GRAZING MANAGEMENT FOR THE IMPROVEMENT OF BROWNTOP PASTURES IN HILL COUNTRY : A PROGRAMME

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Abstract

The effects of summer spelling, frequency and severity of defoliation on improved pasture which had reverted to browntop dominance in spite of adequate topdressing were investigated on north-west and south-east aspects in North Wairarapa hill country pastures. Frequency and severity of defoliation affected both pasture production and botanical composition on the south-east aspect but had little significant effect on the north-west aspect. A pasture improvement programme based on the field trial results was devised and applied. The interim results of this programme are given.

INTRODUCTION

THE PROBLEMS of the hill country farmer are many and not the least of them is how to change browntop pastures into high producing swards. Levy (1970) saw fertilizer and stock, together with adequate management, as the means of achieving this end but now after three decades of aerial topdressing, during which time a considerable amount of phosphatic fertilizer has been applied, the hill country farmer still faces the same problems. His pastures are similar to those of the 1930s (Brougham *et al.*, 1973) before the advent of aerial topdressing in spite of his adherence to the often quoted formula of "more fertilizer and more stock". Obviously something has been overlooked and a series of trials were conducted in North Wairarapa to examine some of the effects of pasture management on hill country pasture.

EXPERIMENTAL

, Small plot (1.5 m x 1.0 m) pasture management trials were conducted on a yellow-brown earth soil of sandstone origin (10 to 20" slope) on north-west and south-east aspects during 1974-76. The effects of summer spelling, frequency and severity of defoliation were examined on pasture that had been sown down to perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) after cultivation and had then reverted to brown-

top (*Agrostis tenuis*). The pastures on the north-west aspect were browntop-*Notodanthonia* associations with low ryegrass/white clover content, whereas the pastures on the south-east aspect, though browntop dominant, nevertheless had a moderate proportion of ryegrass/white clover. About 240 kg/ha/yr of superphosphate had been applied to the trial pastures over 9 years together with 900 kg/ha lime and some molybdenum. Soil test pH was 5.5 on both aspects and soil test phosphate was 19 and 10 on the north-west and south-east, respectively,

The effects of frequency/severity of defoliation and summer spelling were examined in separate trials. In the summer spelling trials pastures were cut as for treatments (3) and (5) of the frequency/severity trial treatments listed below.

(1) Pasture cut every 2 weeks (severe defoliation).

(2) Pasture *cut* every 4 weeks (severe defoliation).

(3) Pasture cut when 2-4 cm high (severe defoliation).

(4) Pasture cut every 4 weeks (lenient defoliation).

(5) Pasture cut when 6-8 cm high (lenient defoliation) .

Dry matter production was determined by cutting entire plots to 3 to 4 cm (lenient defoliation) or 0.5 to 1.0 cm (severe defoliation) with a shearing handpiece. Regrowth on the frequent severely defoliated plots was often poor and cuts were not taken if there was very little or no growth.

All plots were cut to 0.5 to 1.0 cm at the commencement in November 1974 and again at the completion of the trials in December/January 1975-76. Core samples (5 cm diameter) were used to determine botanical frequency and density. Angular transformations were performed on all the frequency of occurrence data.

RESULTS AND DISCUSSION

On both aspects at the completion of the trials, the occurrence of most species on the 2-weekly severe defoliation treatment was similar to that at the commencement (Table 1). However, the occurrence of white clover was higher on the north-west aspect as was the occurrence of browntop and weeds on the south-east aspect. The higher occurrence of the white clover on the north-west aspect can probably be attributed to the absence of selective defoliation under cutting. The increase in browntop and weed occurrence under the 2-weekly severe defoliation treatment on the south-east aspect is also probably the result of cutting. It is likely, in view of the small botanical change under this treatment, that it approximates the normal management of these pastures.

