Selecting a Replacement Boar

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The purchase of herd boars has always been a key decision for commercial pork production. Since fewer boars are used than gilts and sows more time has been spent in choosing boars, and this situation is amplified when using A.I.

While the number of boars on a farm represent less than five percent of the breeding herd, they represent fully 50 percent of the genes in the progeny, the end product. If replacement females are selected within herd this becomes compounded. Table 1 illustrates what would happen to a purebred herd which bought boars of a different breed and retained replacement females from within herd. After just three generations the original breed makes up less than ten percent of the genes of progeny. This example of grading up is to demonstrate how important boar selection can be.

Table 1. AN EXAMPLE OF GRADING UP

	SIRE	DAM		PROGENY	
Generation	% Breed A	% Breed A	% Breed B	% Breed A	% Breed B
0	100	0	100	50	50
1	100	50	50	75	25
2	100	75	25	87.5	12.5
3	100	87.5	12.5	93.75	6.25
4	100	93.75	6.25	96.88	3.13
5	100	96.88	3.13	98.44	1.56

The steps needed to choose a boar are as follows:

1. Determine the use of the boar.
2. Identify suppliers who can meet demands.
3. Select an individual animal.

Each of these questions needs to be given serious consideration as the answer to each of them may affect the way that the next question is asked. For example, if the boar is to be used to introduce a new breed or line the suppliers which can meet the demand may be different than if a consistent source of a given type of boar is needed. Under several circumstances the decision may be what boar to purchase semen from rather than what boar to purchase.

1. Determine the use of the boar:

As with any purchase, the first step is to determine why you are buying a boar. Your choice of suppliers may be quite different if the boar is to be used as a terminal vs a maternal sire. Terminal sires should come from breeds or lines with a history of performance testing in growth rate, feed efficiency and carcass quality. If a boar is to produce replacement females, his background should have the same traits, plus the traits needed for a gilt to be a productive sow. These include litter size, mothering ability, longevity, milking ability, etc. Most commercial producers should be using terminal or rotaterminal crossbreeding systems, and may need to purchase terminal as well as maternal sires. Larger operations may purchase grand parent or great-grand parent gilts while for smaller operations parent gilt purchasing will likely be most practical.

2. Identify suppliers who can meet demands:

After a given breed or type has been chosen, the next step is to identify a supplier. There are a greater number of seedstock suppliers today offering records demonstrating genetic improvement than ever before. This is the most difficult and time consuming step, but must receive serious attention Besides looking at the glossy pictures, how should you choose? The first person to talk to is your fellow pork producer. Ask what they know about a supplier, or if they have had experience with them. Visit with a representative of the supplier and have a list of questions prepared. What is their performance testing program, and are they willing to share records with you? With performance pedigrees or historical record of EPD's can they demonstrate a history of good performance and genetic improvement? What are their selection objectives? Are they similar to yours? How do their pigs perform under production systems similar to yours? Can they recommend specific feeding or management advice for their pigs? What is the health status and health monitoring system for their herds? What guarantees do they offer? Nearly any seedstock supplier can identify one superior animal or one superior kill sheet, so it is important to ask questions to understand how good their improvement programs are. It is recommended that once a supplier is identified the commercial producer should plan to stay with them for a while to assure uniformity in health and of pigs, and so that their performance can be fairly evaluated on-farm.

Potential sires can be compared on numerous bases. Keep in mind the overall performance and farm profitability when making replacement decisions. Just because the packers collect and report kill-sheet data doesn't mean that it is the only important performance information. The best boar for one operation may not be the best boar for another that has different housing, management, marketing etc.

The performance of nine genetic populations as terminal sires has recently been reported (NPPC, 1994). While certainly not a comprehensive test, this is the most objective, extensive evaluation available. The populations represented in that study include Berkshire, Danbred USA, Duroc, Hampshire, Nebraska SPF Duroc, Newsham Hybrid USA, National Genetic Technology Large White, Spot and Yorkshire. While this test was not able to evaluate all potential sire lines, it can give producers an idea of the sort of information that might be available. Summaries of the results of this study are available from national and state pork producers organizations.

3. Select an individual animal:

After you have selected a seedstock supplier, the next step is to choose from among the boars being offered. In the short run the easiest way is to let the supplier choose for you. If you do this, however, you have no room to complain if the boars don't meet your expectations.

