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AUTUMN SAVED PASTURE IN A HIGH FROST ENVIRONMENT

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Abstract

Herbage mass, moisture content and *in vitro* OMD of autumn saved ryegrasslwhite clover pasture grown on irrigated flats in the Upper Waitaki Basin were monitored over four winters from 1979-82. During the winter of 1981 and 1982 the effect of closing date and nitrogen application was examined. In addition Merino ewes were all-grass-wintered from mid June to mid September without supplements on a feed allowance of 1.2 kg DM/hd.day to determine effect on liveweight.

Mean herbage mass and OMD loss from mid May to early September were 25 and 13% respectively and the moisture content of the pasture decreased from 73 to 45%. Herbage mass by mid May was less for March and April than for February closing, although for March closing this deficit was offset through use of nitrogen. Approximately 50% of the sward was frosted by mid September with OMD of the frosted portion (60%) comparable to hay. Ewe liveweights initialiy ieii but recovered during the latter half of the winter despite the constant fall in herbage OMD. Sward desiccation exceeded loss in digestible herbage mass over the winter, suggesting increasing rather than decreasing food value.

Keywords: High country, herbage losses, frosting, in-vitro OMD, irrigated pasture, autumn-saved-pasture, nitrogen, feed value, all-grass-wintering, Merino ewes.

INTRODUCTION

Successful all grass wintering in lowland areas relies on short (80 day) winters and reasonable winter herbage growth (e.g. 10 kg DM/ha/day). However, in the high country environment winters are long (120 days), frost up to -15°C occur and herbage growth is minimal (Greenwood & Paton, 1985). Because of this stock are usually wintered on hay, forage crops, or on oversown sunny hill blocks. Nevertheless as there are 72,000 hectares in the Mackenzie-Omarama Basin alone which are irrigable (Kerr & Ives, 1973), there are many unproven management options needing consideration in relation to the possible development of fully irrigated farms and their capacity to winter stock. There is some evidence that dryland cocksfoot deteriorates through severe winter frosting in this environment (Douglas & Drew, 1969) but the effect of winter damage on irrigated ryegrasslwhite clover pasture is unknown.

The feasibility of all-grass wintering on irrigated pastures was therefore assessed over four winters from 1979-82 and the extent of herbage deterioration determined.

METHODS

Soils and location

The experiments were conducted on Mackenzie YBE soils (N.Z. Soil Bureau, 1968) at Tara Hills High Country Research Station, Omarama, altitude 480 m. The pasture, four years old in 1979, comprised 70% Nui ryegrass and 30% Huia white clover and was border strip irrigated.

Experimental

Herbage mass, moisture content and quality (% OMD *in vitro)* were monitored at regular intervals over four successive winters. In 1979 and 1980 the pasture reserved for winter grazing was closed in early February, but in 1981 and 1982 closing in early April and early March respectively was also examined. The effect of applying 50 kg N/ha as urea at time of closing was examined for these later closing dates. Four replicates of 4.8 m^2 plots were mown to 2.5 cm at three weekly intervals to determine herbage mass and moisture content, and subsampled for OMD analysis (Drew, 1966). During May and July in the fourth winter hand clipped herbage was dissected into green or frosted grass and clover for OMD analysis.

During the 90 day period in 1981 and 1982 (mid June to mid September) a flock of 100 mated Merino ewes were wintered without supplements on autumn saved pasture with the objective of maintaining their liveweight. In order to achieve this the pasture was strip grazed in two day shifts and the stock were offered a maintenance allowance of 1.2 kg DM/hd.day (Thompson & Jagusch, 1979). In 1981 ewes were mixed aged and in 1982 two tooths, with respective initial liveweights of 50 and 43 kg. Non-fasted liveweight was monitored by weekly weighing and feed allowance was assessed also weekly by a comparative visual assessment (Haydock & Shaw, 1975) of pre-grazing herbage mass.

RESULTS AND DISCUSSION

The mean loss of herbage mass over the four winter periods from mid May to early September was 600 kg DM/ha or 24% of the initial level of 2500 kg DM/ha (Figure 1). The greatest loss occurred in early winter 1981 when herbage mass levels were initially high (3700 kg DM/ha) following favourable autumn growth.

