe—Sonoray

The technique of selecting hogs by probing is described in University of Missouri Guide 2301, *Selecting Meat-Type Hogs by Probing and for Age at 240 Pounds*. This useful tool aids the producer in selecting animals with a minimum of fat and a high percentage of lean meat. Gilts should be probed when they weigh around 200 pounds. One probe could be made at the last rib and 0.1 inch added. This will give a figure close to that obtained by averaging three probes and adjusting to 230 pound weight. Minimum standards may vary among producers on the back fat measurement, depending on the meatiness of the sow herd. Most producers should set a minimum standard of one inch of back fat on replacement gilts; however, for gilts exceptional in other traits, one could go up to 1.25.

Many Missouri producers have used the ultrasonic measurement to determine meatiness in replacement gilts. It is a valuable tool you may want to consider in your selection program. It gives you information on back fat and an estimate of area of the loin eye muscle. This is an indicator of the total meatiness and carcass characteristics of your replacements.

Figure 1. Gilt Selection Worksheet (Form A—Sow Productivity)

Farrowing Group _____ Farrowing Date _____

Litter No.	Sow No.	No. Born Alive	No. Alive at 21 Days	Litter Wn. Wt. (21 days; lbs)	Sow Product Index[1]	Sow Product Index Ratio[2]	Rank	Prev. Rank	Comments (reasons for culling
Total						------	-----	----	
Avg.	----					100.0	-----	----	

[1]Sow Productive Index = 6.5 x no. born alive + adjusted litter weaning weight at 21 days—
Adjustments to Litter Weaning Weight at 21 days:
a. Parity: Add 25 pounds to first litter.
b. No. alive at 21 days adjusted to 10 pigs: Add 9 pounds per pig for gilts or 10 pounds per pig for sows.
[2]Sow Productive Index Ratio = Sow Productive Index of litter ÷ Average sow productive index.

Select For Conformation And Soundness

Producers will still need to examine gilts for superior conformation and soundness. Animals with adequate length, showing indication of muscling in the ham and shoulders, are most desirable. Good length is associated with better underlines. Number and spacing of teats should be checked. At least six good teats, uniformly spaced, should be on each side of the underline. Gilts should have adequate size and stand on well developed feet and legs. Small-boned animals, those showing tendencies of knots on joints or lameness, and those showing inability to walk freely should not be considered as replacements.

Keep Records

Once you have performance data, you can make a decision on which gilts will be placed in the producing herd. To simplify the accumulation and evaluation of records, many producers use some type of swine litter record. This assures that you will have a place to summarize the records on each pig and make accurate evaluation of its performance in relation to others being considered for replacements. University personnel use *Gilt Selection Worksheet (Form B);* see Figure 2.

Swine Improvement Programs

Selection is defined as a process in which given individuals are chosen or randomly selected from a population to reproduce the next generation. (Genetically, if natural selection is practiced with random matings and no lethal genes are present, the gene frequency should not change. However, artificial selection is commonly used in livestock production, and gene frequency changes; rate of change depends on the intensity of selection. Three methods of artificial selection are commonly used by breeders today:

Tandem method is defined as selecting for only one trait at a time until it has been satisfactorily improved, then relaxing or disregarding it and selecting for a second trait. This is the least efficient type of selection. However, maximum progress can be made for a single trait under this system of selection. An example of selecting strictly for back fat can be shown, using a sow herd averaging 1.5 inches back fat. By selecting a boar with .7 inch back fat, you would expect to reduce back fat on replacements to 1.32 inches.

[(Sow herd average - Boar back fat) ÷ 2] x Heritability estimate = Genetic improvement or change; 1.5 - .7 = .8; .8 ÷ 2 = .4; .4 x .45 = .18 inch; 1.5 inch - .18 = 1.32 inch back fat for replacement gilts.

Independent culling method is defined as selecting for two or more traits with a minimum trait standard that each animal must meet to be allowed to reproduce. The disadvantage to this type of selection is that there may be no merit given to an animal that is superior in a given trait or maybe three out of four traits if four traits are involved. If the animal fails in one trait, it is not allowed to reproduce. Example:

Four traits involved, with a minimum standard of 1 inch for back fat, 1.8 pounds daily gain, 300 pounds of feed to make

Figure 2. Gilt Selection Worksheet (Form B)

Farrowing Group _____

Gilt No.	Birth Date	Dam No.	Sire No.	Days to 230[1]	Back Fat 230[2]	Loin Eye Area 230[3]	Visual Appraisal (Feet and Legs, Underline, Frame, Other)
.Avg.							

