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WHAT IS THE MAKE-UP OF A **DRYLAND** PASTURE?

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Abstract

Summer grazing managements, spelling, set-stocking, fast or slow rotations and topping or no topping, did not influence herbage growth in autumn of Nui ryegrass pasture. The cause of pasture deterioration on dryland, previously suggested to be through summer overgrazing, now seems more likely to be an effect of autumn overgrazing, particularly if pastures have been attacked by Argentine stem *weevil* and drought is continuing from summer.

Low nitrogen fertility through often low fixation of nitrogen by clover, uncertainty of response of pasture to nitrogen fertiliser in cool season, and the effects from overgrazing, cause an extreme limitation in autumn-winter feed supply for stock in drought years. Feeding of silage in summer-autumn is advocated as a positive approach to this situation.

On sunny aspects of dry hill country, buildup of dead herbage through summer considerably reduces the quality of the subsequent cool season growth of grass in the herbage mass. Several attempts to establish oversown grasses for improved cool season yield have not been successful. Dry hill grassland thus provides a considerable challenge to effect much improvement beyond manipulating the quality of the existing vegetation by grazing management.

Keywords: Dryland pasture, grazing management, fertility, herbage quality

INTRODUCTION

In dryland areas of New Zealand, plant survival during protracted drought is usually not a problem. Rather, the emphasis is on the effect of management during drought on subsequent growth. Cocksfoot, prairie grass and red clover grow further into the drought period than do most ryegrasses, while some of the newer ryegrasses have enhanced recovery after drought. Drought has other important effects such as reduced clover growth indirectly affecting the nitrogen supply.

On dry, sunny aspects of unploughable hill country, the retention of herbage cover in summer is generally advocated for soil conservation purposes. The consequence of such accumulation of dead herbage on the subsequent feeding quality of the herbage mass needs to be known. Annual resident legumes, such as striated clover, because of their restricted growth season constitute a limitation in both feed production and nitrogen input.

This paper will consider two situations of dryland farming. First, the effects of grazing management and seed head removal in summer, on autumn growth of 'Grasslands Nui' ryegrass pasture, and the seasonal growth of white clover influencing nitrogen input, in the context of pasture growing on the Canterbury Plains, and second, the growth and feeding quality of Danthonia/striated clover grassland on dry, sunny aspect North Canterbury hills.