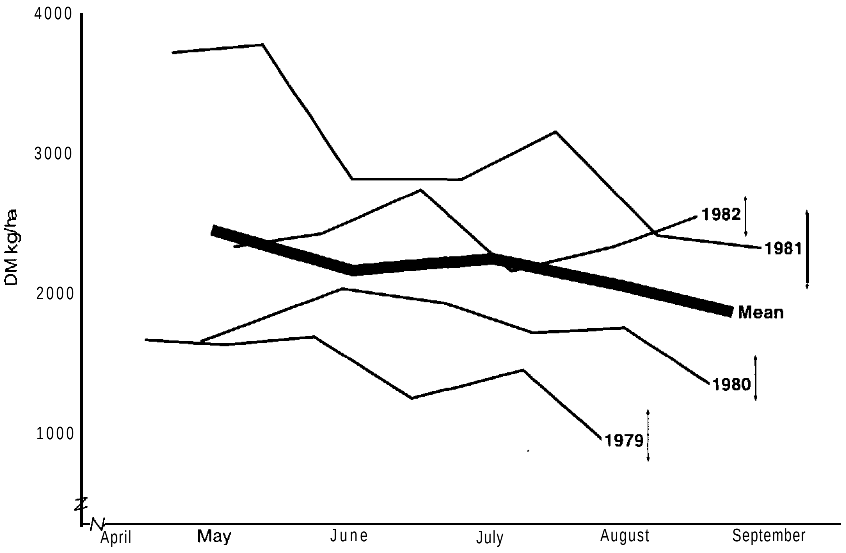

Figure 1: Changes in herbage mass of autumn saved pasture (DM kglha) during winter in the high country. (Mean = monthly mean 1979-1982) | = L.S.D. (5%)

Herbage growth was apparent on various occasions during winter (Figure 1) and this reflected small improvements in sward quality (Figure 2). The decline in total sward quality from mid May to early September was similar over the four winters. The mean 13% loss represented a linear drop in % OMD of around 0.1 units/day. Greatest losses occurred during periods of high rainfall as in August 1980 and May 1982 when precipitation was 171 and 91% above average respectively; and minimal loss during periods of severe frost and average rainfall, as in July 1982 when ground frosts averaged -8°C (normal -5.3°C) with a maximum of -14.6°C. This suggests that the major factor causing winter deterioration in grass quality is a combination of frost and rainfall, a conclusion supported by American work in a similar environment (Utley et *al.*, 1972). The freeze-thaw situation resulting from rain following frost has also been shown to increase grass damage (Gusta & Fowler, 1977).

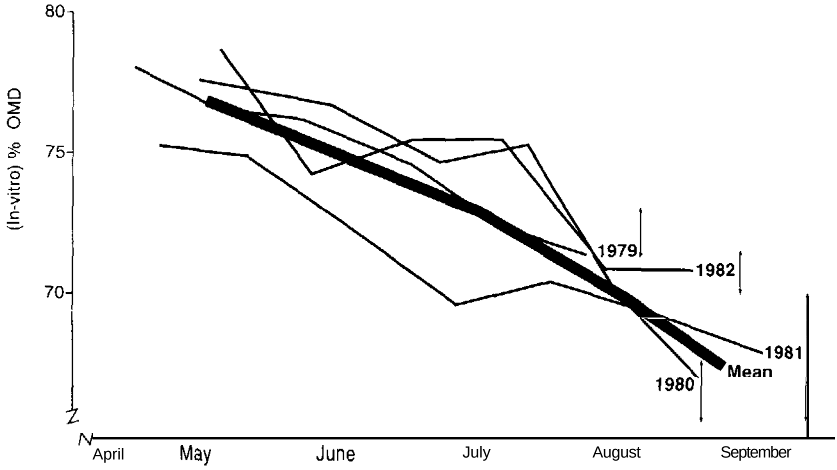

Figure 2: Changes in in-vitro digestibility (% OMD) of autumn saved pasture during winter in the high country. (Mean = monthly mean 1979-1982) ↕ = L.S.D. (5%)

