
SOME EFFECTS OF GRAZING DURATION AND SUB-DIVISION ON PASTURE UTILIZATION IN HILL COUNTRY

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Abstract

In hill country, imbalance in feed supply and demand, and animal preference for favoured pastured types and localities result in variable utilization of pasture by grazing animals. The effects of grazing duration (3, 6, 9, 12, 15 days), and easy/ steep land area ratio, on utilization patterns of pasture grazed by sheep were assessed in two experiments (late summer, mid-winter) at Whatawhata Hill Country Research Station. Where feed allowance was equal and post-grazing residuals of < 1.0 t DM/ha were achieved, greater pasture utilization (DM per ewe grazing day) occurred with longer duration/ lower stock density combinations. Consequently, for these combinations, low pasture mass was achieved relatively earlier and final utilization was more uniform. In both experiments there was a preference by stock to graze pasture on easy rather than steep land. This preference was greater during early stages of the grazing period, with longer grazing durations, and when the paddock was dominantly steep. The implications of the results to farming practice are discussed.

INTRODUCTION

Seasonal imbalances between pasture growth and animal demands cause major variations in pasture utilization in allgrassland farming. In hillcountry, additional variation is commonly encountered as a result of preferential grazing of different land classes (aspect, slope, fertility) and plant types (size, species, quality).

Uniform and controlled pasture utilization is a major aim of different stock policies, conservation methods and grazing systems. In hill country, improved stock control and reduced paddock variability can be achieved by subdividing preferred from rejected areas; by combining complementary stock classes; and by mobbing stock through the use of deferred grazing systems; (Suckling, 1959, 1975). While the benefits of separating sunny and shady aspects are recognised, similar information on the contour fencing of easy from steep land classes is not available. The importance of grazing duration within rotational grazing systems has been speculated upon (Smith and Dawson, 1977) but the direct effect of simultaneously reducing grazing duration and increasing stock density on pasture utilization has not been reported. To examine the effects of land class variation and different grazing duration/stock density combinations on pasture utilization, two experiments were established at Whatawhata Hill Country Research Station in areas that contained both easy rolling land and steep, tracked hillsides. This paper reports on these two experiments.

EXPERIMENTAL

SUMMER EXPERIMENT: (20/2/80 to 3/3/80)

The paddocks used in this experiment were of a similar NW aspect and as there were no major dissecting streams or gullies all areas were easily accessible to grazing stock. The experimental area was stratified into two land classes, viz: flat and rolling contoured land with predominantly ryegrass-white clover pastures (Easy E); and steep hill-sides (25-30° slope) containing stock tracks and inter-track zones with pastures dominated by browntop, annual grasses and annual legumes (Steep S). Using electric fencing, paddocks containing E/S surface area ratios of 0/100, 25/75, 50/50, 75/25 and 100/0 were formed. Individual paddock areas ranged from 0.4-1.0 ha. Four paddocks of each land combination were established and allocated to one of four grazing duration treatments; 3, 6, 9 and 12 days.

All paddocks were grazed in early January and then spelled until 20/2/80. For three weeks prior to the start of the experiment, pasture growth rates were estimated (trim technique) to be 45 and 9 kg DM/ha/day for easy and steep sites respectively and were assumed to equate with pasture growth during the subsequent two week experimental period. Simultaneously, four ewe mobs were preconditioned to the grazing durations to which they were subsequently allocated.

A common pasture allowance of 2 kg DM/ewe grazing day was used in calculating stock requirements for each paddock. Consideration was therefore given to differences in paddock size, E/S ratio, initial pasture mass, assumed pasture growth rates and grazing duration. Stock densities ranged between 29-49 ewes/ha and 87-115 ewes/ha for the respective 3 and 12 day grazing durations.

Initial pasture mass (kg DM/ha) and that after 33%, 66% and 100% of the grazing duration was estimated for both land classes in each paddock by taking 30-50 visual ratings which were calibrated to ground level cuts. Pasture sampled from visual rating areas was bulked and dissected into total green leaf, grass stem and dead material. Percentage green leaf at the beginning and end of grazing was 41% and 19% for easy and 34% and 14% for steep land zones.

WINTER EXPERIMENT: (25/6/80 to 10/7/80)

The structure and operation of this experiment was very similar to that of the summer experiment. Paddocks of 25/75, 50/50 and 75/25 easy/steep ratios were established and grazing durations of 3, 6, 9, 12 and 15 days were compared. Mean pasture growth rates were estimated as being 19 and 6 kg DM/ha/day on easy and steep land respectively. A common pasture allowance of 2 kg DM/ewe grazing day was again used, and stock densities ranged between 28-33 ewes/ha and 59-76 ewes/ha for the respective 3 and 15 day grazing durations. Percentage green leaf at the beginning and end of grazing was 84% and 60% for easy and 71% and 48% for steep land zones.

