COMPARISON OF SELECTION INDICES

B.C.RUSSELL and E.M.ROBERTS

Department of Wool and Animal Science,
University of New South Wales,
P.O. Box 1, Kensington NSW 2033, Australia.

SUMMARY

Five selection indices were compared to examine the effects on the rankings of a group of sires. It was found that there were substantial differences in ranking between the indices. These differences were due to the relative weightings given to fibre diameter and clean fleece weight.

INTRODUCTION.

Selection indices are commonly utilised in sheep breeding programs. The development of Woolplan has allowed breeders to routinely utilise selection index theory.

Woolplan offers four separate options to breeders, representing a range of different breeding objectives. The specific details of these objectives are described by Ponzoni (1987). For breeders who find that none of these these options are suitable, Woolplan also allows breeders to specify their own economic weights for traits in the breeding objective. As breeding objectives are likely to vary between breeders, a range of different selection indices have been developed by various organisations and people within the industry in an effort to cater for these differences.

Therefore the breeder must make a choice between a range of available indices in order to achieve his breeding objectives. This paper presents a number of different recommended indices and uses them to evaluate a group of sires.

METHOD

Five selection indices were applied to fourteen rams from the University of New South Wales sire evaluation program, conducted at Hay, N.S.W. A single trait Best Linear Unbiased Prediction (BLUP) analysis was used to calculate estimated breeding values for the sires using data from the hogget shearing of their progeny. The BLUP was done using Harveys LSMLMW program (Harvey, 1987) The progeny were run as a single management group, and the dams were all of the same bloodline. The resulting EBV's were then multiplied by the appropriate economic weightings to produce an index score, as described by Walkley and Brien, (1988).

The five indices used had varying economic weights, and were chosen to represent a range of R values. The R value is the ratio of clean wool price ($/kg) to micron premium ($/kg/micron) (Cottle, 1990). The R value is effectively the weighting given to both clean fleece weight and fibre diameter, with a high R value indicating an index with a high emphasis on increasing fleece weight, and a low R value indicating an index with an emphasis on reducing fibre diameter.

The indices used, and their economic values are summarised below:

Table 1 Economic values and the ratio between wool price and micron premium (R) for the five indices, adjusted to a standard value for clean fleece weight.

Index	CFW	FD	HWt	R
Woolplan1	49.67	-9.12	0.72	20
Trangie 5	49.67	-3.04	0.38	59
Merinotech	49.67	-26.01	-0.26	8
Aust.Merino.Soc.	49.67	-9.18	0.05	20
N.Z.Fine merino	49.67	-17.99		11

Woolplan 1 is aimed at simultaneous improvement of all major economic traits (ie: clean fleece weight, fibre diameter, and body weight) while the Trangie 5 option is designed to maintain fibre diameter while increasing clean fleece weight (Atkins pers. comm).

The Merinotech values gives a greater weighting to fibre diameter, and have an effect of reducing fibre diameter and maintaining clean fleece weight while holding body weight and number of lambs weaned constant (Carrick pers. comm.).

The Australian merino society weightings were developed in 1989 to provide economic values for their members to apply to estimated breeding values, providing a link with Woolplan.

The New Zealand fine merino index was developed at the Lincoln University wool measurement service (Nicol and Cottle 1990) and was predicted to reduce fibre diameter and slightly reduce fleece weight.

RESULTS

Table 2. Estimated breeding values and index ranks of sires for 5 separate indices.

Sire	Breeding Values			Index Scores				
	CFW	FD	HWt	WP1	T5	MT	AMS	FM
1	0.58	-0.20	-0.82	1	1	2	1	1
2	-0.12	0.34	-0.02	12	10	11	10	11
3	0.10	1.02	-2.46	11	8	12	7	12
4	-0.18	0.70	6.44	13	12	13	13	13
5	-0.42	-1.96	-1.28	10	14	1	14	2
6	-0.20	-1.28	-1.30	7	11	3	11	4
7	0.08	0.06	3.16	4	5	8	5	7
8	0.16	0.12	-1.72	5	4	6	4	6
9	0.14	-0.44	0.88	2	3	4	3	3
10	0.22	0.24	-0.48	3	2	7	2	5
11	0.06	0.34	0.20	8	6	10	6	10
12	-0.14	-0.54	-1.22	9	9	5	9	8
13	-0.08	1.62	-2.64	14	13	14	12	14
14	0.01	-0.06	1.28	6	7	9	8	9

NB; WP1 = Woolplan option 1
   T5 = Trangie option 5
   MT = Merinotech
   AMS = Australian Merino Society
   FM = New Zealand Fine Merino

DISCUSSION

When choosing between indices, it becomes clear that it is important for the breeder to know his breeding objectives, and then select the appropriate index to achieve those objectives.

