A RELATIONSHIP BETWEEN FORAGE AVAILABILITY AND WOOL GROWTH-RATE FOR HIGH AND LOW PRODUCING SHEEP

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I. INTRODUCTION

Willoughby (1958, 1959) has demonstrated a relationship between pasture availability and animal production (liveweight change) for young Merino sheep grazing upon a Phalaris tuberosa L.-Trifolium subterraneum L. pasture at Canberra, A.C.T. He concluded from these studies that maximum liveweight gain was achieved at and above 1600 kg/ha or 1400 lb/at (dry weight of green material). The form of the curve, as Willoughby pointed out, should apply generally to the free-grazing animal at pasture, though the actual values might be expected to vary with animal factors, and pasture factors.

Three flocks of 21-25 Merino wethers grazing natural pastures in the Deniliquin district of N.S.W. have provided data which can be used to ascertain the type of relationship between forage availability and wool production from high and low producing sheep.

II. EXPERIMENTAL

Three flocks of 21-25 sheep selected initially for uniform liveweight have been maintained continuously for two years on pastures of (a) Atriplex vesicaria Hew. on a grey soil of heavy texture, (b) Chloris acicularis Lindl.-Danthonia caespitosa Gaud.-Stipa falcata Hughes on a red-brown earth, and (c) Danthonia caespitosa-Kochia ciliata F. Muell. on a grey soil of heavy texture, at district stocking rates of four, one and two acres per sheep respectively.

During the two years, the wool was harvested each six weeks from tattoo patches on the mid-side of each sheep. At the same time, at specified locations in each of the three paddocks, quadrats were clipped to ground level. The pasture samples were separated into green and dry fractions, oven-dried, and weighed. The liveweight of each sheep was recorded at each sampling date.

III. RESULTS

Changes in the rate of wool growth were found to be related to the green fraction of pasture presented to the flocks. The relationship of wool growth-rate to the availability of total pasture was meaningful only when the green fraction was the major component. Further, it was apparent that all three pastures could be considered together and in Figure 1 the wool growth-rate for the three flocks is plotted against the green fraction of the pasture presented to the animal (dry-weight per sheep, rather than per acre).

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The relationship is asymptotic, approaching the maximum value of \( 1.35 \) mg/cm\(^2\)/day at 400-450 kg green forage/sheep.

In Figure 2, the wool growth-rates of the six highest and six lowest producers in each flock are set out. Generally the six highest and six lowest growth-rates belonged to the heaviest and lightest fleece-producers.

The relationships are also asymptotic, with the high-producing sheep attaining a maximum level of approximately \( 1.70 \) mg/cm\(^2\)/day at 500 kg green forage/sheep. The low-producing sheep reach their maximum level of \( 1.10 \) mg/cm\(^2\)/day at approximately 300 kg green forage/sheep.

There were no differences in net liveweight and liveweight change between these high and low producing groups at the six-weekly weighings over the two years.

**IV. DISCUSSION**

Willoughby (1958, 1959) has drawn attention to the relationship between liveweight change and the amount of green forage presented to the animal, with maximum liveweight gain at 1600 kg/ha. This general relationship appears to hold for wool growth, with a mean maximum for wool growth-rate of the three flocks at 400-450 kg green forage/sheep. Above this level of pasture availability there is no increase in wool growth-rate.

This general relationship suggests that the kind of pasture is irrelevant, the amount of green forage presented per sheep being the sole determinant of wool
growth. However, this relationship must be interpreted cautiously. Admittedly, there are several major contributors to the sheep's diet which are common to the three pastures, including Danthonia caespitosa, Chloris truncata R.Br., and Sporobolus caroli Mez., but there are discrepancies in the wool-growth responses. For example, the flock grazing on the Danthonia-Kochia pasture (Figure 1) grew wool at both high and low rates when the pasture presented was scanty, an observation which indicates that relative pasture growth-rates at the same pasture availability level may be more relevant for wool growth. Again, on the Atriplex pasture wool growth-rates were never less than 1.20 mg/cm²/day, nor has the green forage on offer been estimated at less than 300 kg/sheep.

The mean value for the three flocks masks the performance of the high and low producing individuals, particularly at the point where the relationship between wool growth-rate and green forage presented approaches the asymptote. The performance of these sheep (Figure 2) suggests that the greater wool growth-rate of the high producing animals is possibly due to their larger feed intake, the

![Graph showing wool growth-rates vs green forage presented](image-url)
opportunity for greater selection increasing with increasing forage availability, i.e. as the amount of forage increases. We can infer that individuals in turn reach their particular maximum intake in the contemporary situation, and hence the wool growth-rate permitted by that intake.

The absence of any difference in liveweight change between these high and low producing groups at six-weekly weighings over the two year period means that the postulated larger intake, though sufficient to increase wool-growth substantially in the high producing sheep, is not sufficient to produce a discernible increase in body tissue.

The conclusions drawn by Willoughby (1959) from the relationship between liveweight change and available green pasture, namely, that substantial increases in liveweight follow small increases in green forage at low levels of pasture availability, and the ineffectiveness of increasing pasture production when it is already adequate, clearly apply to wool growth.

In addition, the differing wool growth-rate and pasture availability relationships for high producing and low producing sheep indicate that even at low levels of forage availability the wool growth-rate of the high producers exceeded that of the low producers by a substantial margin. If, as appears likely, both larger intakes and greater efficiencies are responsible for this increased production (Schinckel 1960), then the relative contribution of these two factors will determine whether elite animals should be preferred. At present there are no data bearing directly on this, though one can infer that the lack of liveweight differences does indicate the relatively smaller role played by increased intake compared with efficiency.

These wool growth-rate and pasture availability relationships also indicate that in periods when green forage in a particular pasture is below the level at which maximum intakes can be achieved, and maximum wool-growth expected, there will be competition between low and high producers. This interaction is inherent in the data, and can be expected to have a greater effect on the wool production of the elite animals than on the less-productive animals.

It is a consequence, therefore, that where intensive husbandry can be practised, and when green forage is scarce, the high producing animals could be managed according to production criteria, as in the dairy industry, rather than allowing them to graze in company with less-productive sheep whose capacity to respond is more limited.

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VI. REFERENCES

