THE EFFECT OF SUB-MAINTENANCE FEEDING OF EWES DURING MID-PREGNANCY ON LAMB AND WOOL PRODUCTION

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SUMMARY

Four trials investigating the effects of sub-maintenance feeding of Romney ewes in mid-pregnancy are described. Feeding hay at approximately 40% maintenance from 6 to 16 weeks after mating commenced caused 14 to 23 lb differences in liveweight at the end of the period of feed restriction in comparison with ewes offered hay to appetite.

Following the period of restriction ewes were fed high-quality pasture until lambing. During lactation ewes were fed pasture *ad libitum* or restricted.

No differences in ewe death rates, twinning rate, ewe barrenness, lamb birthweight and lamb survival rates were observed. Lamb weaning weights were lower in the groups restricted during mid-pregnancy and lactation (two trials). Differences in ewe liveweights were eliminated before the following mating period.

Sub-maintenance feeding in mid-pregnancy reduced the quantity and quality of wool produced. The economic and managerial implications of the results are discussed.

ON MANY FARMS from May until September feed from pastures must be supplemented with feed conserved the previous summer. Such feed is expensive in terms of conservation and utilization costs. Managerial techniques which will reduce the use of conserved feed will increase profitability provided any subsequent reduction in income from stock does not exceed the value of feed saved.

One possible managerial technique is sub-maintenance feeding of ewes in early and mid-pregnancy. Many farmers have adopted such a technique in the general belief that savings in feed costs exceed subsequent losses in lamb and wool returns.

Sub-maintenance feeding in early and mid-pregnancy has reduced the quantity and quality of wool produced, but Hodge (1966) and Coop and Clark (1969) found that the incidence of barrenness or twinning was not affected. These workers reduced initial liveweights by 17 and 18%, respectively, following sub-maintenance feeding between 6 to 16 and 3 to 13 weeks after mating commenced. Hodge

(1966) reported no effect on lamb growth rates to weaning.

The object of the four trials reported in this paper was to further document these aspects. Two levels of nutrition during lactation were used in order to document the effect on lamb growth rates under *ad libitum* and sub-optimal feeding.

EXPERIMENTAL

The trials were conducted at Invermay in 1967 and 1968 (I.67 and I.68) and in Southland in 1968 and 1969 (S.68 and S.69) and were as shown in Fig. 1. Romney ewes, 2½-year and older, were randomly allocated into two groups six weeks after mating commenced. Three experiments used 240 ewes each and the fourth 212 (I.67). All ewes were mated to Romney rams and in the Southland experiments only ewes pregnant to first service were selected.

The groups were fed meadow hay either to appetite (winter high — WH) or at a sub-maintenance level (winter low — WL). Six weeks before the commencement of lambing, the winter low hay ration was increased to approximately maintenance. For the four weeks before lambing commenced, both groups were grazed on autumn- and winter-spelled pasture 3 to 4 in. in length. The ewes grazed for 3 to 4 hours daily for two weeks initially and then continuously.

During the period of hay feeding the ewes were stocked at 100 to 150 per acre on bare pasture (Invermay) or

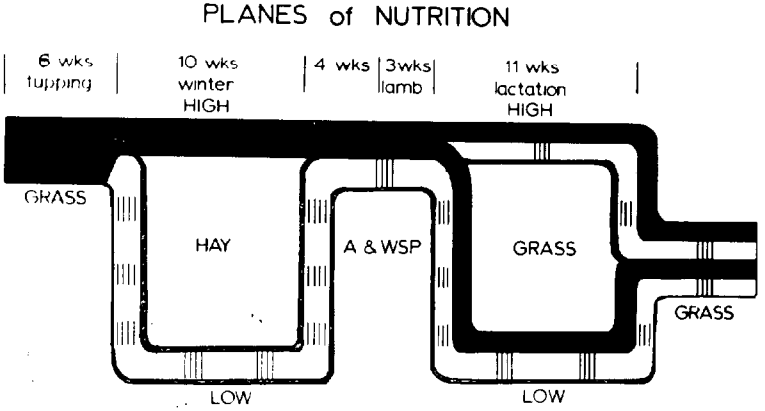

Fig. 1: Design of experiments.

wheat stubble (Southland). Hay was fed in racks or on the ground. The amounts of hay fed to the WL group ranged from 35 to 47% of that fed to the WH group. Details of hay feeding are shown in Table 1.

TABLE 1: HAY FED PER EWE DURING THE WINTER FEEDING PERIOD

Group	*I.67*	*I.68*	*S.68*	*S.69*
Mean hay fed daily (lb/day):				
WH	2.1	1.6	2.2	2.5
WL	0.7	0.7	0.8	1.2
Total hay fed (lb):				
WH	155	120	130	170
WL	55	55	45	80

At lambing the WH and WL groups were subdivided by transferring each ewe within 48 hours *post partum* to either of groups offered pasture *ad lib.* (lactation high, LH) or restricted on to pasture kept bare by heavy stocking (LL). In both LH and LL groups the WH and WL treatment animals were grazed together and the percentages of lambs with ewes in the winter treatment groups equalized as far as possible. Lambs were weaned about 10 to 12 weeks of age. Weaned ewes were grazed together until the following mating.

