
VOLUME 62 2002

THE EFFECT OF LEVEL OF HERBAGE DRY MATTER PER ANIMAL ON EFFICIENCY OF UTILIZATION OF PASTURE BY YOUNG FRIESIAN CATTLE

R. MARSH

Ruakura Animal Research Station, Hamilton

SUMMARY

Groups of ten Friesian steer calves born between June and August, 1975 were offered daily either 3.0, 4.5, 6.0 or 7.5 kg pasture DM per 100 kg liveweight for 24 consecutive weeks beginning December 4, 1975. Liveweight within treatments increased linearly with time despite fluctuations in the seasonal pattern of herbage DM yield per hectare. The response of daily liveweight gain and herbage intake per animal to increasing increments of daily herbage DM allowance per 100 kg liveweight was also linear, indicating that the highest allowance, which supported a daily gain of 0.63 kg, was limiting animal performance.

INTRODUCTION

A knowledge of the relationships between herbage availability, herbage intake and animal performance is essential for efficient operation of any feed budgeting system under grazing conditions. Since quantitative information of this nature for beef cattle is limited, it was decided to initiate a project primarily aimed at providing these data. The 3- to 4-month-old dairy-beef Friesian steer was chosen for this first trial.

EXPERIMENTAL

TREATMENTS

Treatments were four daily herbage DM allowances above ground level, namely, 3.0, 4.5, 6.0 and 7.5 kg herbage DM per 100 kg liveweight. The animals were allocated to treatments at random within blocks based on initial unfasted liveweight.

MANAGEMENT

Each treatment was imposed within a 4-paddock, 28-day, fixed rotational-grazing system. Each paddock within each treatment was grazed for 7 days on each of 6 occasions by the same cattle at the same grazing pressure. This allowed measurement of the cumulative effects of treatments on both sward and animals. The method of imposing the DM allowances within this system was as follows: DM yield per paddock was determined from fresh weights and DM contents of herbage cut to ground level twice weekly. From these data, together with the total liveweight of each treatment group of cattle, the area required for grazing was computed and fenced off. This area was strip-grazed using daily breaks without a back fence. Surplus herbage was grazed at the opposite end of each paddock at the same grazing pressure with similar "non-experimental" cattle. After the 7 days' grazing, herbage samples were taken at ground level from the whole paddock and similarly processed to give comparative estimates of utilization and subsequent net herbage DM production; no correction was made for growth during grazing periods. Experimental and non-experimental cattle grazed alternate ends of paddocks from cycle to cycle.

Estimates of faecal output on a group basis were determined by the Cr_2O_3 method (Marsh and Murdoch, 1974) in cycles 2 and 6. Digestibility of ingested herbage was estimated *in vitro* from herbage samples taken from exclosure cages to a height similar to that of the surrounding grazed sward.

A 28-day rotation was imposed on the pasture from November 6, 1975, but grazing by the experimental cattle did not begin until December 4, 1975, and ended on May 18, 1976.

RESULTS AND DISCUSSION

The seasonal pattern of herbage DM yield before and after grazing is shown in Fig. 1. From cycles 1 to 4, pasture DM avail-

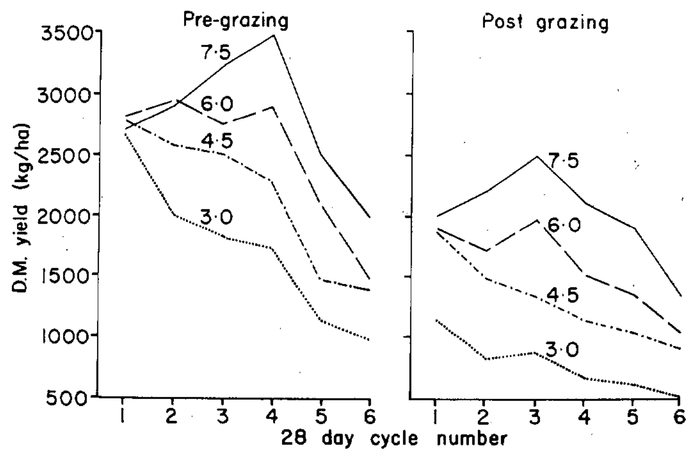

FIG. 1: *Seasonal pattern of DM yield (kg/ha) before and after grazing.*

able declined rapidly on the 3% allowance, declined less rapidly under 4.5% allowance, was more or less maintained at the 6.0% allowance treatment, and increased on the lax, 7.5% allowance treatment. From cycles 4 to 6 inclusive, pre-grazing herbage yield on all treatments declined, the rate of decline increasing with increasing DM allowance, or yield at cycle 4. A similar trend was observed in the seasonal pattern of herbage DM refused.

TABLE 1: HERBAGE DM PRODUCTION AND UTILIZATION

	Treatment			
	3.0	*4.5*	*6.0*	*7.5*
Apparent or net DM produced (kg/ha)	5200	5090	5510	5030
Total DM disappearance (kg/ha)	5670	5220	5420	4650
Apparent utilization (%)	109.0	102.6	98.4	92.6
Apparent utilization per grazing (%)	54.1	39.8	35.9	27.5

Table 1 shows net DM production over the 24 weeks (assuming 1000 kg DM/ha remained when paddocks were closed before the first experimental grazing) was similar on all treatments. The cumulative differences in herbage yield before and after grazing (*i.e.*, total net disappearance) are also shown in Table 1 and indicate high utilization of herbage produced. However, mean utilization per grazing fell from 54 to 28% as DM allowance was increased from 3.0 to 7.5 kg/100 kg LW.

