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## PASTURE UTILISATION AND ITS EFFECT ON HERBAGE QUALITY

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### Abstract

An existing grazing trial on an irrigated Wakanui silt loam at Lincoln College, Canterbury, was sampled at five consecutive grazings (January to July, 1983) to determine the effects of pasture utilisation on herbage composition and *in vitro* digestibility of regrowth.

Rotational grazing of sheep at two stocking rates, high (27.5 ewes/ha) and low (17.5 ewes/ha), resulted in different levels of utilisation. Low utilisation (27%) produced a sward with a high dead material content (44%) and low *in vitro* digestibility of the whole sward (<70%). The high stocked sward (utilisation, 60%) had a greater percentage of green material (83%) but total green yields were only half those at the low stocking rate. The *in vitro* digestibility of the sward under the high stocking rate was >70%, mainly as a result of only a small proportion of dead material with low (46%) digestibility.

**Keywords:** pasture utilisation, herbage composition, dead matter, green herbage yield, *in vitro* digestibility, stocking rate.

### INTRODUCTION

High quality pastures are a major requirement for maximising animal production. In practice this is a highly digestible sward dominated by leafy herbage, especially white clover (*Trifolium repens*), with a low proportion of stem and dead material. The presence of these latter components may interfere with animal grazing and reduce intake (Dudzinski & Arnold, 1963; Hodgson, 1982; Rattray, 1978; Thomson, 1977).

Digestibility of the whole pasture is a function of the sward components present, especially dead material (Rattray, 1978). The composition and structure of a sward can be manipulated by the grazing management imposed on it (Brougham 1981). If grazing is lax, especially during spring, dead and stemmy material will accumulate in the sward (Campbell, 1964; Hunt, 1965; Korte, 1982; Rattray & Jagusch, 1978).

Strategic "close" grazing will allow light in to the sward base and stimulate tillering (Brougham, 1960a) and subsequent leaf growth (Langer, 1973). However, if grazing is continually close, total pasture production may be reduced (Brougham, 1960b; Harris, 1978).

Grazing management is thus a compromise between close grazing to produce a high quality leafy sward and overgrazing to the extent of reducing green leaf yield.

The aim of this experiment was to measure the effects of differing levels of pasture utilisation during grazing on the quality of herbage regrowth.

### METHODS

The trial was located at Lincoln College, Canterbury, on a Wakanui silt loam. Two paddocks, which had been sown in "Grasslands Nui" perennial ryegrass (*Lolium perenne*) and "Grasslands Huia" white clover 5 years previously, were rotationally grazed with sheep. The grazing management treatments, high stocking rate (HSR) at

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27.5 mixed age Coopworth ewes/ha and low stocking rate (LSR) at 17.5 ewes/ha, had been imposed for eight months before measurements began. However, it should be noted that stocking density (ewes/ha during grazing, Hodgson, 1979) was considerably higher than the overall stocking rate, as shown in Table 1. Thus the two 0.2 ha paddocks were vastly different at the start of measurement in January 1983. Samples were taken at every grazing until July (Table 1).

Table 1: SAMPLING DATES AND STOCKING DENSITY (EWES/HA)

| Sample | Harvest date |            | Grazing period<br>(days) | Stocking density |     |
|--------|--------------|------------|--------------------------|------------------|-----|
|        | pre-graze    | post-graze |                          | HSR              | LSR |
| 1      | 17/11        | 25/11      | 7                        | 165              | 105 |
| 2      | 16/2         | 25/2       | 8                        | 330              | 210 |
| 3      | 31/3         | 7/4        | 6                        | 330              | 210 |
| 4      | 26/4         | 30/4       | 4                        | 330              | 210 |
| 5      | 5/7          | 11/7       | 8                        | 1320             | 840 |

Because of a declining **herbage** mass gradient away from the fence between the two paddocks, only one half of each paddock (adjacent halves) was sampled. Twenty 1 m x 0.085 m samples were cut to ground level with a shearing handpiece, from random positions within a grid pattern. Before and after grazing, adjacent cuts taken for **herbage** mass (HM) estimates and botanical composition were bulked and washed, then either dried and weighed or separated into components before drying and weighing. *In vitro* digestibilities, using the modified method of Tilley & Terry (1963), were carried out on the whole sward samples and on individual components, including dead matter.

## RESULTS

The average utilisation at grazing throughout the trial was significantly greater ( $P \leq 0.01$ ) for the HSR (60%) than the LSR (27%) treatment (Table 2). There was always more **herbage** left after grazing (residual **herbage** mass) in the LSR sward (Table 2).

