THE CRITERION FOR SHEEP PRODUCTIVITY - MATING LIVEWEIGHT PER HECTARE

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SUMMARY

Comparisons of the production of wool and lambs across different wool sheep genotypes varying in mean fibre diameter from 19 to 24 micron and grazing pastures with annual and/or perennial species in Victoria, S.A., N.S.W. and the A.C.T. have been made from published information.

Linear correlation coefficients (*r*) of ewe flock mean mating liveweight in kg/ha with each of the following parameters were:

(i) number of lambs born per ha, $r = 0.92$, $n = 22$, r.s.d. = 2.18

(ii) number of lambs weaned per ha, $r = 0.97$, $n = 22$, r.s.d. = 0.94

(iii) liveweight of lambs weaned (kg/ha), $r = 0.92$, $n = 18$, r.s.d. = 25.76

(iv) weight of greasy wool (kg/ha), $r = 0.98$, $n = 22$, r.s.d. = 3.48.

The quadratic coefficient for (iii) above was, $r = 0.94$, $n = 18$, r.s.d. = 22.47.

Thus irrespective of the ewe genotype, environmental and management differences which occurred naturally or were experimentally imposed, significant correlations were observed between reproductive, growth or wool characters and ewe mating liveweight per hectare.

Keywords.- sheep, productivity, liveweight, wool, lamb.

INTRODUCTION

Changes in sheep size and/or sheep numbers per hectare are the 2 major sheep factors enabling changes in productivity. Per head production has been the main criterion for wool sheep productivity assessment and selection both in stud and commercial flocks. Liveweight gain per head declined linearly with increasing stocking rate, and a curvilinear relationship was derived between liveweight gain per hectare and stocking rate for both beef cattle and sheep by Jones and Sutherland (1974).

Recent research (Obst 1987; Obst et *al.* 199 1) has emphasised that productivity per hectare and not production per head should be the criterion for sheep productivity. The upper and lower limits of potential sheep productivity are largely set by the level of pasture productivity and the degree of pasture utilisation.

To test and extend the per hectare productivity relationships, comparisons of published results on the relationships between wool or lamb production or ewe production and ewe liveweight amongst different wool sheep genotypes from Victoria, S.A., N.S.W. and the A.C.T. were made and are presented in this paper.

MATERIALS AND METHODS

A literature review was conducted to collect published results of ewe stocking rate experiments with wool-producing genotypes within Australia. Data on mean ewe mating liveweight (EMLWHA, kg/ha) of different treatments within each experiment were correlated with the mean number of lambs born (NLBHA, n/ha), the number of lambs weaned (NLWHA, n/ha), the liveweight of lambs weaned (WLWHA, kg/ha) and the correlation between EMLWHA and weight of greasy wool per hectare (WHA, kg/ha).

RESULTS

The linear regression equations (coefficients ± s.e.) of the data surveyed are as follows:

(i) NLBHA (n/ha) = 0.21 (± 1.384) + 0.026 (± 0.002) x EMLWHA
($n = 22$, $r = 0.92$, r.s.d. = 2.18)

(ii) NLWHA (n/ha) = 0.49 (± 0.599) + 0.018 (± 0.001) x EMLWHA
($n = 22$, $r = 0.97$, r.s.d. = 0.94)

(iii) WLWHA (kg/ha) = 36.05 (± 18.13) + 0.302 (± 0.032) x EMLWHA
($n = 18$, $r = 0.92$, r.s.d. = 25.76)

(iv) WHA (kg/ha) = 1.24 (± 2.209) + 0.092 (± 0.004) x EMLWHA
($n = 22$, $r = 0.98$, r.s.d. = 3.48) (Obst *et al.* 1991).

A quadratic regression equation was also calculated from the data:

(v) WLWHA (kg/ha) = –27.76 (± 22.47) + 0.577 (± 0.116) x EMLWHA – 0.00025 (± 0.00011) x $EMLWHA^2$
($n = 18$, $r = 0.94$, r.s.d. = 22.47).