Liveweights of ewes and lambs were recorded at intervals. At lambing the reproductive performance of ewes and lamb birth-weights and survival were recorded. Ewes were shorn at weaning and fleeces weighed and subjectively graded for "style". In the Southland trials tensile strength measurements were made on wool samples clipped from the left mid-side at shearing. A commercial assessment of wool quality was obtained by binning and selling the wool separately from each treatment through the wool auction system.

RESULTS

EWE LIVEWEIGHTS

Initial liveweights of ewes and liveweight changes by the end of the period of winter differential nutrition are shown in Table 2. The Invermay ewes were 18 to 26 lb lighter than the fat Southland ones, and were subjectively estimated to be smaller and in "forward store condition".

TABLE 2: INITIAL LIVEWEIGHT OF EWES AND LIVEWEIGHT CHANGE AFTER WINTER DIFFERENTIAL NUTRITION PERIOD (lb)

	I.67	*I.68*	*S.68*	*S.69*
Initial liveweight	116	117	135	142
Liveweight change during differential nutrition (lb):				
WH	−3	−5**	+5**	+2
WL	−19**	−19**	−18**	−20**

**$P < 0.01$

The initial liveweight of the ewes in the WL group was reduced by 13 to 16% within 8 weeks and liveweight differences of 14 to 23 lb created between WH and WL groups.

Liveweight differences between the WH and WL groups subsequent to the period of feed restriction are shown in Table 3. The liveweight differences existing at the end of winter differential nutrition steadily diminished from four weeks prior to lambing onwards. By weaning significant differences of 6 to 7 lb remained in I.67 (LH and LL) and S.69 (LL) ($P < 0.05$). By mating the following autumn all weight differences were eliminated and weight losses regained except in the WH-LL group of I.67 where a significant difference of 8 lb persisted ($P < 0.05$).

MORTALITY AND REPRODUCTIVE PERFORMANCE OF EWES

In I.67 and I.68 no differences in the number of ewes that died were observed. In S.68 and S.69 four more deaths (pregnancy toxaemia) occurred in the WL group than in the WH group but this difference was not signifi-

TABLE 3: LIVEWEIGHT DIFFERENCES BETWEEN WH AND WL GROUPS WITHIN THE LACTATION-NUTRITION SUB-GROUPS (lb)

Time of Observation	*I.67*		*I.68*		*S.68*		*S.69*	
	LH	LL	LH	LL	LH	LL	LH	LL
Immediately after lambing	7*	13**	−2	3	−1	2	8**	11**
Weaning	6*	7*	−3	3	1	3	2	7*
Pre-mating	3	8**	−6*	3	−2		−1	0

*$P < 0.05$ **$P < 0.01$

cant. Within experiments no differences were observed in incidence of barren ewes, the proportion of twin-bearing ewes, birth-weight of lambs and their survival to one week of age. The number of lambs surviving to one week of age expressed as a percentage of ewes initially in each group did not differ significantly. In I.67 the WL group exceeded the WH group by 10% but in the other three trials the WH groups exceeded the WL groups by 6 to 8%.

Growth Rates of Lambs

The weaning liveweight of the lambs are shown in Table 4. No significant differences were recorded between lambs

TABLE 4: WEANING WEIGHT OF LAMBS (lb)

	I.67	*I.68*	*S.68*	*S.69*
Lactation high:				
WH	52	52	49	57
WL	52	52	48	58
Lactation low:				
WH	42	41	48	54
WL	39	42	46	50
Significance of difference	*	N.S.	N.S.	*

N.S.: $P > 0.05$ $*P < 0.05$

TABLE 5: DETAILS OF WOOL PRODUCTION

	I.67	*I.68*	*S.68*	*S.69*
Fleece weight (lb):				
WH	10.7	9.5	9.1	11.1
WL	10.0	8.6	8.3	9.6
P	< 0.01	< 0.01	< 0.01	< 0.01
Tensile strength (kg/g):				
WH	—	—	26	40
WL	—	—	12	16
P			< 0.01	< 0.01
Style grading (6 = excellent, 1 = very poor):				
WH	3.5	3.6	3.6	4.0
WL	3.1	3.7	3.5	3.3
P	< 0.05	N.S.	N.S.	< 0.01
Price at auction (c/lb):				
WH	—	24.6	26.0	22.1
WL	—	24.6	25.4	22.2

from WH and WL sheep subsequently fed *ad lib.* during lactation. Under sub-optimal feeding during lactation significant differences of 3 and 4 lb were recorded in I.67 and S.69, respectively ($P < 0.05$).