The indices used here produce different rankings on the same group of sires, depending on the relative emphasis placed on fibre diameter and clean fleece weight. For example sire 5 is ranked last by both Trangie and AMS indices, tenth by Woolplan, but first and second by Merinotech and N.Z Finewool respectively. Therefore a breeder using the Merinotech index is likely to select this sire, while a breeder using the Trangie or AMS index would be likely to cull him. Sire 5 has the highest negative EBV for fibre diameter, and the lowest EBV for clean fleece weight, which confirms that the indices that rank this sire highly, do so on the basis of fibre diameter, and that the sires EBV for clean fleece weight has little bearing on his ranking.

Cottle (1990) found that a Woolplan index produced a different ranking of rams than the N.Z Fine merino index of Nicoll and Cottle (1990), with that result being repeated here. Four of the top eight rams ranked on Woolplan 1 and five of the top eight ranked on Trangie 5 had higher than average fibre diameters while in the Merinotech index, only two of the top eight rams were of above average fineness, While the N.Z finewool index had only three.

Other discrepancies between indices should be noted. The highest ranked ram for Trangie 5 was sire 1, as he was for three other indices. However, the second ranked ram for the Trangie option was sire 10, who was ranked seventh and fifth by Merinotech and N.Z fine merino respectively. Sire 6 was ranked third and fourth by Merinotech and N.Z fine merino, but eleventh by Trangie 5 and A.M.S and seventh by Woolplan 1.

The Merinotech index ranks the finest sires highest, with clean fleece weight having a reduced effect on the merit of each sire. This is evidenced by the fact that sire 5 was ranked highest by the Merinotech index despite having the lowest clean wool weight of any of the tested sires. Selection using this index places most emphasis on fibre diameter with clean fleece weight and hogget weight having a minimal effect. Sire 1 was ranked second by the Merinotech index despite being ranked fifth in fibre diameter, however this sire had an exceptionally high fleece weight and still managed to have a lower than average diameter.

It can be seen that the ranking of sires on index score is greatly dependent on the ratio between the clean wool price and the micron premimum assumed in the economic values. Ponzoni (1987) showed that using three different sets of economic values (Woolplan, Jones, 1982 and Ponzoni, 1986), the same individuals would be selected. It must be noted however, that although the economic values for clean wool weight and fibre diameter were different in the three indices, the R values were very similar (32.5, 30.0 and 25.5 respectively). It is not the actual economic values that determine the ranking of sires, but the ratio between the values.

The choice of index will therefore largely decide which sires will have the greatest influence on the genetic makeup of the flock. The indices presented here represent a range of breeding objectives. If an inappropriate index is chosen, the wrong sires may be selected, and the breeding objectives may not be realised. Showing the effects of the different indices on the relative rank of sires may make it easier for the breeder to choose a selection index that satisfies his breeding objectives.

REFERENCES

Cottle, D. (1990) - AJAR 41:769

Harvey, W.R. (1988) - Users Guide to LSMLMW PC-1 Version

Jones, L.P. (1982) - In Future Developments in the Genetic Improvement of Animals (Eds. J.S.F. Barker, K. Hammond and A.E. McClintock, 119 (Academic Press, Australia).

Nicol, J.J. and Cottle, D. (1990) - AAABG 8 - 249
Ponzoni, R. (1986), J. Anim. Breed. Genet. 103:342

Ponzoni, R. (1987) - In Merino Improvement Programs in Australia - p.25 (Aust. Wool Corp.)

Walkley, J. and Brien, F (1988) Ram Breeders Guide to Wool Plan (South Aust. Dept.).