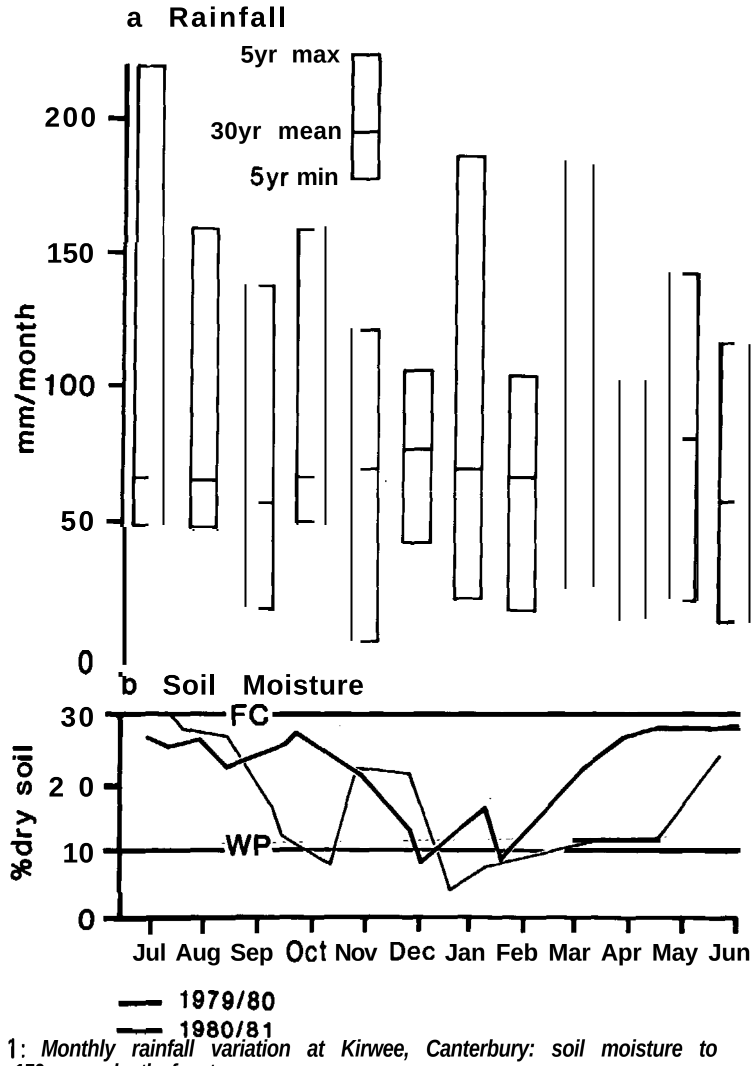

Fig. 1: Monthly rainfall variation at Kirwee, Canterbury: soil moisture to 0- 150 mm depth for two years.

LOWLAND PASTURES

Fig. 1 shows rainfall at Kirwee, Canterbury, was highly variable over the years when the experiments reported in this paper were conducted. Water stress may be severe and protracted as evidenced from the soil moisture contrasts given for two of those years.

Management of Pastures Prior to and During Drought

On dryland, ryegrass pastures are usually set-stocked from lambing in early August until November or December when lambs are drafted or weaned. Four management systems during summer drought were studied for 3 years on a Nui ryegrass/white clover pasture stocked at 14 ewes/ha.

(1) No grazing until end of summer, accumulating a maximum mass of 2.8 t D.M./ha when it was mob-grazed and insecticide applied to ensure autumn regrowth was unaffected by porina caterpillar; (2) set stocking; (3) fast rotation, a 3-paddock 15 day rotation system giving 4 cycles during summer; (4) slow rotation, a 3-paddock 45 day rotation system giving 2 cycles during summer. Over three years all treatments coincidentally ended just before autumn rains. Pasture recovery in the absence of stocking was measured after 6-7 weeks.

Table I: TOTAL HERBAGE RESIDUALS AND NEW GROWTH RECOVERY OF NUI PASTURE ON DRYLAND AT KIRWEE (t DM/ha)

	1977178		1978/79		1979180	
	Residual	Recovery	Residual	Recovery	Residual	Recovery
Not grazed (till days 75-90 of summer period)	0.5	0.7	0.6	0.8		0.8
Set Stocked	0.3	1.0	0.5	0.9	1.0	1.3
5-Day Rotation						
Sub-division (a)		0.8		0.9		1.1
(b)		0.7		0.8		1.2
(c)	0.4	0.6	0.4	1.1	1.4	0.8
15-Day Rotation						
Sub-division (a)		0.8		1.2		1.3
(b)		0.9		1.1		1.2
(c)	0.4	0.8	0.6	1.0	1.5	1.2
SED	0.07	0.13	0.18	0.22	0.21	0.23

Table I shows total herbage at the end of the summer treatments and subsequent regrowth. At all stages during drought grazing, residual herbage (to ground level) exceeded 0.3 t D.M./ha so that grazing was close, but not 'bared'. There were no significant effects of any treatment during drought on autumn regrowth. Korte (1981) reported a summer management influence on regrowth of pasture in the Manawatu, but that was with considerably higher amounts of growth in which effects of management on the tiller population could be expected.

This lack of any drought management effect suggested that controlling events occurred earlier in the season. One possibility was that flowering during the set-stocked grazing period would inhibit new tillering which would otherwise be susceptible to the effects of grazing managements in the ensuing drought. In the present circumstance with flowering under grazing, all that grazing management achieved in summer was a progressive depletion of the herbage mass, as there was negligible new growth.