RESULTS

SUMMER EXPERIMENT

Initial pasture mass ranged from 2.5-3.1 t DM/ ha on easy and 1.7-2.3 t DM/ ha on steep land classes and at the completion of grazing, the respective residuals were 1.1-1.5 t DM/ ha and 0.7-1.0 t DM/ ha. Throughout the experiment, pasture utilization rates (kg DM/ewe day) were greater with longer grazing durations and lower stock densities (Figure 1 A). The effect was most apparent for pastures on easy land and during the early stages of grazing when pasture allowance and utilization rates were high.

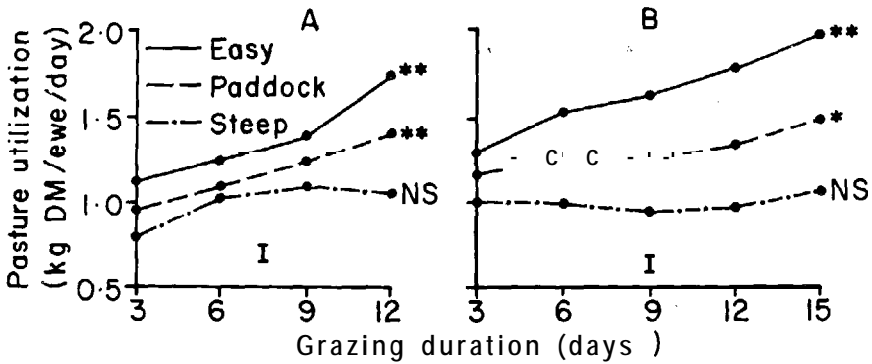


FIG. 1: Mean pasture utilization rates (kg DM/ewe day) on easy and steep land zones, and on a paddock basis, as influenced by grazing duration (days) in the summer (A) and winter (B) experiments. S. E. D. bars and statistical significance levels (* $P < .05$; ** $P < .01$) are presented for within line comparison.

In most duration treatment, the percentage utilization of pasture on easy land was generally similar to that of pasture on steep land. Consequently, the ratios of % easy pasture utilization: % steep pasture utilization were approximately unity, although they tended to increase for the longer grazing durations (Figure 2A). Therefore, for longer duration/lower stock density combinations, there was a greater preference to graze pasture on easy land zones.

Easy-steep % utilization ratios decreased as the proportion of easy land within a paddock increased (Figure 3A). Where easy land was in the minority, there was a greater preference to grazing it, rather than pasture on the dominant steep land. The degree of this preference was similar throughout the grazing periods.

WINTER EXPERIMENT

Pasture mass at the start of this experiment ranged from 1.9-2.4 t DM/ ha on easy and 1.4-1.8 t DM/ ha on steep land classes and at the completion of the grazing treatments, residual mass ranged from 0.6-0.8 t DM/ ha and 0.5-0.7 t

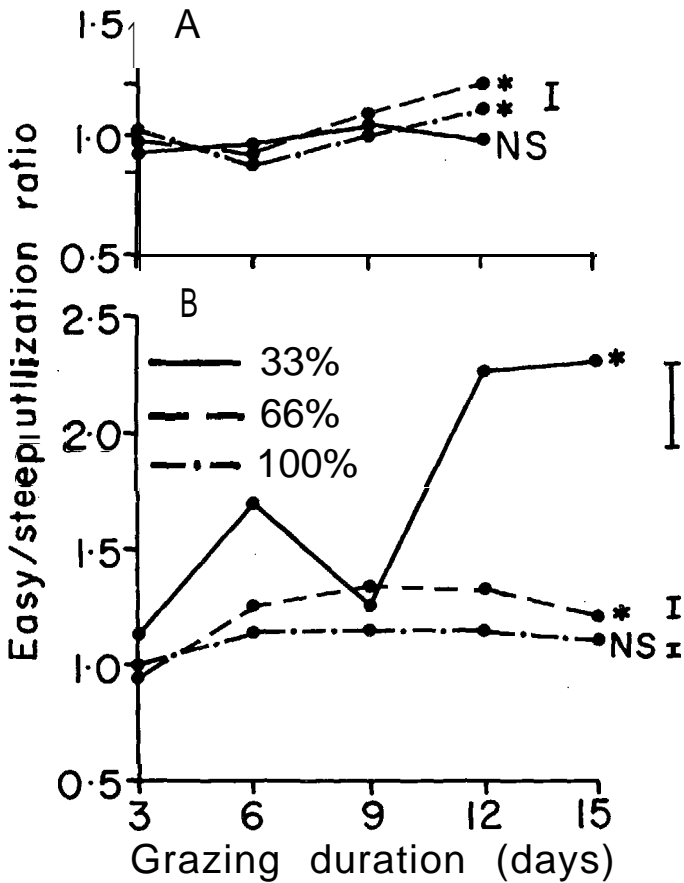


Fig. 2. Easy — steep % utilization ratios for three similar time periods (i.e. after 33%, 66% and 100% of the full grazing duration), as influenced by grazing duration in the summer (A) and winter (B) experiments.