The HSR treatment produced swards with a high percentage of live material (average 83%), but yields of green material were less than on the LSR sward (Fig. 1). In the LSR sward, dead material comprised nearly half (average 44%) of total **herbage** before every grazing (Fig. 1).

Table 2: UTILISATION (%) AND RESIDUAL HERBAGE MASS (kg DM/ha) FOR BOTH STOCKING RATES OVER ALL SAMPLING PERIODS.

|              |     | Sample |      |      |      |      |
|--------------|-----|--------|------|------|------|------|
|              |     | 1      | 2    | 3    | 4    | 5    |
| Utilisation' | HSR | 62     | 63   | 67   | 27   | 79   |
|              | LSR | 30     | 25   | 25   | 14   | 42   |
| Residual     | HSR | 600    | 440  | 590  | 690  | 290  |
|              | LSR | 2900   | 2310 | 2950 | 2690 | 1920 |

$$\text{'Utilisation (\%)} = \frac{\text{Herbage Mass before grazing} - \text{Residual Herbage Mass}}{\text{Herbage Mass before grazing}} \times 100$$

*In vitro* digestibility of the whole sward and the dead material within the sward, was always lower for the LSR treatment (Table 3). There were no differences in digestibility of the green material components between the two stocking rates.

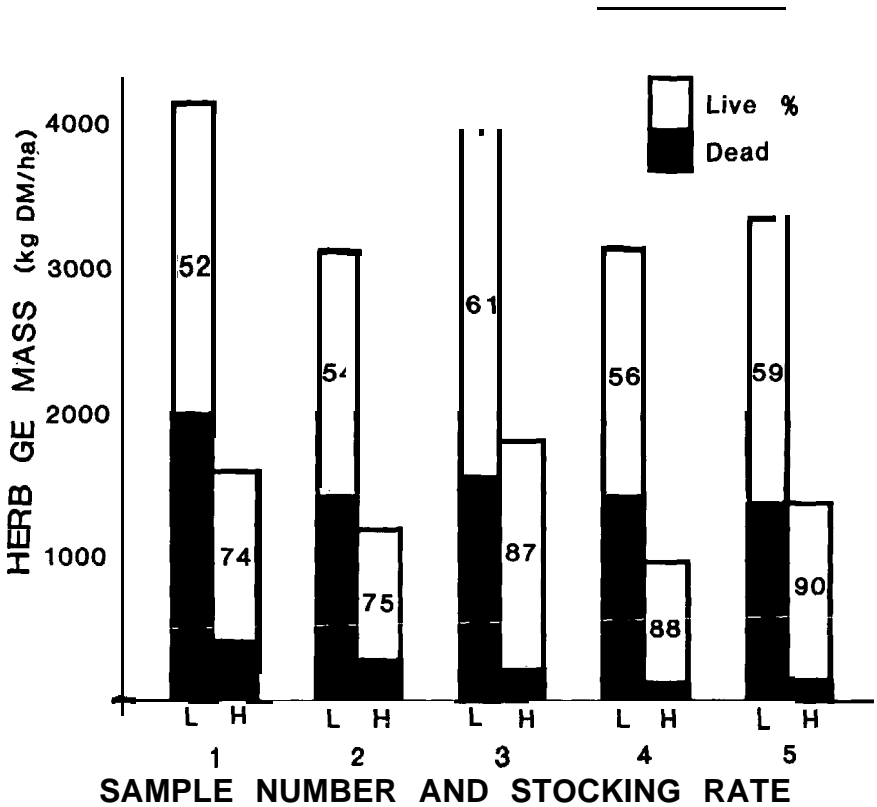


figure 1: *Herbage* mass and percentage live and dead *herbage* before grazing at each sampling period for low (L) and high (H) stocking rates.

