Breeding better pigs

B M. Goss
IN the past, pig breeders have tended to select animals on physical characteristics, many of which have little or no relevance to economy of production. Selection techniques now available open up the possibility of improved pig production efficiency.

Because quarantine regulations preclude the importation of pigs or pig semen into Australia, the national herd is in fact a closed one. However, the main breeds probably carry the desirable genes for efficient production but they need to be identified and exploited.

Breeds

Of the three major breeds in Western Australia the Berkshire's hardiness and adaptability has been turned to good account under the extensive scavenger system which has been the predominant pig keeping method in the past. The white breeds, Large White and Landrace, are better suited to the more intensive conditions of management and are likely to increase in numbers in the future.

All three breeds have desirable characteristics that can best be combined in a three way crossing programme.

Genetic variability

It is not necessary to possess a profound knowledge of genetics to start a sound pig improvement programme. Two basic principles are used to advantage, firstly, that some animals grow more efficiently than others and, secondly, that like begets like.

If the herd performance can be measured and the superior animals bred from, then subsequent generations will have the potential to produce pigmeat more economically than their parents.

Genetic traits vary in their degree of heritability, and consequently it is important to limit selection to those factors which have the best chance of generating worthwhile gains. Although heritability estimates vary with different strains of pigs and with environmental differences, average figures for the more economically important factors are:

<table>
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<tr>
<th>Trait</th>
<th>Heritability</th>
<th>Measure of Performance</th>
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<tbody>
<tr>
<td>Fecundity</td>
<td>Low 15%</td>
<td>Number of pigs per sow reared annually</td>
</tr>
<tr>
<td>Economy of gain</td>
<td>Medium 30%</td>
<td>Feed per lb live-weight gain</td>
</tr>
<tr>
<td>Carcass quality</td>
<td>High 50%</td>
<td>High ratio of lean meat to fat</td>
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Because litter performance is affected by management much more than by breeding, little progress can be anticipated by direct selection and the use of cross breeding is a more promising method of producing better results from the breeding herd.

Growth rate and feed conversion ratio, on the other hand, are sufficiently heritable to make selection for them rewarding, while carcass characteristics are highly heritable and respond well to selection.

Effectiveness of selection

The potential improvement that can be made will be determined by the number of animals and the variability of performance within the herd. A large breeding
unit with some very good and some very bad animals would be better placed in this respect than a small herd with an even performance, but any breeder of pigs should derive some benefit from the progressive selection of his breeding stock.

The effectiveness of any programme will depend also on how accurately performance is measured and the speed with which generations are replaced. In both cases economic considerations of labour cost and the value of culled breeding animals usually puts some brake on progress.

Variability of performance determines the standards set for the selection of the next generation and where performance is fixed in a narrow band around a mediocre average, it may pay to look outside the herd for animals which are superior for those traits which are deficient within the herd.

However, it should always be borne in mind that an outstanding performance under a given management is no guarantee of success in different conditions and it usually pays to choose animals from an environment as similar as possible to that in which they will live.

Selection programme

It is important to set high standards when selecting a boar, whose influence for good or bad will be 15 or more times as great as each female.

In any pig improvement programme the animals must measure up to certain minimum physical standards.

They should be free of genetic defects, such as hernias, possess 12 functional teats, and be in good health. Moreover, they should be sound in the legs and well developed for their age, so they are fit for the stress of a productive life. To ignore these physical needs could be expensive in the long run.

Without specialised accommodation it is difficult to record feed intake, but the feed conversion rate is associated with rate of gain and with leanness in the carcass. Thus the selection of the fastest growing pigs will tend to reduce the feed required, provided the animals selected have lean carcasses and do not lay down excess fat.

Cross breeding

Controlled crossing has brought great rewards to the maize grower and to the poultry industry. The benefits of crossing to pig production were demonstrated in the 1930s, and it is now widely practised. For characteristics which are weakly inherited, crossing between breeds is more effective than direct selection.
The average figures below are from a recent survey involving 34,000 litters in the U.K. and show the improvement that may be obtained by crossing:

<table>
<thead>
<tr>
<th>Trait</th>
<th>% improvement over purebred</th>
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<tbody>
<tr>
<td></td>
<td>Crossbred Litter</td>
</tr>
<tr>
<td>Number born alive</td>
<td>2</td>
</tr>
<tr>
<td>Number alive at 8 weeks</td>
<td>5</td>
</tr>
<tr>
<td>Litter weight at 8 weeks</td>
<td>10</td>
</tr>
</tbody>
</table>

Crossbred pigs on average are more vigorous and have a better survival and growth rate up to weaning, while crossbred sows tend to produce more live pigs and will milk better. Hybrid vigour therefore benefits mainly pre-weaning performance, although there is some gain in post-weaning growth as well.

**Recording**

Recording generally is not popular with farmers, but is essential if worthwhile genetic progress is to be made.

A record card should be kept for each sow, showing details of pigs born and weaned, and performance of the litter up to market weight. From this information unproductive sows can be quickly culled, and the fastest-growing pigs selected for replacements.

**Future developments**

In the past, National Pig Improvement Programmes have concentrated on central progeny testing. In theory the accuracy and environmental control of this method of selection should have produced genetic improvement, but success depends on a degree of breeder participation and discipline which has to date only existed in Denmark; results elsewhere have been disappointing. Recently, attention has turned to on-the-farm performance testing where selection is made on the basis of an index incorporating speed of growth and carcass quality. Schemes of this type are now operating in a number of countries.

Artificial insemination (A.I.) in pigs suffered from teething troubles, but is now producing good results on a commercial scale. Its obvious advantage is that, where superior tested stock are available, several hundred sows can be inseminated by each boar. However, to be financially viable A.I. requires a large pig population in a small geographical area, and for this reason it is unlikely to be a commercial proposition under Australian conditions in the foreseeable future.
A.I. could, however, be a feasible method of introducing fresh blood into minimal disease herds if done under proper veterinary control, or as an adjunct to a boar performance testing station.

Exploiting the individual merits of a number of breeds by controlled inbreeding and then crossing, is under investigation at a number of centres. This type of project is both expensive and long term, but if a high performance repeatable hybrid pig could be evolved, then this could produce a transformation in the pig industry similar to that which has occurred in the poultry industry.

The increasing complexity and scale of pig improvement programmes has led to the growth of group breeding projects in the U.S.A. and the U.K. along the lines of that illustrated in the diagram. Possibly these projects could have an application in Australia if a number of breeders decided to "pool" their genetic material and test facilities to their mutual advantage, each concentrating on improving one pure breed, and marketing the end product as a crossbred gilt.

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