1997

BLUP for Merino breeding

David Windsor
david.windsor@agric.wa.gov.au

Johan Greeff

Follow this and additional works at: http://researchlibrary.agric.wa.gov.au/journal_agriculture4

Part of the Sheep and Goat Science Commons

Recommended Citation

Windsor, David and Greeff, Johan (1997) "BLUP for Merino breeding," Journal of the Department of Agriculture, Western Australia, Series 4:
Vol. 38: No. 2, Article 5.
Available at: http://researchlibrary.agric.wa.gov.au/journal_agriculture4/vol38/iss2/5

This article is brought to you for free and open access by Research Library. It has been accepted for inclusion in Journal of the Department of Agriculture, Western Australia, Series 4 by an authorized administrator of Research Library. For more information, please contact jennifer.heathcote@agric.wa.gov.au, sandra.papenfus@agric.wa.gov.au.
BLUP for Merino breeding

How do you judge the success of a Merino breeding program? Until now the rate of genetic improvement in individual flocks and the wool industry as a whole have both been notoriously hard to measure. Seasonal differences make it very difficult to tell whether the year to year changes in a flock's fleece weight, fibre diameter, liveweight or style are the result of genetic change, climate or management. Long-term data are required to pick up consistent trends in your flock.

All this is changing with new genetic technology, Best Linear Unbiased Prediction (BLUP) is currently being used by a limited number of Western Australian ram breeders with the assistance of officers from Agriculture Western Australia's Wool Program.

The technology will soon be more widely available as the RAMPOWER '96 computer system is introduced by fleece testing laboratories. BLUP gives breeders the unique ability to monitor genetic change in their flocks from year to year performance (Figure 1).

BLUP can help breeders to achieve their breeding objectives in two significant ways. The first is by providing more accurate breeding values (EBVs) than any other genetic evaluation system. BLUP EBVs incorporate information about an animal’s own performance, the performance of its relatives and any known environmental influences. This helps breeders to make better informed decisions when selecting elite animals to use in their breeding programs.

BLUP's second great advantage is its ability to distinguish between genetic and environmental influences on animal performance. We can finally tell the difference between the effects of breeding and feeding. Breeders can directly measure the effects of their breeding decisions on the genetic merit of their flocks and monitor progress toward achieving their breeding goals.

Group breeding scheme

Merinotech is a group breeding scheme based in the woolbelt shires of Kojonup, Boyup Brook and Tambellup. Genetic gains generated in the Merinotech Central Nucleus are passed on to five ram multiplier and 60 commercial flocks. The group's breeding objective is to increase clean wool weight, reduce fibre diameter, increase staple strength and maintain live weight.
Merinotech nucleus manager Ian Robertson faced a number of challenges in pursuing this objective. The first was identifying the right sheep to satisfy Merinotech’s goals. Another was how to monitor progress in the flock to see whether the program’s goals were being achieved.

Ian has an impressive collection of data (from a full 12 months wool growth) for the hogget animals measured and visually classed each year, but simply comparing these from year to year is not enough. Hogget fleece weight and fibre diameter go up and down with good and bad seasons. Merinotech sheep are selected under local commercial management, which has seen stocking rates increase in recent years. This has also put downward pressure on both the fibre diameter and fleece weight of the breeding flock.

**Separating genes from environment**

Luckily, one of BLUP’s strengths is its ability to separate the genetic and environmental changes taking place in the flock (see Figure 1). The phenotypic trends in the hogget data collected each year suggest at first glance that fleece weight and fibre diameter are being slowly reduced in the Merinotech flock.

This is largely due to environmental effects, including increased stocking rate and recent poor seasons. These environmental effects are much larger (for example, a nearly 2 micron difference in fibre diameter between 1989 and 1990 born sheep) than the small genetic changes occurring each year.

Once the environmental effects are removed it can be seen that genetic fleece weight is steadily increasing in the Merinotech flock while fibre diameter is following a downward trend (Figure 1). “With these genetic trends, we know where we’re going and can fine-tune our program to get the results we want,” says Merinotech Chairman Rob Young.

All successful breeding programs start with a well defined **breeding objective**. This is essentially a plan which outlines the type and size of genetic changes which the breeder aims to achieve in the flock. A sound breeding objective will normally include all the traits which are important to the breeder, and will indicate which traits are the most important to change.

BLUP genetic trends can be used to monitor how closely the results of a breeding program coincide with the breeding objective.

