PLG - GENETIC PROGRESS IN NUCLEUS AND MEMBER FLOCKS OF A TERMINAL SIRE GROUP BREEDING SCHEME

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SUMMARY
The genetic trends for nucleus and contributing flocks in an open nucleus breeding scheme for a terminal sire sheep breed are presented and analysed. Rates of genetic progress have been substantial since sires external to the scheme have been introduced through AI. An observed increase in the variance in performance traits between member flocks is attributed to some member flocks introducing nucleus sires by AI and making efficient use of LAMBPLAN, while others have not. The effect of this trend on the future structure of the group is discussed.

Keywords: Terminal sire, LAMBPLAN, genetic progress.

INTRODUCTION
Group, or open nucleus breeding schemes were first established over 30 years ago (Parker 1976) when only within-flock genetic information was available. Given an optimum structure it has been calculated (James 1976) that they could deliver a 10-15% higher rate of genetic progress than closed nucleus programs.

Prime Lamb Genetics (PLG) is a terminal sire open nucleus breeding program using predominantly White Suffolk sheep. Following an initial developmental period by UNSW during which selection was concentrated towards removing coloured points, an open nucleus system has operated from 1986 to 1995 (Eldershaw and Eppleston 1987). The scheme consists of a total of approximately 8000 breeding ewes distributed between a nucleus flock of some 350 ewes, and 35 member flocks each contributing 2 hogget ewes to the nucleus annually. Selection for growth and carcase traits is currently achieved using the LAMBPLAN 60:20:20 index, with some emphasis being allocated to structural traits. Since the publication of Central Progeny Test results and later the across-flock LAMBPLAN data, semen has been sourced from outside the group. This paper examines the genetic progress achieved both in the nucleus flock and in members flocks over the last 8 years, and looks at the genetic relationships between member flocks over that same period.

MATERIALS AND METHODS
Data on animals in the PLG nucleus flock and in members' flocks were obtained from the LAMBPLAN National Database. These data consisted of Estimated Breeding Values for Yearling Weight (EBVYWT), Yearling Fat Depth (EBVYFAT) and Yearling Eye Muscle Depth (EBVYEMD), and the 60:20:20 (Ind 60) and Growth 80+EMD (Ind 80) indices. These values had been calculated using BVEST (Gilmour and Banks 1992) software and were published in the September 1996 Across Flock Analysis for the White Suffolk breed (Banks 1996).
Genetic trends for the PLG nucleus flock and for the group as a whole were calculated as the change in average trait value for each year of drop. Between flock variance for EBV_YWT, EBV_YFAT and EBV_YEMD and the Ind 60 and Ind 80 indices for the years of drop 1988 to 1995 were computed using the REML procedure of SAS (SAS Institute Inc., Cary, NC.). The numbers of progeny and flocks in each drop included in this analysis are presented in Table 1.

Table 1. The number of flocks and progeny within each year of drop analysed to estimate between-flock variances

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<td>20</td>
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RESULTS AND DISCUSSION

The genetic trends for all traits for the PLG group as a whole are presented in Figure 1, while the trend in the 60:20:20 index for the nucleus flock and for member flocks combined are presented in Figure 2.

Figure 1. The genetic trend in EBV's for YWT (kg), YFAT (mm), YEMD (cm^2) and the LAMBPLAN 60:20:20 index calculated for the PLG open nucleus breeding scheme over years of drop.

Progress in YWT, YFAT and the 60:20:20 index has been marked since 1992-93, but before this time there was little change in any of the traits presented. Several factors were associated with an increase in selection pressure for growth and carcase traits around this time. As reflected in Table 1 the numbers of sheep in the scheme were low, many member flocks were still involved in grading up from their non-white Suffolk base flocks and in the central nucleus, selection emphasis was still
being applied against coloured points. From 1992 onwards, selection pressure for the objective
traits increased as a result of the accumulated impact of the recently released LAMBPLAN, and in
particular the introduction into the nucleus flock of genes from outside the group by AI. The
divergence in 60:20:20 index between nucleus and member flocks shown in Figure 2 is likely to be
due to the use of AI and the concentration of better performing ewes in the nucleus flock.

Figure 2. Genetic trends for 60:20:20 index in the nucleus and member flocks for 1988 to
1995 years of drop.

The large response observed in the 1996 drop has been estimated only from nucleus animals which
have as yet only been measured for birth weight so it will be interesting to see whether this increase
diminishes when data from LAMBPLAN testing at 10-11 months of age becomes available.

The response in YEMD, however has been in the wrong direction. This may be due to the low
selection emphasis being applied both by the group and by the LAMBPLAN 60:20:20 index. For
the present at least, the over-the-hook lamb market does not pay premiums for carcases with a
larger eye muscle, but this may change in the future if a system of meat grading for the export
market is introduced.

The between member flock variance for each trait for the period 1988 to 1995 is presented in
Figure 3. It is evident that differences between member flocks in their average genetic merit has
increased, particularly since 1993. This is in contrast to a reduced variation between flocks that
could be expected in an open nucleus system particularly one which has involved a grading up
process from a variety of breeds as stabilised genes filter down from the nucleus to the contributing
flocks.

This increased variability can reasonably be attributed to the different rates of adoption of AI using
semen from superior nucleus sires by member flocks. Those members using nucleus sires by AI
have substantially reduced the relative superiority of the nucleus flock in a short 1-2 generations
whereas those continuing to use allocated rams of a lower grade remain approximately 2 generations behind the nucleus flock (Banks 1987). It is likely then that three tiers of flock performance will evolve with those flocks continuing to use nucleus sires by AI forming a middle tier, but with all levels making similar rates of progress in the long term.

![Figure 3. Between member flock variance for the traits EBV_YWT (kg), EBV_FAT (mm), EBV_EMD (cm²) and the LAMBPLAN 60:20:20 and Growth 80+EMD indices over the 8 year period 1988 to 1995.](image)

The ability to identify superior rams through across flock genetic information and their ease of access through frozen semen technology, as well as new animal health risks such as Ovine Johne's Disease will undoubtedly alter the future structure and operation of the PLG group. Indeed some members have already used the same external sires as the nucleus flock and the genetic gap between nucleus and some members' flocks will undoubtedly diminish in the future. The role of the PLG nucleus flock now needs to be redefined.

ACKNOWLEDGMENTS

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REFERENCES