Most seedstock suppliers can provide EBV's, EPD's, or indexes for replacement boars. If they can't you are taking a gamble. An EBV is the Estimated Breeding Value of an animal.

The simplest calculation of an EBV is:

$$EBV = h^2 \times (\text{individual performance - group average})$$

where h^2 = heritability, the proportion of phenotypic variation which is transmitted to progeny.

The calculation becomes more complicated, but more accurate, as information from relatives is included in the calculation. EBV's allow for the most accurate estimates by including information from relatives and removing variation from known non-genetic causes such as season of the year, using a statistical procedure referred to as BLUP (Best Linear Unbiased Prediction).

An EPD is the Expected Progeny Difference. This is how much different you expect progeny of a given animal to perform relative to the base population and is calculated as one-half EBV. While it would be nice to have EPD's to compare all animals across populations this is not currently possible. This is because the EPD is the expected deviation from the base population which is different for each breed and each breeding company line. A full description of EPDs will be reserved for a future article.

How should EPD's be used? One of the nice features of EPD's is that they are measured in the units of the trait. That means if boar A has an EPD of +.04 for backfat his progeny would be expected to have .04 inches greater backfat depth than the mean of the base population. Boar B, with a -.11 EPD, would produce progeny with .11 inches less backfat than the base population, and .15 inches less than boar A. This allows us to calculate the expected difference in economic worth of boars.

If our only concern were backfat thickness, for example, we could calculate the difference in value between boars A and B above. In the Guidelines for Uniform Swine Improvement Programs booklet published by NSIF (1996) the value of decreasing backfat thickness by one inch is estimated as $15.00. Since the difference in EPD's between boar A and boar B was .15 inches, we estimate a difference in value of progeny as (.15 inches x $15.00) = $2.25. If the boar is to be mated to produce 500 litters of eight market hogs (a very realistic value with use of A.I.), then the expected difference in value between the boars would be ($2.25/pig) x (8 pigs/litter) x (500 litters) = $9,000.

For demonstration purposes in the previous example it was assumed that we were only concerned with backfat thickness. This is obviously a dangerous oversimplification. It would be possible to conduct similar calculations for all economically important traits individually. This would be time consuming and misleading, since it would not account for genetic correlations among traits. In order to simultaneously consider multiple traits, selection indexes have been developed. These formulas take into account the economic importance and genetic correlation of multiple traits, and combine them into one value. Indexes used by the National Swine Registry (NSR) have been made available to the public, and are used here as examples. The NSR has adopted a Terminal Sire Index (TSI), a Maternal Line Index (MLI), and a Sow Productivity Index (SPI). The TSI ranks animals on days to 250 lbs. and backfat thickness. The MLI includes these traits, but places twice as much emphasis on number born alive and 21 day litter weights. The SPI includes only number born alive and litter 21 day weight. The base for all three indexes is 100, meaning that the average animal in the base generation had an index value of 100.

The index EPD's in the STAGES and PAGE1 reports from the NSR are calculated in economic terms. One TSI unit is equivalent to $.10 per pig marketed. This means that a boar with a TSI of 111 is expected to sire progeny which are worth ($.10) x (11) = $1.10 per head more than the base population. Each unit of the MLI different from 100 represents $1.00 per litter produced by the daughters. If a sire has an MLI of 105, for example, his daughters are expected to produce litters worth ($1.00) x (5) = $5.00 more than daughters of boars from the base population.

These indexes represent the simplest way to select on multiple traits simultaneously. They allow for superior performance in one trait to partially compensate for performance closer to the average in another trait. One potential drawback is that they are based on NSIF average economic values which may actually be quite different among farms. The other limitation is that because of the ability of traits to "compensate" for each other, a group of boars with similar index values may produce progeny with greater variability than desired. For example, two boars may each have a TSI of 106. One may have average backfat thickness with rapid growth, and the other may have average growth with low backfat. If both boars are used on the same operation the resulting progeny may have more variation than optimal which complicates management. It is not difficult to use these tools without encountering the associated problems. If you are buying five boars, select the ten with the greatest index values in your price range. Then look at EPD's for individual traits and decide if one might present variation problems, or which ones are strongest where your herd is weakest. The last step is to evaluate remaining candidates on visual appeal to get your five boars. The NSR indexes are used as examples. If your seedstock supplier uses a different index ask them which traits are included and how they are weighted.