TABLE 2: HERBAGE OM INTAKE (kg/animal/day)

	Treatment			
	3.0	*4.5*	*6.0*	*7.5*
Cycle 2	1.40	1.63	2.26	2.62
Cycle 6	3.37	3.43	3.55	3.76
Mean	2.38	2.53	2.91	3.19

The differential rates between increasing herbage allowance and decreasing herbage utilization per grazing are explained, in Table 2, by the herbage intake data from the Cr_2O_3 analyses. In both periods herbage intake per animal increased with increasing herbage allowance, but the rate of increase was lower in week 22 than in week 6 and coincides with both greater animal size and higher DM digestibility of selected herbage (70.3 *vs.* 75.2%).

The effect of constant herbage DM allowances on animal performance is shown in Fig. 2. Daily gains on all treatments were

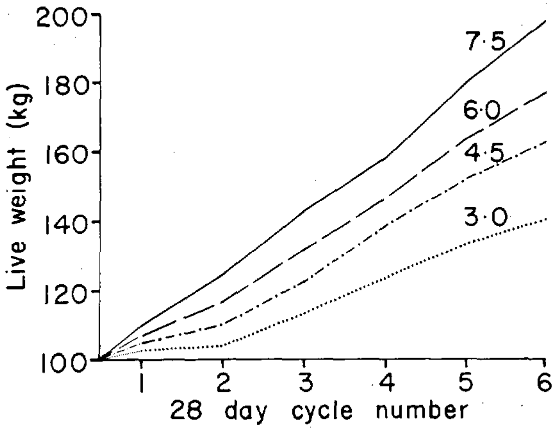

FIG. 2: *Seasonal change in mean liveweight (kg).*

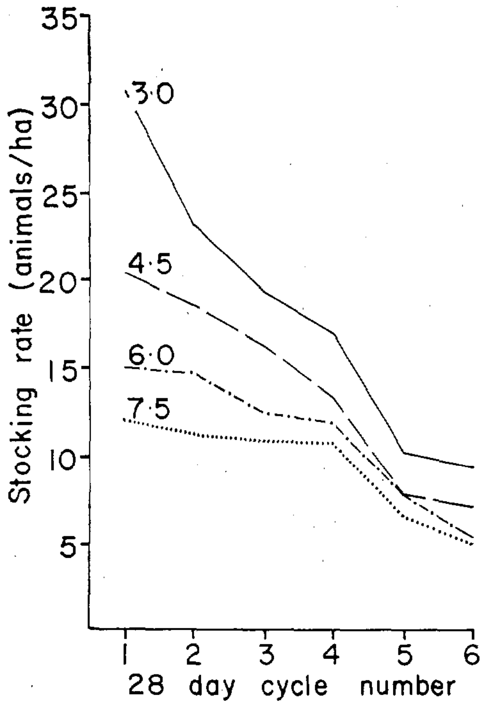

FIG. 3: *Seasonal pattern of stocking rate (animals/ha).*

lowest over the first 4-week cycle but thereafter increased linearly on all treatments. The mean overall daily gains were 0.29, 0.43, 0.52 and 0.63 kg/day for the 3.0, 4.5, 6.0 and 7.5% allowance treatments, respectively.

The regression equation relating daily gain in kg (Y) to daily DM allowance in kg/100 kg liveweight (x) was:

$$Y = 0.081 + 0.074\ (\pm\ 0.0076)\ x\ (n = 40;\ r = 0.91;\ \mathrm{RSD} = 0.0805)$$

and was significant at the 0.1% level. The range of daily gains and the lack of any indication of a declining response at the highest allowances indicate that allowances imposed in this experiment were too narrow and too low to encompass the point of inflection.

The seasonal pattern of stocking rate needed to support each rate of gain is shown in Fig. 3. A 2.5-fold difference in stocking rate was necessary to impose the 2.5-fold difference in herbage allowance at the start of the trial when yield per hectare was similar on all treatments but by the end of the experiment the same 2.5-fold difference in allowance per 100 kg LW which represented a 3.5-fold difference in herbage allowance per animal could be accommodated by a 1.8-fold difference in stocking rate.

The computed total gains per hectare for each treatment over the 24-week experiment were 723, 798, 944 and 976 kg/ha for the respective increasing allowances. The highest yield (976 kg) of liveweight gain over the 24 weeks, which produces about 48% of the annual DM yield of neighbouring Waikato pastures (Cumberland, 1974), represents a potential yield of just over 2000 kg liveweight gain per hectare per annum. This figure represents the production target for a beef production system (or systems) towards which future research in the field of pasture utilization with beef cattle will be pursued.

REFERENCES

Cumberland, G. L. B., 1974. *Proc. Ruakura Frmrs' Conf. Wk.*: 113.
Marsh, R.; Murdoch, J. C., 1974. *J. Br. Grassld Soc.*, *29*: 305.