Across-Herd Genetic Evaluations

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Seedstock producers want to be able to compare animals from different herds because:

1. Other breeders may have some seedstock that is genetically superior to theirs for important economic traits,
2. Having a number of herds to pick from increases the chance of finding an exceptional animal, instead of just evaluating animals within herd, and
3. It gives breeders an opportunity to evaluate their own breeding program by comparing their animals to those of other breeders.

Commercial producers would like across-herd genetic evaluations to be done so they can source the best genetics available to improve the profitability of their operations.

Currently in Australia, there are two main ways to compare animals from different herds. The first is to buy animals or semen from other breeders and test their progeny on-farm against "home-bred" animals. The second is to enter animals in a central testing facility, such as WACOL, SABOR or TOCAL. Both of these methods can be subject to sampling problems or, in other words, chance, that can affect the accuracy of the genetic evaluation. Figure 1 illustrates this point.

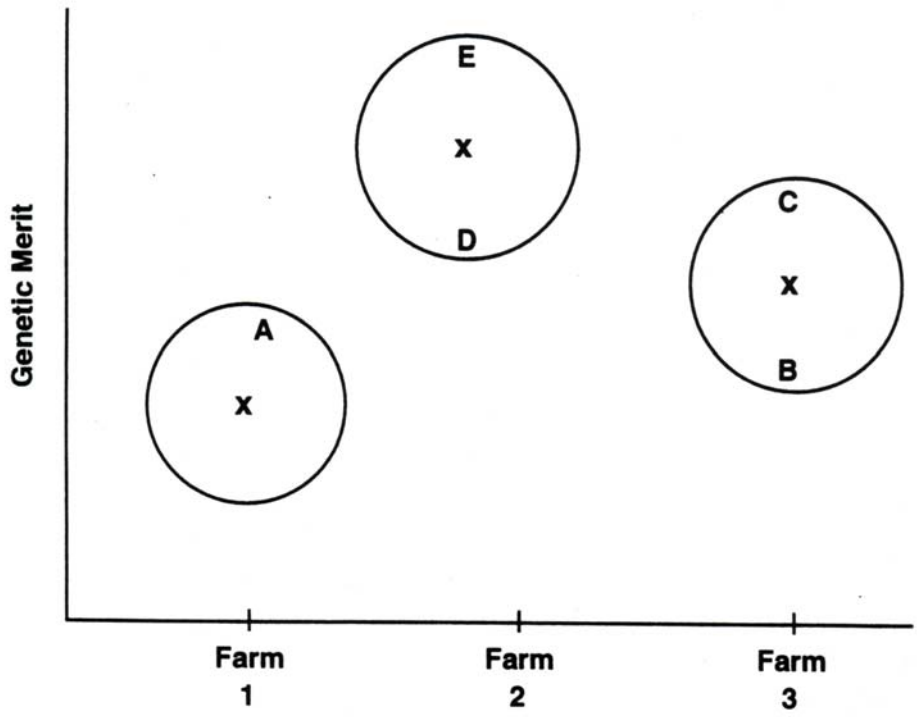

Figure 1

Shown are three farms. X denotes the true average genetic merit for each of the three farms and 5 boars (A-E) are also shown with their true genetic merit. On average Farm 2 has the highest genetic merit, followed by Farm 3 and Farm 1. E is the best of the five boars shown here. D is from the best herd but slightly inferior to C from Farm 3. A is from the poorest herd but is slightly superior to B. If another breeder bought C and D, or semen from them, to make an on-farm comparison he/she might come to the wrong conclusion that, on average. Farm 3 had better stock than Farm 2. A similar situation could arise from choosing A and B to make comparisons between Farms 1 and 3. Often breeders will only mate one or two sows to semen from an outside boar and will evaluate that seedstock source on the performance of the 1-2 litters produced.

Similarly, if these 5 boars were entered into a central test in different intakes there is the chance they will rank differently than they should given their true genetic merit. If A were being tested with some very poor boars while C & D were being tested in another intake with exceptional boars we might get a wrong impression of the relative genetic merits of Farms 1, 2 and 3 based on those 3 boars. This also ignores the different environments/management of the 3 farms, where farm 3 might have better overall performance than 2 due to management but have inferior breeding stock.

These are extreme examples, but many breeders have small herds (within a single breed) and are unable or unwilling to commit a large number of matings to evaluate outside seedstock sources. Also, central testing has limited capacity and can be costly so many breeders do not want to enter the number of boars into the central test that would be needed for valid across-herd comparisons.

A solution to these problems would be to couple on-farm and central testing information together in a single evaluation using BLUP technology. This procedure uses information from relatives and can account for the different management/environments on the different farms participating in the across-herd evaluation. By using BLUP, genetic comparisons could be made between animals on different farms, in central test stations and in AI centres. This is the way the Australian Pig Industry is moving, but to facilitate this type of across-herd comparison, several things need to be addressed.

