FROM TEXTBOOK TO TEST PEN

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Within practical limits the knowledge necessary to develop a sound swine breeding program is simple. The principles were laid out for us many years ago by Dr. J. L. Lush and refined and extended by many others. Failure or lack of maximum progress of such programs has seldom been the fault of the theory but in most cases a result of the lack of application.

It is our purpose here to review this theory and attempt to relate these principles to goals and recommended procedures developed by NSIF.

The central issue in record utilization is selection. The central concept of selection is the concept of breeding value. Records can be utilized to estimate the breeding value of potential herd replacements. Selecting on estimated breeding values can improve the effectiveness of selection. We must consider the use of records available from performance programs in the estimation of breeding values and examine their value in breeding programs.

The seedstock producer differs from the commercial operator in that he sells breeding values or genotypes while the latter sells only phenotypes. In the final analysis a breeding program of a seedstock producer will be measured by how the offspring of the stock he sells perform and not by the merit of the stock itself. However, a conflict exists. As swine breeders we must have a profit motive. We often desire to sell all the animals we can as breeding stock regardless of their estimated breeding value. Too often this is based upon their absolute records and not deviations of their records from the average of the contemporary group of which they were a part.

Performance records are relatively expensive both in terms of money and time required to obtain them. If these records can be utilized to improve the accuracy of selection without increasing the generation interval or reducing selection intensity, the swine industry will be better served. This is exactly what can be achieved by estimating breeding values from relative and individual records.

What traits should be considered in selection? Obviously these should be those traits that affect profit and loss at the commercial level, i.e., the economically important traits. Althouth the economic value of each trait may differ slightly over time and locality, in general, reproductive and maternal performance, feed conversion, rate of growth and carcass desirability are the most important traits and hold a relative importance of 10:4:2:1, respectively. Structural traits are likewise of great economical significance but at present can best be handled on an acceptable or unacceptable manner.

The second issue is the decision as to what source of information will be used in selection. Breeding values can be estimated on the basis of the individual's own performance, or that of his parents, offspring, half sibs or littermates. The decision rests primarily on the heritability of the trait in question and the relationship of the relative(s) to the individual being considered.

For a lowly heritable trait such as litter size raised or litter weaning weight the individual's record is a relatively weak predictive tool. On an equivalent basis 5 sibs, 25 half sibs, and 5 offspring provide accuracy comparable to that of the individual's own record. Hence, for these traits information on relatives should be considered in addition to that of the individual and when available should include repeated records on the individual himself.

For the moderately heritable traits such as rate of growth and feed conversion, the relative merit of the individual's record improves in comparison with that of relatives. On an equivalent basis, 8 sibs, and 6 offspring are equally predictive to the individual's own record but no number of half sibs provides this amount of information. This suggests that for growth and feed efficiency testing of animals in sib groups should be given high priority and the littermate data be used along with the pig's performance to estimate the breeding value of the animal. Theoretical calculations suggests 7 littermates to improve the accuracy of selection by 50%, 3 littermates by 30% and 2 littermates by 23%.

It is apparent that for traits of high heritability such as most carcass traits individual selection should be emphasized. This is especially true if these traits can be measured with reasonable accuracy in the live animal. For traits like backfat thickness with a heritability of approximately 50%, the individual's record is as predictive of his own genotype as information on over 100 full sibs and seven offspring. No number of half sibs can provide this equivalent amount of information.

There are several reasons why individual selection should be the preferred method of selection for moderately to highly heritable traits:

1. Individual performance is relatively cheap and simple to measure on large groups of animals.

2. It allows for minimizing the generation interval to a period of as short as one year thus maximizing the potential for genetic change per unit of time.

3. It eliminates the need for slaughtering sibs and hence provides a larger number of animals from which to choose replacements.

4. All animals tested are eligible for selection whereas with progeny testing few sires can be evaluated thus eliminating selection opportunity.

Central testing has contributed greatly to swine improvement. It has provided a "show window" for the industry and permitted the private breeder to advertise the records of his animals that were achieved under carefully controlled and unbiased conditions. The major shortcomings relate to the limited space in central stations and the high per head testing cost. Only a few highly selected animals are compared from each herd and the number of boars available for sale is far below industry demand. The non-randomness of sampling of test pigs and the small number represented from each herd limits the value of this technique for correctly assessing the relative genetic merit of different herds. Although central testing must be continued to aid in detecting superior boars and for herd comparison, more conformity between stations in testing procedure and techniques to more accurately assess station differences are needed. Participation in such programs should not be

construed as a complete testing program for a given breeder and can only supplement programs of within herd testing. In fact, on the farm testing should be a prerequisite for participation in central testing.

Intraherd selection of some replacement boars and nearly all replacement females appears to be a sound recommendation for the seedstock producer. Since selection opportunity is greater from an entire breed than from within a herd and assuming the top performing boars from the best herds can be recognized and purchased, genetic progress is almost certain to accrue at a faster rate with this approach than through closed herd systems. It is for this reason that disease control methods that permit relatively free and safe movement of seedstock or germplasm from one breeding herd to another must be developed. Maximum genetic progress in the pork industry and, in fact, the survival of the private breeder depends on such an approach.

It is evident that the true genetic merit of individual pigs are often masked by differences in level of environment that exist between herds. Performance levels achieved by superior management will not be transmitted to offspring. It has been shown by a few investigations that genetic differences between herds are small for most performance traits. The fact that animals from a given herd often shift in relative rank among pens in central stations from one test to another is additional evidence. This is to be expected since sons and grandsons of superior boars quickly find themselves in other herds thus creating a reasonably high genetic relationship among herds.

The assumption that between herd differences are mostly of an environmental nature leads us to the conclusion that the performance of an animal relative to that of the average of his contemporary herdmates is the important criterion that must comprise the basis for comparison. It follows that animals below their herdmates in performance are unlikely to render progress in superior commercial herds. It is for this reason that the sale of animals below herd average, i.e., with performance ratios of less than 100 should be discouraged and why NSIF encourages the indexing of animals tested in central stations and on the farm on the basis of contemporary deviations. Our present state of knowledge suggests that with other information the same, a boar gaining 2.10 lb/day in a herd averaging 1.80 is genetically equivalent to one gaining 2.60 in a herd averaging 2.30.

As our industry progresses it will become evident that the commercial producer will demand healthy, sound seedstock with meaningful performance information. Hence, it is a must that the seedstock industry prepare itself to meet this need.