Table 3: *IN VITRO* DRY MATTER DIGESTIBILITY (%) OF THE WHOLE SWARD AND THE DEAD MATERIAL COMPONENT FOR HIGH AND LOW STOCKING RATES OVER THREE SAMPLING PERIODS.

|               | Sample 3 |      | Sample 4 |      | Sample 5 |      |
|---------------|----------|------|----------|------|----------|------|
|               | HSR      | LSR  | HSR      | LSR  | HSR      | LSR  |
| whole sward   | 73.6     | 70.2 | 76.3     | 62.6 | 82.7     | 62.0 |
| dead material | 46.2     | 38.9 | 44.9     | 35.8 | 48.2     | 40.0 |

Regression analyses showed that increasing dead material digestibility (DD) increased the digestibility of the whole sward (SD) (Equation 1). Reducing the percentage of dead material (DM) in the sward had a similar effect (Equation 2). These factors are also associated through the observation that dead material digestibility decreased as the percentage of this component in the sward increased (Equation 3).

$$SD = 8.57 + 1.48 DD, r^2 = 0.73, P \leq 0.05 \dots\dots\dots 1$$

$$SD = 83.0 - 0.4 DM, r^2 = 0.77, P \leq 0.10 \dots\dots\dots 2$$

$$DD = 49.8 - 0.3 DM, r^2 = 0.90, P \leq 0.01 \dots\dots\dots 3$$

### DISCUSSION

The two stocking rate treatments caused a considerable difference in pasture quality prior to and during the measurement period. The differences were due to the effects of contrasting utilisation during grazing and residual *herbage* mass.

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The main difference in pasture composition was the greater amount of dead material in the LSR treatment. This may be regarded as a result of the four factors: (1) Because of the higher residual **herbage** mass of the low stocked sward (Table 2), the potential for dead material to accumulate before the next grazing was greater. Korte & Sheath (1979) considered that a large proportion of **herbage** left ungrazed was incorporated into the dead fraction before the subsequent grazing. However, it must be realised that much of the residual **herbage** will remain alive until the next grazing, while it is probable that some **herbage** dying after grazing has decomposed before the next sample is taken.

(2) It is likely that in spring, reproductive development of **ryegrass** proceeded without interruption in the LSR sward. Although no measurements were made, initial observations of dead **seedhead** numbers, and extrapolation from the work of Korte (1982), Korte & Sheath (1979) and Korte, Watkin & Harris (1982), indicate that spring grazing management of the LSR sward allowed reproductive apices to develop and form seedheads. These were subsequently rejected by the animals and became a component of dead material in January and the following months. Reproductive development in the HSR sward was prevented by the removal of the stem apex during spring grazing, so that no seedheads were produced to be incorporated into the subsequent dead fraction of the sward.

(3) The greater green **herbage** mass of the LSR sward allowed the animals an opportunity to refuse the dead material as described by Dudzinski and Arnold (1973), Rattray (1977) and Thomson (1977). This would have led to a relatively higher accumulation of dead material in the LSR treatment.

(4) The decomposition of dead material may have been slower in the LSR sward. O'Connor (1966) suggested that at higher stocking rates, nutrient cycling is more rapid. In this experiment, at the low stocking rate, nutrients for microbial activity may be limiting, slowing up the decomposition of dead material. The dead matter of the LSR sward contained more stem residues (unquantified observations) which, with a higher lignin content (Woodman *et al* 1931) would be harder to break down.

That increasing dead material content of a sward decreases the total digestibility (Equation 2), is well understood. Rattray (1978) discussed the inverse trend: that increasing the proportion of green material increased the whole sward digestibility. These relationships result from the low digestibility of dead material, such that its proportion in the sward has a large effect on total digestibility.

From Equation 3 it seems that management resulting in an accumulation of dead material also affects the chemical and structural composition of the material so that its digestibility is reduced.

Fig. 1 illustrates the conflict between quality and quantity. The HSR sward could be regarded as high quality **herbage** with its large percentage of green and low amount of dead material. However, because the total mass of green leaf was low, growth rates were probably slower (Parsons & Leafe 1981), so the absolute yields of green **herbage** were less than in the LSR sward. On the other hand, if the composition and structure of the LSR sward, in particular the percentage of dead material, affects the grazing behaviour and intake by animals (Dudzinski & Arnold 1963; Rattray 1978), this sward may not give greater animal production than the HSR sward, despite the greater amount of green **herbage** present.

## CONCLUSIONS

1. Lower utilisation at grazing led to a greater amount of dead material in the LSR sward. This is thought to be due to:

- a) A greater potential to accumulate dead material due to a higher residual **herbage** mass.
- b) More dead **herbage** residue from uncontrolled spring growth.

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- c) Dead material decomposing more slowly.  
d) Higher allowance enabling animals to select against dead **herbage**.
2. The in vitro digestibility of the low stocking rate treatment was less than in the **HSR** sward because of a higher content of lower digestibility dead material.
3. The HSR sward was regarded as high quality forage, but may not be better than the LSR sward for animal production, due to the low total mass of green dry matter.

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