The Sandilands family of Billandri stud, Kendenup, have long been proponents of objective measurement in sheep breeding. Since the introduction of Woolplan in the late 1980s their breeding objective has been to increase clean fleece weight while reducing fibre diameter and maintaining liveweight.

Bill, Kay and Geoff Sandilands’ involvement with Agriculture Western Australia’s research during the 1990s has led them to add increasing staple strength (through reducing CV of fibre diameter) and improved internal parasite resistance to their breeding objective. Like Merinotech, they collect full sire and dam pedigrees, birth date and twinning data from their stud flock to maximise the accuracy of their selections.

During the 1980s, Bill monitored his flock’s progress by keeping a five year rolling average of production figures for his stud sheep. This provided a guide, but was influenced by good and bad seasons, and would be thrown
Neil and Jane Campbell, who manage the Darkan Ram Breeding Cooperative are making good genetic progress, breeding more profitable sheep.

into confusion by any major changes to flock structure or lambing or shearing times. BLUP now gives Bill and Geoff a direct measure of genetic change in the flock which is unaffected by season or management.

The Sandilands can use their BLUP trends to compare the rate of genetic progress their flock is making with the results that were predicted for their selection index at the beginning of the program (Figure 2).

The genetic changes happening at Billandri are close to the theoretical predictions for all four traits shown. This gives Bill and Geoff confidence that measurement and visual selection are combining successfully to give them the results that they want. "The best thing about BLUP is knowing where you're going without having to worry about the effects of changing seasons, stocking rate or lambing time," says Bill.

Darkan breeding results

Neil Campbell manages the breeding nucleus of the Darkan Ram Breeding Co-operative (RBC). The RBC mates 1800 ewes to 34 progeny tested rams each year. Of the 750 performance tested hogget rams available each year, the best 200 are selected visually and the highest performing 13 of these enter the progeny testing program.

Darkan RBC's breeding objective is to prevent any increase in fibre diameter while maximising gain in clean fleeces weight. Five years into the program, Neil's BLUP analysis showed that hogget fibre diameter had decreased by about half a micron and clean fleeces weight increased by about 200 grams per head.

What do these kind of changes mean for Darkan RBC's contributors and ram buyers? The cooperative distributes 300 rams annually at $165 per head. Total matings to the group's rams are about 40,000 ewes per year.

Agriculture Western Australia Wool Program Geneticist Johan Greeff has modelled the flow of superior genes from the ram
breeding flock to the commercial ewe base. He estimates that even after subtracting the cost of setting up the program and discounting the value of future returns, these genetic gains will be worth up to a million dollars to the RBC's members over the next 20 years (Figure 3). The small annual gains from genetic improvement have enormous value when multiplied across a large commercial ewe base.

**Flock comparisons**

BLUP’s power to assist in ram selection does not stop at the farm gate. As well as identifying the best sires within your flock, BLUP will accurately compare their performance to rams born in other flocks. Neil Campbell, for example, uses link matings and BLUP analysis to compare all his flock’s rams with all of those born at another Darkan-based RBC, Boolading Blue, and to provide links to sire evaluation schemes.

Boolading Blue RBC manager Max Ewen has taken this process a step further by entering rams in the YARDSTICK sire evaluation (Figure 4). The links between sites and across years mean that Boolading Blue are now able to use BLUP technology to compare the performance of their rams with those entered in sire evaluations across Australia. This helps the group select ‘guest rams’ for their on-farm progeny testing program. Boolading Blue progeny test 30 to 40 rams a year in pursuit of their goal to maximise gain in fleece weight without increasing fibre diameter. As Max puts it, “Making money from sheep is all about turning grass into wool”.

Keeping the best rams for more than one mating to create links across years means that each year’s ram drop can be compared genetically to rams born in previous years. “It’s great to see that our best ram (Boolading 373) ever of a few years ago in terms of fleece weight looks pretty ordinary compared with our best young rams now,” says Max (Figure 4).

BLUP gives Merino breeders the opportunity to increase the efficiency of their breeding programs through better sire selection and flock monitoring. For the first time, breeders are able to use all the genetic and environmental information they collect for their stock, and to directly monitor genetic changes within their flocks. Widespread adoption of this technology would represent a major step forward for the Western Australian wool industry.

---

**Figure 3.** The genetics of profit.

**Figure 4.** How do your rams compare?

---

David Windsor and Johan Greeff, Animal R&D Services, Great Southern Agricultural Research Institute, can be contacted on (08) 9821 1755.