

SHOULD WE APPLY TYPICAL SELECTION METHODS?

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The general goal of pork producers and the pork industry is to produce meat at the least possible cost. One way in which this can be approached is to consider the goal of the industry in terms of the dollars required for feed, labor and capital per pound of pork produced (table 1). In order to improve the efficiency of production, the industry can decrease the cost (feed, labor or capital) for the same amount of pork produced or increase the pounds of pork produced while keeping the costs constant. For the most part, the industry agrees on this general goal but does not agree on how to achieve this goal. I would like to discuss our thoughts on the genetic aspects, fully realizing that there are many other management type things that can be done to help produce pork at a lower cost per pound of pork, some of which are being discussed here today.

Improving Feed Efficiency

Feed is the largest expense of a hog operation, making up from 55% to 70% of the cost of producing a hog from breeding to market. Because of this, an obvious place to look for improved production efficiency would be to genetically improve the animal. Most central swine testing stations and corporate breeding companies are set up to measure feed efficiency on a small group of pigs. However, most purebred breeders do not have the facilities to obtain feed efficiency performance records and probably this information will not be available in the near future. Let's examine the experimental data and see how much feed efficiency can be improved over a five year period of time by selecting on actual feed efficiency and selecting on lean growth, that is, increased growth and decreased backfat (table 3). These studies indicate feed efficiency can be improved more effectively by selecting for increased growth and less backfat than by direct selection for feed efficiency. In fact, the improvement is 260% of that based on selection on actual feed efficiency records. Unless information to the contrary is forthcoming, it seems the best course of action is to forget measuring feed efficiency for selection and concentrate on the traits desirably correlated with feed efficiency such as growth rate and backfat. This approach also eliminates the need for facilities with small pens and the additional feeders and waterers necessary to accommodate small groups of pigs and the labor and paper work associated with measuring the pounds of feed consumed by the pigs in each pen. The selection study recently completed at Iowa also showed the improvement in feed efficiency in the individually fed boars was not found in their group-fed littermates.

Indexes and Swine Breeding

Breeding better hogs tends to be a complicated, confusing business. Consider the indexes proposed by the National Swine Improvement Federation. There are three given from which to choose for on-the-farm testing (table 4). All three include four traits: litter size born

alive, 21-day litter weight, days to 230 lb and backfat at 230 lb. Three of these four traits need to be adjusted before the selection index can be calculated (table 5). There are two other indexes given if feed efficiency information is available such as in central testing stations and another index if the central test stations do not have feed efficiency data available. Finally, there is a sow productivity index available which evaluates the sows in your herd and a sow productivity breeding value estimate which takes into consideration each of the litters the sow farrows. For you breeders who don't have (1) labor to collect all of this performance information or (2) labor, or a family member or a computer to calculate the indexes, then the selection index probably isn't for you. It just isn't practical!!! Probably using independent culling levels is better for you. That is, choosing a level of performance for both traits that is acceptable. For example, to save the best 5% of your boars to go back into your herd with equal selection pressure on growth and backfat, select the heaviest or fastest growing 1/3 of the available boars and from within that group keep the leanest 15% to obtain the best 5% of the boars for both traits (table 6). To me, it is much simpler than a selection index and almost as good. If it is used because of its simplicity, it will be much more valuable than an unused selection index. Perhaps this method of selection should be considered more fully in the future.

The Swine Industry Compared to Other Animal Industries

As we look at other livestock industries that are thought to have made substantial genetic improvement, three industries come to mind. These are (1) the dairy industry, (2) the egg-layer industry and (3) the broiler industry. The dairy industry is primarily a one-trait industry - lb. of milk. The egg-layer industry is primarily a one-trait industry - number of eggs. The broiler industry is primarily a one-trait industry - growth rate to 8 weeks. All of these industries have made substantial genetic improvement and have concentrated predominantly on 1 trait, while tempering their selections with secondary traits. The swine industry, 10-15 years ago, emphasized one trait - carcass composition - and made tremendous improvements in this trait which resulted in a great deal of pride to the industry. But we have moved away from this trait because of some undesirable side-effects of this selection. It seems to us that the trait we should be concentrating on is growth because of its desirable association with feed conversion. We need to moderate our decision on which boars to use by their backfat or their dam's maternal performance, but breeding stock producers should not consider a boar unless he grows rapidly.

As there is a lack of information on the consequences of selection for growth in swine, we need to look to other animal research to see what might happen if the swine industry should concentrate on growth. The work with mice and broilers is the most extensive, so we will summarize it (table 7). First of all, appetite increases. Because of the increased appetite, a smaller proportion of the feed is used for maintenance and therefore feed efficiency improves. Fat content of the carcass at a constant weight is unchanged or slightly improved in growth selected animals compared to unselected control animals. Also,

litter sizes tend to be larger in growth selected lines compared to the unselected lines. With all these pluses, it seems to us that the swine industry should select for growth as the best way to improve the production efficiency of the industry.

TABLE 1.

$$\text{Efficiency of Production} = \frac{\$ \text{ Feed} + \$ \text{ Labor} + \$ \text{ Capital}}{\text{lbs. Pork}}$$

TABLE 2. Results of direct selection for feed efficiency in swine.

Location	Per 100 lb. gain change/generation	Equivalent change in 5 gen.
Iowa	-1.9	300 → 290.5
Alabama	-1.1	300 → 294.5
Canada	- .9	300 → 295.5
Scotland	+ .06	300 → 300.3
Totals	- .96	300 → 295.2

TABLE 3. Results of selection for increased growth and decreased backfat on feed efficiency in swine.

Location	Per 100 lb. gain change/generation	Equivalent change in 5 gen.
Norway	- .6	300 297.0
Canada	-2.3	300 288.5
France	-3.7	300 281.5
England	-3.0	300 285.0
Nebraska	-2.7	300 286.5
Totals	-2.5	300 287.7

TABLE 4. NSIF selection indexes for on-the-farm testing programs

General:	$I = 100 + 6.6 (L-\bar{L}) + .4 (W-\bar{W}) - 1.6 (D-\bar{D}) - 65 (B-\bar{B})$
Maternal:	$I = 100 + 7.6 (L-\bar{L}) + .5 (W-\bar{W}) - 1.5 (D-\bar{D}) - 45 (B-\bar{B})$
Paternal:	$I = 100 + 5.2 (L-\bar{L}) + .3 (W-\bar{W}) - 1.8 (D-\bar{D}) - 80 (B-\bar{B})$

TABLE 5. General index.

$$I = 100 + 6.6 (L - \bar{L}) + .4 (W - \bar{W}) - 1.6 (D - \bar{D}) - 65 (B - \bar{B})$$

Where L = Litter size born alive

W = Adjusted 21-day litter weight
 - Standardize to 8-10 pigs/litter
 - Age when weighed
 - Number nursed
 9 lb/pig for less than 10 pigs - Gilt
 10 lb/pig for less than 10 pigs - Sow

D = Adjusted days to 230 lb weight when weighed.

B = Adjusted backfat at 230 lb weight when weighed

TABLE 6. Selection for growth and backfat by independent culling levels

Select	Growth	Backfat
5%	33%	15%
25%	60%	42%
50%	78%	64%

TABLE 7. Consequences of selection for growth.

- a) Increased appetite.
- b) Improved feed efficiency.
- c) Carcass fat is unchanged or slightly improved.
- d) Litter size increased.