To test this hypothesis, in another experiment a flowerhead removal treatment was imposed whilst Nui ryegrass pasture was set-stocked grazed during spring. Such grazing continued during summer drought and the pasture was spelled in autumn for regrowth measurement. Table 2 shows that in autumn 1981, there

Table 2: AUTUMN GROWTH OF RYEGRASS PASTURES ON DRYLAND NEAR LINCOLN (t DM/ha)

	to 15.4.81			to 15.4.82		
	Ryegrass	legume	dead	Ryegrass	legume	dead
Ryegrass:						
North Canterbury						
topped	0.9	0.01	0.6	0.3	0.01	0.4
not topped	0.6	0.02	0.5	0.3	0.01	0.8
Nui						
topped	0.6	0.02	0.5	0.3	0.03	0.3
not topped	0.6	-	0.6	0.2	0.02	0.4
Ruanui						
topped	0.5		0.6	0.09	0.04	0.3
not topped	0.5	0.01	0.7	0.1	0.05	0.4
SED	0.15	0.01	0.18	0.05	0.015	0.13

was no significant difference between topped and not-topped treatments. In 1982 after the severest drought in 100 years, again no treatment differences were shown. Consequently it appears that on dryland, if grazing in summer does not bare the pasture for long periods, it is insensitive to a wide range of grazing managements. More important is grazing management immediately after summer drought. Grass which has not tillered during drought, produces new tillers in autumn and should be treated similarly to the establishing phase of a new sowing. Yet such regrowth is expected to provide pre-mating greenfeed for ewes, because the timing of that requirement is, unfortunately, in the worst years close to the 'break' of drought. Unless silage and lucerne hay or Matua prairie grass is used for that period, pasture damage is inevitable.

A considerable amount of ryegrass on light land was severely damaged by Argentine stem weevil in the 1982 drought. Recent research has linked the weevil's preference for ryegrass with presence of *Lolium* endophyte (rejected) or its absence (attacked) (Mortimer et *al.* 1982). In the flowerhead removal experiment, previously mentioned, the ryegrasses had either high (North Canterbury), moderate (Nui) or nil (Ruanui) infection with endophyte. Ruanui ryegrass was damaged by Argentine stem weevil over summer 1982. thus influencing pasture regrowth in autumn (Table 2). That effect was not shown the previous autumn when Ruanui and Nui pastures yielded similarly.

(b) Soil Nitrogen

Because drought severely affects white clover growth, limitations in nitrogen fertility are often considerable on dryland. Table 3 shows the often low annual contribution of clover to total herbage yield. Even when there is vigorous clover growth in summer resulting from above-average rainfall, there is not necessarily a concomitant increase in nitrogen fixation. This is due to the poor vigour of the grasses in summer leaving soil nitrogen available for use by the clover (Hoglund & Brock 1978). The bulk of nitrogen fixation is in spring, and annual variation

Table 3: ANNUAL YIELD OF LEGUME AT TWO DRY SITES

	Yield (t DM/ha)	% of total herbage
Kirwee (after Crush 1979)		
1974175	4.7	40
1975176	2.7	33
(Hoglund unpublished)		
1978179	3.2	40
1979/80	2.2	23
198018 1	1.1	15
Masterton (after Crouchley 1979)		
1974/75	1.2	13
1975/76	2.2	18

Table 4: RAINFALL AND N-FIXATION AT KIRWEE

	Rainfall (mm) Aug-Sept	Nov-Feb	N-fixation (kg N/ha/annum)
1974175	237	344	106 (after Crush 1979)
1975/76	211	248	145
1978/79	227	227	162 Hoglund (unpub.)
1979/80	162	591	71
198018 1	62	368	6

in N-fixation is greatly influenced by spring rainfall (Table 4). In particular,' *the* protracted spring *drought of* 1980/81 *severely restricted* clover yield (Table 3) and N-fixation.

Low nitrogen fertility status suggests there should be a role for use of nitrogen fertiliser, but results from its use in autumn to boost cool-season grass growth on dryland have been unreliable. Soil temperatures below about 4 C preclude uptake of nitrogen (Hoglund 1980), and when rain occurs late there is often only a very short period in autumn when soil temperature exceeds 4°C. Responses in spring are more reliable.