1. Better genetic linkages between herds participating in the across-herd analysis. Figure 2 illustrates the structure that is required. Farms 1, 2 and 3 are using semen from reference sires in the AI centre. These sires were selected by central testing. Note that Farms 1 and 2 are central testing, and Farm 3 is not. However, Farm 3 is still able to participate in the across-herd analysis because they have used AI and established appropriate genetic links. AI usage is low in Australia relative to European or North American countries and should increase, especially among smaller breeders, to establish the genetic links needed to facilitate a BLUP across-herd genetic evaluation. The Western Australia pig industry did a pilot sire reference scheme in 1987 to assess the possibility of linking pig herds through AI and demonstrated how this could be done (M.J. Carrick, personal communication). The Queensland DPI is currently doing a pilot study to better assess the amount of genetic linkage required between herds for a BLUP analysis to be undertaken properly, and it is anticipated this will be between 10-20% of matings. In the longer term, reference sires could be drawn from on-farm boars that had done well in the across-herd evaluation. This does not mean that central testing will no longer be needed as it does provide the opportunity to measure traits too costly to measure on-farm (feed efficiency, for example).

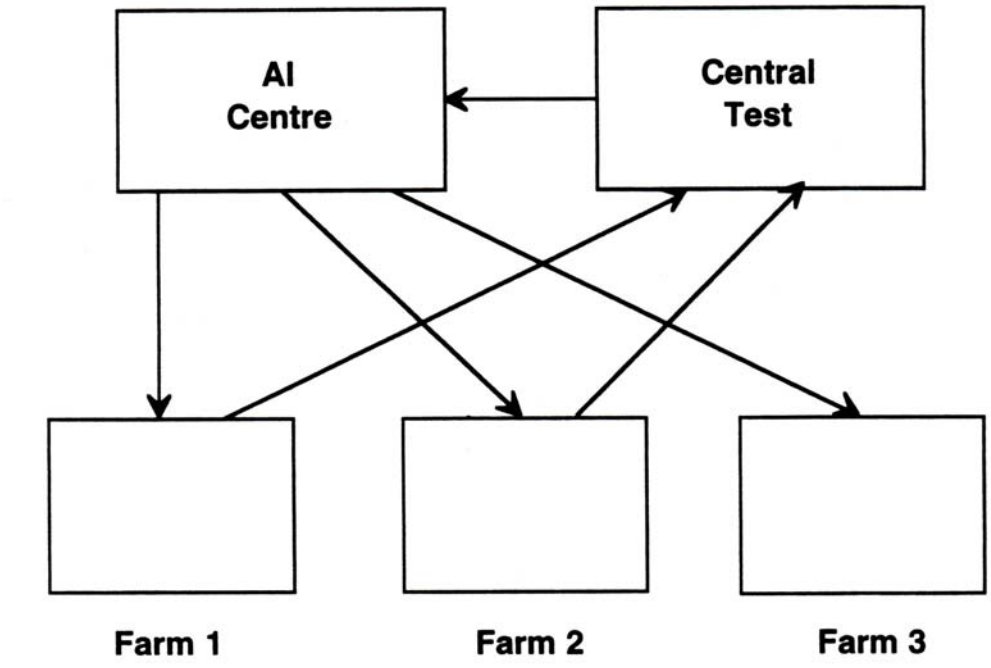

Figure 2

2. Coordination between AI centres and participating breeders as to uniform identification of reference sires. In the across-herd analysis it is critical that all sires have the same identification in herds where they are producing progeny.

3. Determination of who will run the across-herd analysis. Since some breeders will obtain better results than others in the analysis, they will obtain a commercial advantage from that. A "neutral" organisation will need to assemble the data and do the across-herd runs to ensure the objectivity of the evaluations.

4. Coordination between participating breeders as to on-farm testing practices. These should be as uniform as possible. Also breeders would need to be testing the majority of pigs produced on-farm.

5. Participating breeders having their records on computer to facilitate the transfer of data to the organisation performing the across-herd evaluation.

6. To be able to use central test station data in the across herd analysis, there also needs to be good genetic linkages between the central test station and participating herds. To optimise this, sons of AI reference sires should be entered into the central test station.

An across-herd genetic evaluation using BLUP technology is the best method currently available for identifying genetically superior animals from the Industry perspective.

This method is currently being used routinely in Australia by the beef industry in their GROUP BREEDPLAN program and by pig industries in other countries. All of the above items are possible, as they have been implemented in pig industries in other countries successfully.

To implement this in the Australian Pig Industry will require coordination between breeders, AI centres and central test stations and it will probably take 1-3 years to establish this coordination, linkages, computerisation, etc. Although there will be breeders and breeding organisations who will not participate in this type of genetic evaluation for a number of reasons (financial, confidentiality, etc.), those who do will have immense potential for enhancing the rate of genetic improvement both in their herds and for the industry as a whole.

NOTES