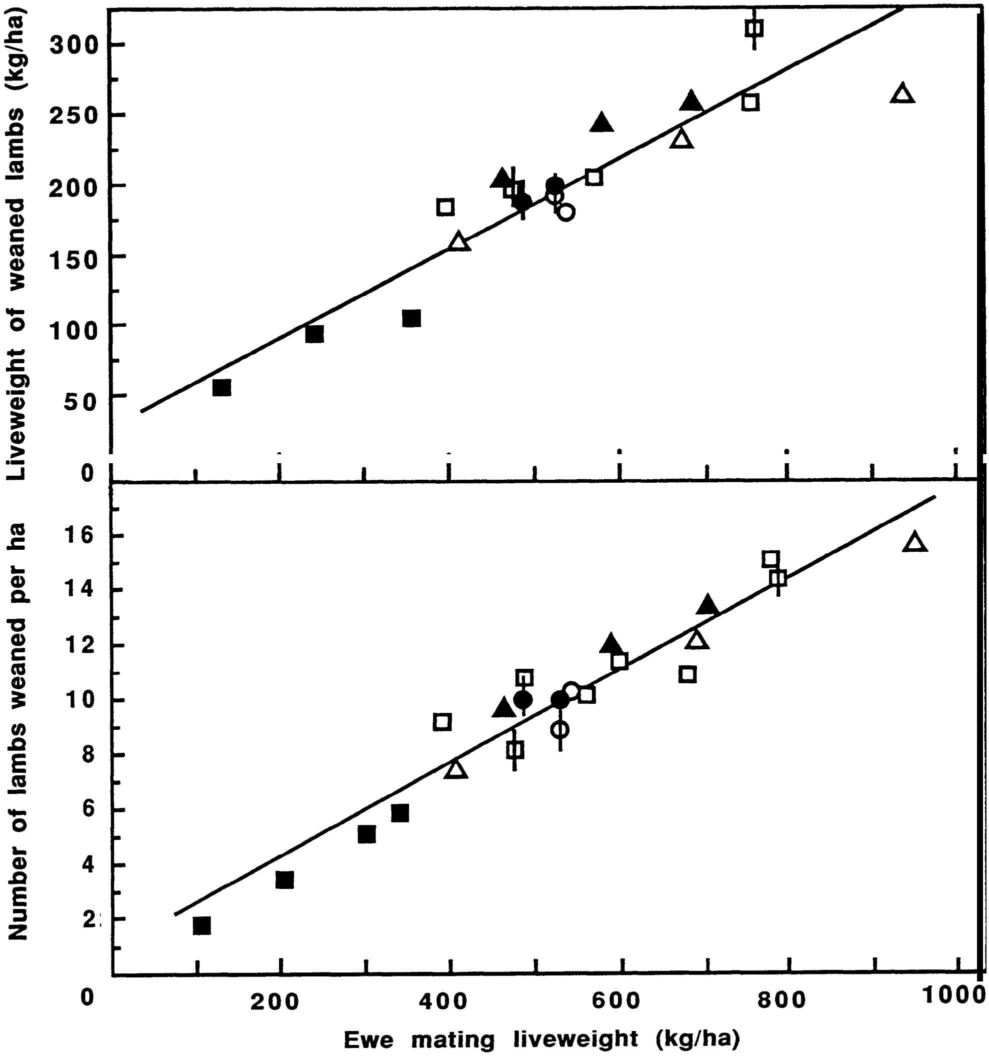

Fig. 1. Relationship between mean number of lambs weaned or mean liveweight of lambs weaned and the mean ewe mating liveweight for fine wool Merinos lambing in May (o) and August (ϕ) and Comebacks lambing in May (●) and August (ϕ) at Hamilton, Vic. (Obst *et* al. 1991); fine wool Merinos at Hamilton, Vic. (▲) (Egan *et al.* 1974, 1977*a*, 1977b) and at Armidale, NSW (⌶) (Langlands *et al.* 1984); medium wool Merinos at Canberra, ACT., grazing phalaris (□) (Donnelly *et al.* 1982, 1983), and at Mia Mia, Vic. (■) (White *et al.* 1983); strong wool SA Merinos at Kybybolite, SA (△) (Brown 1977).

Figure 1 shows the actual data from which the regressions (ii), (iii), and (v) above, are calculated. From 85 to 96% of the variation in mean flock reproductive performance and wool production was associated with the variation in the mean mating liveweight of ewe flocks when expressed on a land area basis.

The above regressions were observed irrespective of the environmental variation between the geographically spaced experimental sites at Hamilton and Mia Mia, Victoria; Kybybolite, S.A.; Canberra, A.C.T. and Armidale, N.S.W. Merino ewe genotypes also varied both in size and wool quality (19-24 micron fibre diameter) between the experimental sites.

DISCUSSION

Sheep genotype has been a major criterion for improvement in wool production over the centuries. While there have been and will continue to be changes in the emphasis of what the specific selection criteria for the best genotype will be, little credence has been given to the fact that all genotypes examined in this study, when compared on an equivalent liveweight basis are similar in wool and lamb production per hectare of pasture.