(c) Management for Sheep Production

Lack of autumn-winter pasture growth through protracted drought, insect attack, autumn overgrazing, low nitrogen fertility and uncertainty of response to nitrogen fertiliser, provides extreme pressure in an all-grass livestock grazing system. Greater emphasis should be upon conserving surplus feed in spring as silage and this, along with lucerne hay, should be fed in summer and autumn rather than in winter. Maintenance of a high static body weight with such feeding would, for high fertility sheep, alleviate the need to 'flush' them in autumn, a feeding practice which is seen to be a contributory cause of pasture overgrazing in dry autumn years.

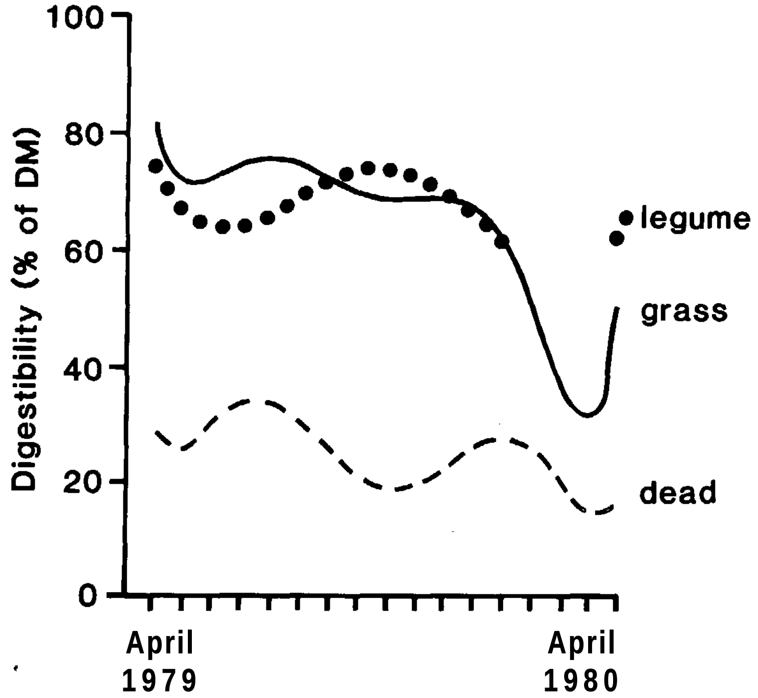

Fig. 2: *Quality of components of danthonia-striated clover grassland on sunny aspect hills, north Canterbury.*

SUNNY ASPECT HILL GRASSLAND

Sunny north-west aspect hill grassland in North Canterbury is normally under moisture stress from November to late February. On a site at about 450. m altitude, sampling of the danthonia/striated clover grassland showed in the year from April 1979-80, that herbage mass varied from 1 to 4 t D.M./ha. The *in-vitro* digestibility of the herbage (live plus dead) did not exceed 60%. The living tissues of both danthonia and striated clover maintained high digestibility for a considerable period (Fig. 2). There was a marked build-up of dead tissue as the flowering time of grass approached, and in this environment the dead tissue was carried through the summer drought. It was of very low digestibility and considerably diluted the effects of new growth in the total herbage mass in the subsequent cool season. There is a prime need to reduce the dead matter in this grassland, to enable better cool season growth of grass. Winter minimum temperatures on sunny aspect hill country at Waikari in North Canterbury did not fall below 10°C in 1979, well above the 4°C minimum for growth.

Attempts to improve cool season growth in this grassland by oversowing Maru phalaris, Matua prairie grass and Nui ryegrass along with subterranean and white clovers have not been successful. Glyphosate spray was necessary to remove the thick cover of danthonia. Uncertain dry weather conditions caused unsatisfactory grass and clover establishment, even with four successive sowings from autumn to late winter, leaving large areas of bare ground which.were gradually covered by sorrel and eventually danthonia. The resident striated clover germinates in autumn from the considerable amount of its seed buried in the soil. Whether other clovers can prevail is unproved. Striated clover is a very small-leaved legume, growing little until near its flowering in spring and then rapidly maturing and dropping leaf. A reassessment is being made of subterranean clover varieties for their adaptability to this environment.

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