HERD LIMITS TO THE EFFICIENCY OF PIG IMPROVEMENT PROGRAMS

D.A. Treacy

Department of Agriculture, Box 125, Bendigo, Vic. 3550

The efficiency of a pig improvement program must be judged against both the results it produces and the cost of achieving those results. The improvement program which produces the maximum rate of genetic improvement may not be the optimum approach if it incurs excessive costs. Similarly, scimping on testing costs may lead to a totally ineffective selection program. Other practical or organisational considerations within the herd may reduce the efficiency of the breed improvement. Some of the major herd limitations are discussed in this paper.

SELECTION PRESSURE AND TESTING COSTS

Eliminating unnecessary cost is a major objective of any business. Breeders, in carrying out on-farm testing programs, will try to develop a method which strikes a suitable balance between the program's cost and the amount of improvement it is likely to produce. The design and sophistication of a testing program in one herd may not be suited to all other situations. Therefore, while a thorough and extensive testing program may be justified in a nucleus or stud herd which services a large commercial sector, a more simple and limited screening method may be suited to a self-replacing commercial herd.

For the most part, pig improvement programs conducted on-farm in Australia are based on growth rate and backfat measurements. There are far fewer instances where the feed conversion ratio of individual animals is measured. The extent of testing can differ considerably between herds. In some cases little preselection takes place prior to assessing most stock for growth rate and backfat. In other herds, a high level of preselection occurs with relatively few stock tested for the both performance traits.

The effect of the level of preselection on the efficiency of the improvement program will depend on the accuracy of the preliminary selection and the savings in testing costs.

If the preselection procedure is unrelated to production traits, then the effective selection pressure will decline with the number of pigs tested. The cost in terms of loss of genetic improvement can only be gauged from the theoretical rates of gain expected to correspond with various selection intensities. Relative rates of gain corresponding to different selection intensities are given in Table 1. The values are expressed relative to a standard of 100 points achieved with a selection intensity of 1 in 30 (3%) for boars and 1 in 5 (20%) for gilts.

TABLE 1: Effect of Selection Intensity on Relative Rates of Genetic Gain. The Relative Number of Pigs Tested, Assuming a Ratio of Five Gilts to Each Boar is Selected, is Given in Brackets.

SELECTION INTENSITY				
BOARS	GILTS			
	1 in 5 (20%)	1 in 3 (30%)	1 in 2 (50%)	1 in 1 (100%)
1 in 30 (3%)	100 (55)	92 (45)	83 (40)	61 (30)
1 in 10 (10%)	88 (35)	79 (25)	71 (20)	49 (10)
1 in 5 (20%)	78 (30)	69 (20)	61 (15)	39 (5)
1 in 2 (50%)			44 (12)	22 (2)

Values in Table 1 are theoretical expectations. In practice the effective selection pressure will be less than these expectations because of the need to disqualify some stock which do not reach minimum physical standards because of leg or feet weakness, insufficient teats, and so on. Care is needed to ensure that selection pressure is not wasted on factors of no commercial importance.

The selection intensity of 3% for boars may be an unrealistic target for some breeders. Nevertheless, it is achieved in some specialist breeding herds. In fact it would be very difficult to achieve this target in small herds where there are insufficient contempories in production at any one time. Batch farrowing would partly remove this limitation of herd size, though this practice does not make the best use of farrowing facilities.

Labour costs of a testing program will be determined both by the labour requirements demanded by the testing facilities, as well as by the number of stock tested. There would be no job more frustrating, I am sure, than performance testing pigs in facilities that encourage them to move in all directions other than what is required. Poor testing facilities are a major limitation to the testing programs in some herds.

A system of quickly working out an animal's age is essential. It is worth noting that recording an animal's birth date as the week rather than the day of birth makes little difference to the accuracy of selection. The estimated loss in accuracy based on the records of three Victorian piggeries was 0.7%, 1.1%, and 0.8%, or about 1% on average. Tattooing or ear-notching each animal with its week of birth may be preferable for breeders who find referring to record cards a chore.