DM/ ha respectively. As in the summer experiment, mean pasture utilization rates for the full grazing period were greater with longer duration/lower density combinations (Figure 1 B). Again this was most evident for pasture located on easy land zones. As indicated by the easy-steep % utilization ratios, there was a strong preference by stock to graze pasture from easy land zones during the early stages, particularly for the longer grazing durations/ lower stock density combinations (Figure 2B). As grazing continued, the preferential removal of pasture from easy land declined and by the end of the duration treatment, easy-steep % utilization ratios approached unity.

The marked preference towards easy land during the early stages of grazing occurred in all paddocks irrespective of the easy-steep area ratios (Figure 3 B).

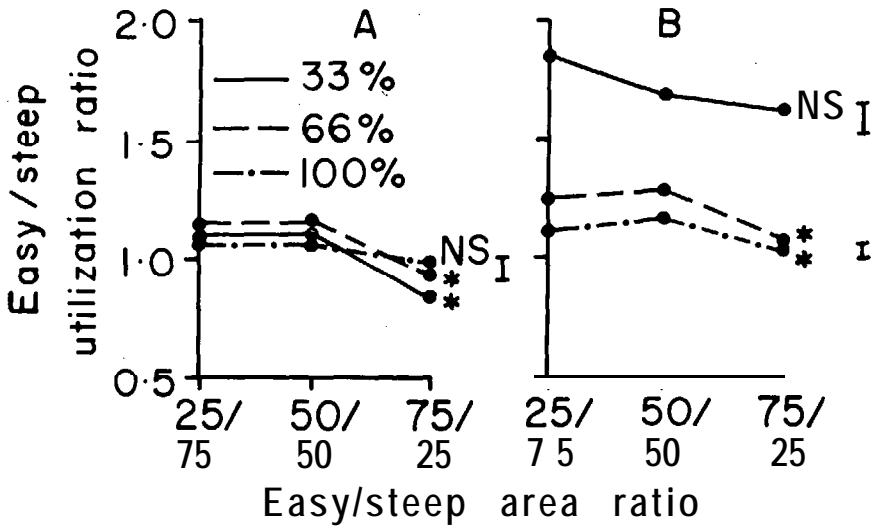


FIG. 3: Easy/steep utilization ratios for three similar rime periods (i.e. after 33%, 66% and 100% of the full grazing duration), as influenced by easy/steep area ratios in the summer (A) and winter (B) experiments.

This preference was most apparent in the 25/75 paddocks compared with those where areas of easy land were dominant. At the completion of the duration treatments, E-S disappearance ratios approached unity, although there was still a trend towards a reduced preference of easy land where it was the major land class within the paddock.

DISCUSSION

Under the conditions of these experiments, the mean disappearance of pasture on a ewe-day basis was greater where grazing durations were lengthened and stock densities reduced. The implications of these relationships to pasture mass levels are depicted in Figure 4. With longer grazing duration treatments, a more rapid decline in pasture dry matter levels occurred, and as a consequence, low pasture masses were reached relatively earlier during their grazing period. For example, in the summer experiment pasture levels occurring after only eight days of the twelve day grazing duration were similar to the final pasture residuals at the completion of the three day grazing duration.

Although a mean pasture allowance of 2 kg DM/ewe day was common for the full term of all grazing durations, it must be recognised that daily allowance levels were much greater during the early stages of grazing, particularly within longer duration treatments (Table 1). If the "diminishing returns" relationship that exists between pasture allowance and animal intake is considered (Allden and Whittaker, 1970; Hodgson, 1976; Rattray et al.,