Table 1: EFFECT OF CLOSING DATE AND NITROGEN APPLICATION ON HERBAGE MASS AND OMD BY MID MAY AND EARLY SEPTEMBER

Closing date/N ±		Mid May DM (kg/ha)	Mid May % OMD	Early September DM (kg/ha)	Early September % OMD
1981	February	3750	75.3	2330	67.8
	April N-	280	80.3	110	78.0
	April N +	3.50	81.6	228	79.2
	LSD	970	5.8	450	7.5
1982	February	2320	78.7	2560	70.8
	March N-	1000	80.4	1530	71.6
	March N +	1680	80.8	2110	74.0
	LSD	650	2.7	490	7.5

The moisture content of the sward decreased on average from 73 to 45% over the winter periods. Associated with this desiccation was a visual browning of the pasture which gave the impression of greater loss of herbage mass and quality than was measured.

Closing of pasture in March and April resulted in less ($P<0.01$) herbage mass by mid May than closing in February (Table 1). Application of nitrogen caused an increase in herbage mass by mid May for the March closing ($P<0.01$) when an extra 14 kg DM/unit of N resulted. However, nitrogen did not increase production at the

April closing. Nitrogen can largely compensate for the production forfeited from February to March closing. Application of nitrogen did not improve OMD by May, however, the combination of April closing and nitrogen showed higher ($P<0.05$) OMD than that from February closing. The differences in herbage mass and OMD apparent by mid May were maintained until early September, showing that winter deterioration for later closing and nitrogen was similar to that for February closing.

A period of average rainfall but severe frosts in June and July during the fourth winter halved the contribution to total DM from white clover (Table 2). White clover was 71% frosted by July compared to 51% for ryegrass. In May the OMD of the frosted sward material (67%) was 19% less than that for the green material (82.5%) and despite heavy frosts OMD for both these components remained stable over the winter. The 67% OMD for the frosted material compared favourably with good quality hay (Ulyatt et *al.,* 1980) rather than dead material (Allan et *al.,* 1976; Rattray, 1978) and was greater than that found for frosted cocksfoot (47.2%) at Tara Hills by Douglas & Drew (1969). This combined with the lower proportion of frosted sward (54% cf. 75-95%, Douglas & Drew, 1969) suggests that ryegrass can withstand frosting better than cocksfoot but variations in site, sward structure and soil fertility may have influenced the differences.

Table 2: THE CHANGES IN HERBAGE CONTRIBUTION, % FROSTED AND % OMD BETWEEN RYEGRASS AND WHITE CLOVER DURING WINTER 1982.

	% Contribution		% OMD	
	May	July	May	July
Ryegrass				
Green	50	42	83	83
Frosted	21	44	66	67
Total	71	86		
Clover				
Green	15	4	82	82
Frosted	14	10	68	68
Total	29	14		

(Replicates bulked – no statistics available)

As revealed by trends in digestible herbage mass (DM x % OMD) and fresh herbage (DM x 100 ÷ DM %) the relative value of the pasture (digestible herbage mass per unit of fresh herbage) actually increased during the winter (Figure 3). Therefore as winter progressed stock were able to obtain a similar intake of digestible dry matter with less ingestion of water. If the energy cost to the animal of warming the cold water content of diets (Nicol &Young, 1981) is considered then the results suggest the pasture, because of desiccation, may be of greater value to the animal by the end of winter than it was at the beginning.

Although liveweights fluctuated over the 90 day periods, the ewes at the end of winter were only 2 kg and 1 kg lighter in 1981 and 1982 respectively (Figure 4). The Merino ewes, taken from laxly grazed hill blocks and unaccustomed to high density mob stocking were initially unsettled, this may account for the sudden liveweight loss during the first week in both years. The overall pattern of liveweight change appeared influenced by climatic conditions, for in both years the greatest liveweight loss occurred when the mean weekly air temperature was at its lowest. These periods of very low temperature were associated with severe hoar frosts and occasional light snow.