[1]Days to 230 adjusted = 2 pounds/per day.
[2]Back fat adjusted = [{ (230 - actual weight) x 0.004} + 1] x unadjusted average back fat.
[3]Loin eye area adjusted = 0.015 square inches per pound.

100 pounds of gain (3.0 feed efficiency), and length of 30 inches.

Possible replacement, 0.7 inch back fat, 2 pounds daily gain, 2.5 feed efficiency, and 29 inches long.

The pig involved would be culled automatically.

Selection index is defined as a separate trait evaluation, and the individual traits are added for a total index of all traits used as a basis for selection. Each trait is weighed according to heritability estimate and genetic association among other traits. Its influence on the total index will be based on its independent economic value. The average breeder selects for more than one economic trait in his breeding program. For this reason we need to know how to figure genetic progress for any one or all of these traits. Most economic traits are affected by additive gene action. The more traits selected for, the slower the progress for any one trait. Assuming there is no non-additive gene action involved, no genetic association between genes, and all traits are independent, we can determine the total progress for each trait.

For example, the breeder would have to keep adequate records to determine the average value of each trait in the sow herd, thus giving a basis for selecting superiority in the herd sire. These data, along with the heritability estimates (which have been established by researchers for each trait—see Figure 3) allow the producer to predict progress:

Figure 3. Heritability Estimates for Economic Traits

Trait	Percent Heritable
Number of pigs farrowed	15
Number of pigs weaned	20
Litter weight at weaning	15
Weight of pig at five months	20
Growth rate (weaning to 200 lbs.)	30
Efficiency of gain	40
Carcass items:	
Carcass length	60
Thickness of backfat	45
Area of loin eye	50
Percent of ham	60
Percent of shoulder	50
Percent of fat cuts	60
Percent of lean cuts	35
Length of leg	65
Conformation	25

The method for figuring the rate of annual progress must consider heritability, selection differential, number of traits, and generation interval. Generation interval = (average age of sows + boar) ÷ 2. Progress = (½ of reach or selected parental difference x percent heritability x $\frac{1}{\sqrt{\text{number of traits selected}}}$ ÷ generation interval.

$$\frac{\text{Sire Performance} - \text{Herd Average}}{2} \times \text{Heritability Estimate} \times \frac{1}{\sqrt{\text{No. Traits Selected}}} = \text{Progress Made}$$

Note that where only one trait is selected, you can expect twice as much improvement as where four traits are selected.

These figures point up three significant functions of breeding:

(1) Progress is slow. The more traits involved, the slower progress will be.

(2) The greater the reach, or difference, between the sire selected and the sow average, the greater the progress.

(3) With adequate records and systematic evaluation and use, progress is like building a brick building; each row of bricks or generation of selection brings the desired objective nearer.

This progress looks small. But consider feed efficiency as a single trait and evaluate a selection program to improve it.

Example: A superior boar with 240 pounds feed to make 100 pounds of gain, mated to 20 sows per year requiring 340 pounds of feed to make 100 pounds of gain, producing 280 pigs to market weight of 200 pounds.

Sow Record - Boar Record = Difference

This example: 340 - 240 = 100 difference
Formula:

(Difference x ½) x % Heritability = Improvement Made

(100 x ½) x 40% = 20 lbs. improvement expected in feed efficiency

Twenty pounds improvement per 100 pounds of gain or 40 pounds feed savings per hog should be realized. A saving of 40 pounds of feed on 280 hogs would equal 11,200 pounds feed saved. If you pay $5 per hundred for feed, this boar would be worth $560 more than an average boar that makes no improvement in the herd.

If four traits are selected for, only one half of this amount of feed saving would be expected.

By using superior boars and selecting home grown replacement gilts based on accurate records, genes common to the sires can accumulate to 96 percent in five generations. Rapid improvement can be expected when the genetic merit of the original sow herd is low by turning the sow herd after 1 to 2 litters. Replacement females should be selected on economic traits by use of both physical and objective tools.

Genetic Contribution of Sires to Litters

Generation	*Expected Sire Influence (%)*
1	50.00
2	75.00
3	87.50
4	93.75
5	96.87

Figure 4. Genetic Progress Expected for Economic Traits in Swine

	Sire Record	Dam Record	Dif.	½ Dif.	% Herit.	Change, One-trait Selection	$\frac{1}{\sqrt{4}}$	Genetic Progress 4 Traits
Growth rate	2.4	1.6	.8	.4	.30	1.72	½	1.66
Feed/cwt. gain	240	380	140	70	.40	352	½	366
Backfat	.7	1.5	.8	.4	.45	1.32	½	1.41
Length	31	28	3	1.5	.60	28.9	½	28.45

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