TABLE 1: EFFECT OF FREQUENCY AND SEVERITY OF DEFOLIATION ON PASTURE PRODUCTION AND BOTANICAL COMPOSITION ON TWO ASPECTS (JANUARY 1976)

Treatment	*No. Defol.*	*DM (kg/ha)*	*%Occurrence*[1] *LOl*[2]	*ASte*	*TRre*	*Weeds*
NORTH-WEST ASPECT						
Commencement			13	75	21	43
1. 2 wk severe	10	4 500 a[3]	14 a	73 a	35 a	37 a
2. 4 wk severe	8	4 050 a	15 a	70a	40 a	32 ab
3. 2-4 cm severe	3	4 730 a	19 a	73 a	40a	28 ab
4. 4 wk lenient	4	5 090 a	16 a	60 a	45 a	14 b
5. 6-8 cm lenient	2	4510a	22 a	68 a	47 a	17b
SOUTH-EAST ASPECT						
Commencement			46	67	63	52
1. 2 wk severe	17	557oc	48 b	79 a	62 b	67 a
2. 4 wk severe	11	6840b	53 b	76 a	64 ab	58a
3. 2-4 cm severe	8	9710a	58 b	68 a	77 a	56a
4. 4 wk lenient	10	9670a	73 a	69 a	69 ab	25 b
5. 6-8 cm lenient	4	9480a	65 ab	69 a	70a	26 b

[1] Angular transformation used.
[2] LOl = perennial ryegrass, ASte = browntop, TRre = white clover.
[3] Duncan's Multiple Range' Test: means without a common letter differ significantly.

The only significant treatment difference on the north-west aspect was a reduction in weed occurrence under lenient defoliation but, though not significant, the occurrence of ryegrass and white clover tended to increase and that of browntop decrease under lenient defoliation (Table 1). On the south-east aspect the occurrence of ryegrass increased and weeds decreased under lenient defoliation while the occurrene of white clover increased in response to both reduced frequency of severe defoliation and lenient defoliation. Browntop tiller numbers were reduced significantly by 50% under lenient defoliation and, while not significant, its occurrence was also reduced.

Harris and Rougham (1968) and Harris (1973) considered that browntop is suppressed when shaded by ryegrass and white clover in lenient rotational grazing or infrequent cutting regimes. Such shading was probably the cause of the lower tiller numbers under lenient defoliation on the south-east aspect. A reduction in frequency and severity of defoliation on both aspects appears to have allowed fuller expression of the more erect growth habit of ryegrass and white clover. This has resulted not only in the strengthening of these species but also in the suppression of

browntop, moss, and many weeds because of their more prostrate growth habit. Such suppression through shading created sites for occupation by improved species and obviously, the higher the proportion of improved species in a sward, the quicker change will take place.

TABLE 2: EFFECT OF SUMMER SPELLING ON PERCENTAGE OCCURRENCE AND DENSITY OF WHITE CLOVER ON TWO ASPECTS (JANUARY 1976)

	North-west		*South-east*	
	% Occurrence[1]	*Rooted Nodes/ 0.1 m²*	*% Occurrence*[1]	*Rooted Nodes / 0.1 m²*
Main effect				
Commencement	*38*		*63*	
Summer spell	*62* a	392 a	*73* a	239 a
No spell	*53* b	*246* b	*72* a	*247* a

[1] Angular transformation used.

Summer spelling had a beneficial effect on white clover occurrence and density on the north-west but not the south-east aspect (Table 2). Such a result possibly suggests a management by aspect interaction whereby white clover survival and persistence under conditions of high summer temperatures and prolonged moisture deficit on north-west aspects are enhanced by the absence of defoliation. In contrast, on the south-east aspect's where moisture is less limiting, defoliation has no effect. Suckling (1959) also found summer spelling to be advantageous on oversown pastures through strengthening of the legume content.

While the botanical composition of the north-west aspect pastures was altered by management, dry matter production was not, whereas on the south-east aspect both reduced frequency of severe defoliation and lenient defoliation gave higher production (Table 1). A relatively high proportion of ryegrass and white clover therefore seems to be required before frequent severe defoliation has any detrimental effect on pasture production. Perhaps Suckling's (1954, 1959) findings that set-stocking was not inferior to rotational grazing can in part be attributed to the relatively low ryegrass/white clover contents of the pastures. Many research and extension personnel advocate the use of rotational grazing (Brougham, 1970; Smith et al., 1976), although Suckling (1959) was an advocate of set-stocking for hill country. The results obtained in these trials suggest that changing from a set-stocking management policy to rotational grazing on dominant

browntop pastures will not lead to an immediate increase in pasture production unless the pasture has a high proportion of ryegrass/white clover, but that changes in botanical composition will occur.

