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STUDIES OF INDICES USED BY THE AUSTRALIAN MERINO SOCIETY IN RAM SELECTION:

I. A LINEAR APPROXIMATION

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INTRODUCTION

The Australian Merino Society (AMS) has been using indices as an aid in ram selection for some time (Shepherd 1976). One of those indices (I_1) has been described by Anderson (1982) and evaluated in relation to other indices by Ponzoni (1985a). More recently (AMS News 1984) a new index (I_2) was introduced with the purpose of placing greater emphasis in the reduction of fibre diameter, and hoping that this would not diminish the emphasis placed on clean fleece weight.

The AMS indices have generated some controversy among breeders and geneticists since they have not been derived using selection index theory and they are of non-linear form. Ponzoni (1985b) described methods of obtaining linear approximations of non-linear indices, and concluded that the method involving the definition of an index with coefficients equal to the first partial derivatives of the original index evaluated at the average value for each character was best.

In this paper I present a linear approximation of the AMS indices (I_1 and I_2) and I discuss the accuracy of the linear approximations.

MATERIALS AND METHODS

AMS indices

I_1 and I_2 include clean fleece weight (CFW), fibre diameter (FD) and hogget liveweight (HW), characters commonly recorded in ram breeding programmes. They are as follows:

$$I_1 = a(CFW/FD^2) + HW$$

where a is a factor calculated from the records to which I_1 is to be applied as:

$$a = \overline{HW}/(\overline{CFW}/\overline{FD}^2)$$

where the bar above each symbol signifies average.

$$I_2 = b(CFW/FD^3) + HW$$

where b is a factor calculated from the records to which I is to be applied as:

$$b = (1.5)[HW/(CFW/FD^3)]$$

The factor 1.5 is applied so that that part of the index containing CFW and FD receives more emphasis than HW.

Linear approximations of AMS indices

Defining an index with coefficients equal to the first partial derivatives of the original index evaluated at the average for each character, the linear approximation of I_1 is found to be:

$$I_{L1} = \frac{\overline{HW}}{\overline{CFW}} \, CFW - \frac{2\overline{HW}}{\overline{FD}} \, FD + HW$$

or $I_{L1P} = CFWP - 2FDP + HWP$

where CFWP, FDP and HWP are the percentage values for each character with respect to the average (e.g. $CFWP = (CFW/\overline{CFW})100$).

Similarly, the linear approximation of I_2 is:

$$I_{L2} = \frac{1.5\,\overline{HW}}{\overline{CFW}} \, CFW - \frac{\overline{HW}}{\overline{FD}} \, FD + HW$$

or $I_{L2P} = 1.5\ CFWP - 4.5\ FDP + HWP$

expressing each character as a percentage.

The method used in obtaining the linear approximations of I_1 and I_2 is described in Ponzoni (1985b).

Evaluation of the linear approximations

I_1, I_{L1}, I_2 and I_{L2} were applied to a set of ram performance records, and the observed correlations between the index scores of I_1 with I_{L1} and of I_2 with I_{L2} were calculated.

RESULTS AND DISCUSSION

The correlations between the index scores of I_1 with I_{L1} and of I_2 with I_{L2} were both 0.99. These very high values indicate that selection based on the linear approximations (I_{L1} or I_{L2}) would have virtually the same effect as selection on the original AMS indices (I_1 or I_2).

Note that the ranking on index scores based on I_{L1} and on I_{L1P} would be identical. Similarly, rankings on I_{L2} would be identical to those based on I_{L2P}. However, I_{L1P} and I_{L2P} are simpler, and thus presentation of the indices in this form may be preferable.

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