Wool Production

Fleece weight, style gradings, prices received at auction, and tensile strengths are shown in Table 5. Sub-maintenance feeding in the winter period reduced fleece weights by 0.7 to 1.5 lb and caused a reduction in style gradings in two trials (I.67, $P < 0.05$; S.69, $P < 0.01$). There were no differences in the prices received at auction. Tensile strength was reduced by 54 and 60%, respectively, in S.68 and S.69.

DISCUSSION

Ewe Liveweights

The reduction and eventual elimination of the end of winter liveweight differences after both groups were grazed together from late pregnancy onwards agree with the findings of Keenan *et al.* (1970). These workers reported that mature Merino wethers fed *ad lib.* after a period of sub-maintenance feeding gained more weight than did sheep which had previously been fed to maintain weight.

The results indicate that, provided lactation levels of feeding are adeqate, weight losses similar to that produced in these four experiments are fully recoverable. Where feed levels during lactation were restricted, the elimination of weight differences was delayed and in I.67 a weight difference still persisted at the following mating.

Reproductive Performance and Ewe Mortality

Sub-maintenance feeding during 6 to 14 weeks after mating commenced had no significant effect on reproductive performance. This is consistent with other reports (Hodge, 1966; Coop and Clark, 1969). Following sub-maintenance feeding of 98 lb Merino ewes in the first 90 days of pregnancy, Everitt (1967) recorded a depression in reproductive performance. However, treatment commenced immediately after mating and is not comparable with the winter low treatment used in these experiments.

In the Southland trials extra ewe deaths in the winter low plane groups were largely responsible for the lower final lambing percentage of those groups.

Coop (1966) showed there is a positive correlation between liveweight at mating and subsequent fertility. As the winter liveweight differences were eliminated by the following mating, reproductive performance in the following year should not have been affected except in I.67 where winter low ewes restricted during lactation did not completely regain their initial weight.

Lamb Growth

No significant differences in lamb growth rates were recorded in the lactation high treatment. This is in agreement with Hodge (1966). However, in two of the four trials, small, but statistically significant, differences due to winter treatment were recorded in the lactation low treatment. These differences were not consistent and are of minor economic importance.

Wool Production

The loss in wool weight and deterioration in quality caused by sub-maintenance feeding in the early and mid-winter period are consistent with the findings of Hodge (1966) and Coop and Clark (1969). Tensile strengths measured in wool from the low plane groups (S.68, S.69) are similar to those previously reported for wool of 46 to 50s count containing a "very bad break" (Ross, 1960). In wool containing a "break" and a "very slight break", respectively, Ross (1960) recorded values similar to those measured in the winter high groups of S.68 and S.69.

A price premium at auction was not received for wool from ewes in the winter high groups and hence superior levels of hay feeding which maintained ewe liveweight in the winter did not result in better wool prices. In I.68 all wool had a bad break and in S.68 wool from the winter high group had a relatively low tensile strength. Also style gradings for wool from both winter treatment groups were similar in these two trials. Thus the absence of a price premium for wool in these two trials is not unexpected. However, the absence of a price difference for wool in S.69 is surprising in view of the superior tensile strength and style grading of the wool from the winter high group.

Economic and Managerial Implications

Keenan, McManus and Freer (1969) found that sheep which lost weight and then regained it were 14% less efficient in utilization of feed to maintain body energy

and produce wool than sheep maintained at a constant liveweight. In New Zealand, where conserved feed is required in the winter, such a loss of efficiency may be profitable if it results in savings which exceed any reduction in revenue.

Compared with the group of ewes fed to appetite, a 60% saving in hay was achieved by allowing the liveweights of the low plane ewes to drop by 13 to 16%. Over the four experiments, the only consistent reduction in revenue resulted from the loss of wool weight. At current prices this is more than offset by the reduction in costs resulting from saving 87 lb of hay per ewe.

In the Southland trials, 3% more ewes died and the calculated lambing percentages were reduced by 7% in the winter low groups. These effects are statistically not significant, yet if the data *are used* and at current prices a loss in revenue calculated, then the total reduction in revenue still does not exceed the savings in costs if hay is worth 1 cent per lb. If summer surplus feed is scarce owing to drought or heavy stocking, then the value of available hay is likely to be more than 1 cent per lb and profits will be increased by adopting the technique of feeding at sub-maintenance levels in early mid-pregnancy.

On the other hand, adoption of the technique by managers with moderate stocking rates would allow them to increase their stocking rate without requiring the provision of extra winter feed.

Overall the trials demonstrated the considerable ability of the Romney ewe to recover from large reductions in liveweight resulting from sub-maintenance feeding in early and mid-pregnancy. Such resilience provides the opportunity for considerable flexibility in matching pasture production to stock demand without seriously altering net profits. The economic effect of sub-maintenance feeding on net profit depends on four factors — increased ewe deaths, reduction in lambing percentage, lowered wool prices, and value of available supplementary feed. In regard to the possible increase in ewe deaths and the possible reduction in lambing percentage, neither of these two effects has been proven in the present four trials.

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