A programme for hill country pasture improvement in the Wairarapa was devised from the results of the small plot trials and evaluated on a larger scale. A 9 ha paddock was divided, one half being managed as outlined in the programme (Table 3) and the other half in a more traditional manner. The paddock was uniformly browntop-dominant prior to initiation of the programme in spite of adequate topdressing in the past, but still retained small undeveloped ryegrass and white clover plants. The objectives of the programme were to utilize:

(1) The different growth rhythms of ryegrass, white clover and browntop.

(2) The sensitivity of pasture species to defoliation soon after the commencement of active growth.

(3) The beneficial effects of lenient defoliation through increasing ryegrass/white clover and decreasing browntop.

(4) The beneficial effect of summer spelling on white clover content on dry faces.

TABLE 3: DEVELOPMENT PROGRAMME

Date	*Operation*
Mid-August	Hard graze sheep; apply 20 units N
	I
	spell
	I
Mid-October	Graze cattle
Mid-November	Graze cattle
	I
	spell
Early Autumn	Graze cattle
Late Autumn	Graze cattle and sheep (clean up pasture)
	I
	spell
	I
Early Spring	Graze cattle
Spring	Graze ewes and lambs (set-stocked)
	spell
	I
Early Summer	Graze sheep and cattle (40-45 day rotation)

The application of nitrogen in late winter/early spring followed by a spell was to encourage ryegrass growth in every way possible and at the same time to shade browntop. The grazing in mid-October was designed to coincide with the commencement of browntop growth and the use of cattle only was considered necessary to ensure that only lenient grazing occurred so that all the beneficial effects of lenient grazing, reduction in browntop tiller numbers, increase in ryegrass tiller numbers, and the creation of sites for invasion by improved species could be realized. The grazing in mid-November was to ensure complete control of the browntop flush and also to ensure that sufficient moisture would be available for white clover to make plenty of vegetative growth before normal summer drying out occurred. After the summer spell for strengthening the clovers, cattle grazing was still considered necessary so that any young ryegrass tillers would not be hard grazed during the usual wet and dry cycles of autumn. At the end of autumn, once the soil was moist the sheep and cattle grazing was designed to ensure that the ryegrass plants received adequate light for tillering and so change the dominance from white clover to ryegrass. The remainder of the programme was designed to bring the area back into normal farm practice and yet retain whatever improvement had taken place.

The pastures on which this programme was evaluated were not as good as those on the south-east aspect previously described but were better than those on the north-west aspect. The interim results, which were obtained from core samples taken at regular intervals over four transects, are those that were expected (Table 4) with an increase in ryegrass and white clover occurrence and a decrease in browntop occurrence on the treated paddock.

There can be no doubt that rapid improvement of hill country pastures can be achieved by the introduction of grazing management programmes designed for this purpose and equally there can be no doubt that "more fertilizer and more stock" alone

TABLE 4: PERCENTAGE OCCURENCE, JANUARY 1976

	Management	
	Traditional	*Progrumme*
Ryegrass	20	57
Dogstail	49	55
Browntop	80	58
White clover	39	74
Sub. clover	60	18
Weeds	37	30
Moss	72	60

without concurrent changes in pasture management will not achieve this result. Brougham *et* al. (1973) came to the same conclusion.

It must be emphasized that the improvement programme outlined was designed for rapid improvement and is not yet fully proven. Obviously, it could only be applied to a small area of a farm at any one time. However, perhaps the most important finding of this investigation is that the frequency and severity of grazing must be reduced if pasture improvement is to take place and any system that allows relatively long spelling of pastures between grazings (Smith et al., 1976) and which preferably raises the grazing height will result eventually in pasture improvement provided that previous topdressing has been adequate and the required species are present. If sufficient numbers of paddocks are available and the cattle policy makes it feasible, then a cattle-only rotation is likely to speed up the rate of pasture improvement considerably.

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