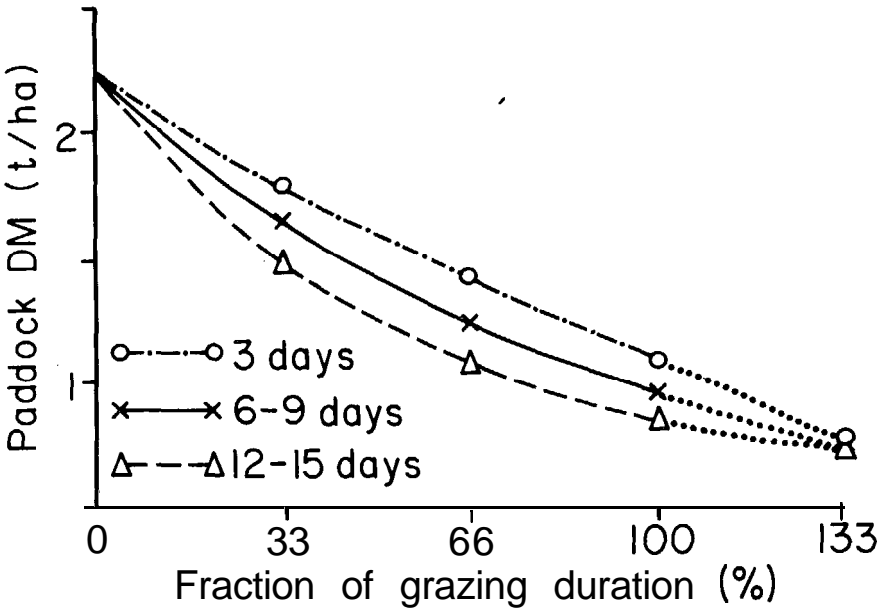


FIG. 4: A stylized representation of paddock dry matter levels for similar relative time periods, as influenced by contrasting grazing durations..

TABLE 1: MEAN DAILY PASTURE ALLOWANCE FOR DIFFERENCE GRAZING TIME PERIODS WITHIN CONTRASTING GRAZING DURATIONS (kg DM/ewe day)

Full-term Grazing Duration	Number of Grazing Days											
	1	2	3	4	5	6	7	8	9	10	11	12
3	6.0	3.0	2.0	—								
6	12.0	6.0	4.0	3.0	2.4	2.0	—	—			—	—
12	24.0	12.0	8.0	6.0	4.8	4.0	3.4	3.0	2.1	2.4	2.2	2.0

1979) it becomes apparent that the high initial allowances of the longer duration treatments allow maximum daily intakes to occur over a much longer relative time period. This means that restrictions in pasture intake by ewes will occur relatively earlier within shorter grazing durations, particularly where pasture quality is low as was evident in the summer experiment. Towards the end of long grazing durations, intake becomes restricted by low pasture dry matter levels and further utilization of pasture is minimal. Obviously, if grazing continued past the full-term of all durations then similar residual pasture levels may be achieved for all grazing durations (see extrapolation Figure 4).

The practical implications of these results is that for any one grazing of a paddock, pasture residuals of 051.0 t DM/ha will be reached relatively

earlier with longer grazing durations. If the full-term of these 9-15 day durations is adhered to, previously rejected areas will be grazed and within-paddock uniformity will be improved. If however, grazing for a further 3-4 days at sub-optimal pasture levels promotes the tendency to move stock relatively earlier, then long duration -- low stock density combinations will result in reduced rationing and allocation power and the likely collapse of a controlled grazing system. As grazing durations are shortened, the grazing system and its manager, as opposed to the grazing animal, exerts an increasing amount of control on the allocation and utilization of pasture.

In both experiments there was a general trend towards preferential grazing of pasture on easy rather than steep land zones. This preference was encouraged by longer duration/lower density combinations and was particularly obvious during the early stages of the winter experiment. Where pasture offered per ewe is increased, whether through higher initial mass, lower stock densities or longer grazing durations, the opportunity for preferential grazing is enhanced. More equitable grazing between the preferred easy and the rejected steep land zones was achieved with shorter durations/ higher stock density combinations.

TABLE 2: EFFECT OF EASY/STEEP AREA RATIOS ON THE RESIDUAL MASS OF PASTURE ON EASY AND STEEP LAND AT THE END OF GRAZING (kg DM/ ha)

		Easy/steep area ratios				
		0/100 Initial Mass	25/75	50/50 Residual Mass	75/25	100/0
<i>Summer Experiment</i>						
Easy	2500		750	810	980	1120
Steep	2000	7.50	940	990	1050	--
<i>Winter Experiment</i>						
Easy	2000	--	500	600	650	--
Steep	1500	--	610	670	660	

In both experiments, the preferential grazing of pasture on easy land decreased as the ratio of easy/steep areas increased. The implications of this relationship are well illustrated in Table 2. Using pasture disappearance rates/ewe day from both experiments, it is evident that differences between pasture residuals on easy and steep land increase as the relative area of preferred easy land decreases. As a consequence, paddocks containing relatively low proportions of easy land are likely to promote higher utilization of preferred easy and lower utilization of rejected steep land zones. More uniform pasture utilization can be expected in paddocks with higher preferred/ rejected area ratios. In these experiments, this related to easy versus steep land, but the same principle may well hold for other preference factors such as aspect and plant type.

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