The high correlation coefficients ($r = 0.92$ to 0.98) observed in this review between wool or lamb productivity and ewe mating liveweight per hectare also indicate that there is little difference in the efficiency of conversion of pasture to wool or lamb amongst the wool-producing genotypes of Southern Australia sampled in this study. The inference from this observation is that the gains in the efficiency of wool production expected by increasing body size are not achievable.

The alternative approach to increased sheep productivity is to extend the upper limits of mating liveweight per hectare of the same genotype by improvement in pasture growth and quality or nutritive value. The success of this approach is outlined by Cayley (1990) where wool production per hectare was trebled from 30 to over 90 kg by the addition of phosphate fertiliser to mixed annual-perennial pastures at Hamilton, Victoria, with a concomitant increase in the stocking rate of fine-wool sheep from 7.5 to 20.3 ewes per hectare. This represented a ewe liveweight increase from 350 to 900 kg per ha. A similar range of ewe liveweights and wool response is reported by Obst et *al.* (1991) in the regression (iv) above where results from different genotypes varying in fibre diameter from 19 to 24 micron are included. Thus both within and between genotypes regressions of wool production (kg/ha) and ewe mating liveweight (kg/ha) are of importance.

Comparing the reproductive performance of the South Australian Merinos at Kybybolite with the fine-wool Merinos at Hamilton indicates a similar number of lambs weaned and similar liveweight of lambs weaned when each genotype was stocked at similar total ewe liveweights per hectare. The WLWHA (Fig. 1) is significantly correlated both on a linear ($r = 0.92$) and quadratic ($r = 0.94$) basis with EMLWHA. The estimated maximum WLWHA using the quadratic regressions is 305 kg/ha from 1150 kg/ha of EMLWHA. Jones and Sandland (1974) deduced that SR at the point of no liveweight gain would be approximately twice the SR required to produce maximum gain per hectare.

Attainment of maximum levels of lamb or wool production per hectare also depends upon control of sheep health, e.g. internal parasite infestations or subclinical trace element deficiencies. Each of these productivity constraints can be approached by genetic means (selection for parasite resistance or resistance to low levels of trace element) or by husbandry techniques (stocking pressure, drenching or vaccination) to correct the observed constraint.

Sheep producers are to be encouraged to use ewe mating liveweight per hectare as a criterion of productivity to increase productivity per hectare and to allow economic survival over the next decade.

REFERENCES

BROWN, T. H. (1977). *Aust. J. of Agric. Res. 28:* 947–61.

CAYLEY, J. W. D. (1990). Research Review 1989-90 Pastoral Research Institute, Hamilton, Victoria.

DONNELLY, J. R., MORLEY, F. H. W. and McKINNEY, G. T. (1982). *Aust. J. of Agric. Res. 33:* 1085–97.

DONNELLY, J. R., MORLEY, F. H. W. and McKINNEY, G. T. (1983). *Aust. J. of Agric. Res. 34: 53748.*

EGAN, J. K., THOMPSON, R. L. and McINTYRE, J. S. (1974). *Proc. of the Aust. Soc. of Anim. Prod.* 10: 284.

EGAN, J. K., THOMPSON, R. L. and McINTYRE, J. S . (1977a). *Aust. J. of Exp. Agric. and Anim. Husb.* 17: 566-73.

EGAN, J. K., THOMPSON, R. L. and McINTYRE, J. S. (1977b). *Aust. J. of Exp. Agric. and Anim. Husb.* 17: 909-14.

JONES, R. J. and SANDLAND, R. L. (1974). *J. Agric. Sci., Camb. 83: 33542.*

LANGLANDS, J. P., DONALD, G. E. and PAULL, D. R. (1984). *Aust. J. of Exp. Agric. and Anim. Husb. 24: 34-46.*

OBST, J. M. (1987). *In* ‘Temperate Pastures, their Production, Use and Management.’ (Eds J. L. Wheeler, C. J. Pearson and G. E. Robards.) pp. 477-88. (Australian Wool Corporation/CSIRO: Melbourne.)

OBST, J. M., THOMPSON, K. F., CAYLEY, J. W. D., THOMPSON, R. L., SAUL, G. R., BROCKHUS, M. A., CUMMINS, L. J., WILSON, J. M. and BUTLER, K. L. (1991). *Aust. J. of Exp. Agric.* 31: 15-23.

WHITE, D. H., BOWMAN, P. J., MORLEY, F. H. W., McMANUS, W. R. and *FILAN, S.* J. (1983). *Agric. Systems* 10: 149-89.