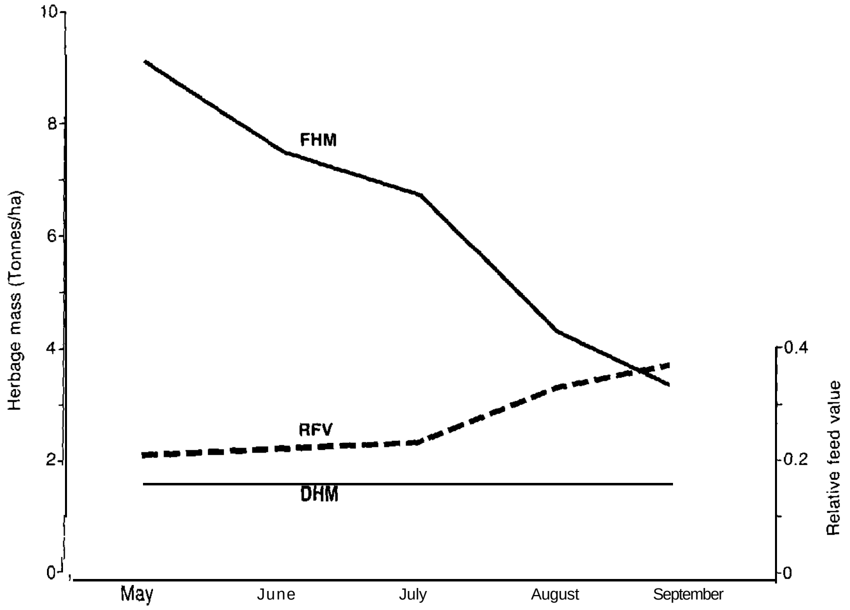

Figure 3: The relationship of fresh herbage mass, digestible herbage mass and subsequent relative feed value (mean of four winters). FHM fresh herbage mass; DHM digestible herbage mass; RHV relative food value (DHMIFHM) **(Data** *derived from Fig's 1 and 2).*

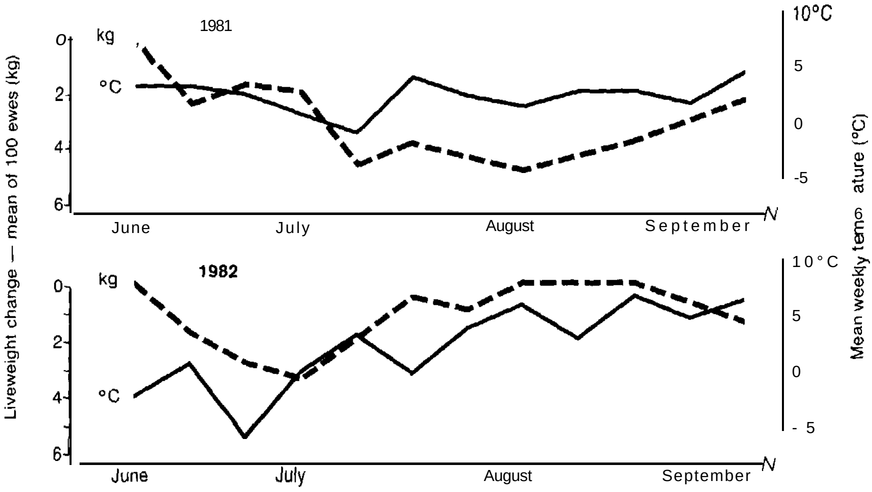

Figure 4: Mean weekly air temperature, and liveweight changes of ewes wintered without supplements on autumn saved pasture during 1981 and 1982.

The improvement in liveweight from late July till early September for both winters from stock given a constant allowance supports the concept of increasing rather than decreasing pasture value over the winter period. Because this period concerned only the ninth to the fourteenth week of gestation complications from increasing foetal weight were considered minimal.

CONCLUSIONS

Contrary to popular belief and visual impression, autumn saved pasture in the high country environment declined on average only 24% in herbage mass and 13% in OMD over four winters. Although by late winter approximately 50% of the sward was frosted the OMD for this component compared favourably with hay.

Pasture losses were greatest during periods of rain following frosting indicating the combination of frost and rain, or freeze and thaw, are the major factors in winter pasture deterioration in the high country.

Nitrogen did not reduce winter losses in pasture dry matter and OMD, however it can be used to delay closing dates by boosting autumn production.

The main effect of frosting in this environment, that is sward desiccation or loss of moisture, was advantageous because the energy cost to the animal of warming the consumed feed was reduced.

The grazing experiment demonstrated ewes could be maintained through the winter without supplementary feeding on autumn saved pasture on high country flats.

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