Few pig units in Australia measure feed conversion ratio. Breeders in Queensland have access to a central testing facility where the thorough evaluation of stock includes an assessment of feed efficiency. On-farm testing programs without individual feeding facilities rely on the use of a selection index that makes some allowance for the correlation of growth rate and backfat with feed conversion ratio. The loss in the accuracy of selection and rate of genetic gain by not measuring feed conversion ratio directly is estimated to be approximately 20%. This figure is based on records of individual feed pigs. The figure should apply fairly well to pigs group-fed to appetite, though the value in measuring feed efficiency will be less when commercial stock are fed restrictively. The estimate would be reduced further where bullies are a problem.

Some breeders do combine the measurement of production traits, including feed conversion ratio, with a high selection intensity. While it would be folly to suggest all on-farm testing programs should be of this standard, producers are well advised to be aware of what others are doing and the probable consequences of their work.

HERD STRUCTURE AND SIZE

Important features of a genetic improvement program may conflict with the needs of a commercial breeding operation. The obvious example involves the replacement of breeding stock. The maximum rate of genetic improvement occurs when boars are replaced after six months use and sows after two litters (Treacy and Jones, 1980), yet few breeders would be willing to sell breeding stock for slaughter after such limited use. This inefficient use of breeding stock is easily avoided in a nucleus breeding system by using these older breeding stock in multiplier or commercial units. A similar practice is used in a number of commercial piggeries in Victoria where the testing and selection of stock is limited to those pigs born to young sows. The decision to sell breeding stock for slaughter is then based on commercial rather than genetic considerations. In small herds it may be difficult to avoid the conflict between immediate commercial requirements and the needs of a genetic improvement program. In these herds depressed performance due to inbreeding may arise if dividing the herd into a nucleus and commercial units leave less than ten different boars per year being used in the nucleus. In this situation the breeder must decide whether he should carry the cost of the genetic improvement program, or accept a lower rate of gain, or operate solely as a commercial unit. If the last option is chosen, the producer could then rely on the work done by another breeder(s) for his genetic improvement.

Consideration of inbreeding can have an important impact on a breeding program. Inbreeding affects production mainly by depressing reproductive performance. In a closed herd the main factors affecting the rate of inbreeding are the number of boars used each generation and the extent that these boars contribute equally to the number of boars used in subsequent generations. The need to minimise inbreeding by using more boars than may be required for matings or by avoiding selection between the progeny groups of different boars can limit the efficiency of an improvement program. Inbreeding can be reduced by occasionally obtaining boars from another herd. The problem is knowing how good other herds are.

HERD HEALTH AND EVALUATION

Herd limits to pig improvement programs have been discussed so far with reference to the within-herd selection of stock. Pig improvement programs based on performance testing have been conducted for a number of years now. Considerable genetic differences between herds could have arisen in this time. If this is so, then there would be an opportunity to rapidly upgrade the least productive herds. Effective selection between herds is limited by the health risks (both perceived and actual) associated with the transfer of stock between herds and by the lack of comparative and up-to-date figures on the merit of alternative sources of stock. These factors are major limitations to pig improvement programs in this country. There would be a considerable cost involved in obtaining reliable estimates of genetic differences between herds.

CROSSBREEDING

Crossbreeding experiments and industry data have shown conclusively that the reproductive performance of crossbred sows is superior to that of pure bred sows. A review of the genetic and practical aspect of crossbreeding was provided by Hill (1981) at the Second Conference of AAABG. The major benefits of crossbreeding rely on the use of crossbred (particularly first-cross) sows. Most of our production systems do not lend themselves to the production of first-cross gilts. Many of our large commercial herds maintain a mix of breeds as a synthetic breed. The extra productivity through crossbreeding (i.e. heterosis) is expected to be less in the synthetic breed of sow than the first-cross sow. However, alternatives to the system of mixing breeds would be impractical in many cases.

REFERENCES

HILL, W.G. (1981). *Proc. Aust. Assoc. Anim. Breed. and Genetics.* 2: 134-138.

TREACY, D.A. and JONES, L.P. (1980). *Livest. Prod. Sci.* 7: 135-145.