Many of the breeding companies provide only within contemporary group comparisons or percentile rankings. In these cases individual boar selection is not possible. Here the commercial producer must decide what level of boar to purchase, and rely on the supplier to provide the best possible individuals within that price range. In making that decision it is important to know how much different boars from the different levels are expected to be, and how many progeny the boar is expected to sire. Let's assume that boars from the highest group are available for $4,000, and boars from the next level are available for $1,500. The difference of $2,500 would require a progeny performance difference of $10 per head if only 250 progeny would be produced, and only $1 per head if 2500 progeny were expected to be produced. Ask the supplier to identify expected differences in progeny performance in economic terms. If a given trait is more important than another the commercial producer should communicate that to the supplier.

Remember that no matter where semen is obtained the supplier is not a mind reader. If you have some concerns about a shipment of semen or a boar, tactfully present your case to your supplier and allow them to explain or to try better the next time. No one knows your individual needs better than you, and no one can meet them if you don't ask.

References

Guidelines for Uniform Swine Improvement Programs. 1996. National Swine Improvement Federation.

Genetic Evaluation - Terminal Line Program Results. 1994. National Pork Producers Council.

"Using STAGES". A Guide to Interpreting STAGES Reports for Breeders and Their Clients. 1996. STAGES home page: http://www.ansc.purdue.edu/stages/

Appendix A

HOW MUCH CAN YOU PAY FOR A GENETICALLY SUPERIOR BOAR?1

	Boar A	Boar B
Price	$450	$900

Which Boar is the better buy?
STAGES can help you answer that question.

A. Maternal Sire Example:

	Boar A	Boar B
EPD Days	-1.87	-1.22
EPD Backfat	.06	- .01
EPD NBA	.22	.63
EPD Lit. Wt.	2.40	8.35
MLI Index	100.00	118.8

The STAGES genetic evaluation predicts that pigs from sire B will be similar in growth rate to those of sire A but will be leaner, and sire B's daughters will have larger, heavier litters. Sire B has an aggregate maternal index of 18.8 units higher than sire A. Each index unit predicts an increase in value of $1.00 per litter produced by daughters of the maternal sire. Therefore, daughters of sire B will be worth $18.80 more in net income per litter produced than daughters of sire A.

The increased value of sire B is dependent on how many of his daughters are used as replacement gilts and how many litters they produce. Assume each sire is used for 15 months, producing 4 litters per month, 1 daughter is saved from each litter, and on average, each daughter produces 2 litters in her life. These assumptions result in a conservative estimate of 120 litters produced by the daughters of these sires.

Difference in Net Income	$18.8 /litter x 120 litters = $2256.00
Difference in Cost	$900 - $45 = $ 450.00
Return over Cost	$1806.00
Percent Return on Investment	401%
Discounted Return on Net Present Value*	278%

*Returns from the daughters' litters are in the future. Therefore, the income should be discounted to net present value to accurately represent the return to a current investment. A discount rate of 5% was used.

In addition, since the littermates of the replacement gilts will be leaner for litters sired by B, there will be an additional $740 ($513 net present value) in increased market hog value. The result is a combined return of $2546 or 565% (392% net present return on investment).

1Source:"Using STAGES"A guide to interpreting STAGES reports for breeders and their clients.

Appendix B

A VERY BRIEF DESCRIPTION OF VARIATION

We often think of performance as the mean or average level among alternatives. This is only one measure. Another measure often given is the standard deviation. The Standard Normal Distribution is one with a mean of zero and a standard deviation of one. Within $\pm$ one standard deviation of the mean will be 68% of the individual observations. If we look at the area under the curve between $\pm$ two standard deviations it will contain 95% of the observations, and 99% will be included in $\pm$ three standard deviations of the mean.

The figure depicts the distributions for two separate herds with a five day difference in days to 230 pounds. The standard deviation for this trait is about 12 days, meaning that 68% of the pigs in the herd are within 158-182 or 143-177 days for the two herds.

From the Figure it should be clear that two populations with different means still overlap substantially due to the variation. Even after a seedstock supplier is identified with a high mean genetic potential, it is still important to choose the best animals from among that population.

Usually the seedstock supplier will not offer the poorest animals for sale. The graphs should illustrate that the highest performing animals are worth more for two reasons. First, because they offer potential for greatest performance, and second, because of the low frequency with which they occur.

Days to 230 pounds