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EFFECT OF HERBAGE PER UNIT AREA AND HERBAGE ALLOWANCE ON DRY MATTER INTAKE BY STEERS

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SUMMARY

Steers aged 16 months with an initial mean weight of 323 kg were offered areas of pasture with yields above ground level of 2000, 3000 or 4000 kg DM/ha (X_2), to provide daily herbage allowances of 10, 15, 22.5 or 33.8 kg pasture DM/head (X_1).

Dry matter intake (Y kg) was related to yield and allowance by the equation $Y = 0.0945 X_1 - 0.000542 X_2 + 7.03$.

INTRODUCTION

Although the relationship between amount of pasture on offer and amount eaten by grazing ruminants is generally accepted to be of an asymptotic type (Hodgson, 1976), specific data for steers are limited (Marsh and Murdoch, 1974). The present experiment was designed to examine the interaction, in the short term, of herbage yield (kg pasture dry matter (DM) per hectare) and herbage allowance (kg pasture DM per head per day) on DM intake by steers.

METHODS

Sixty-six Angus steers aged about 16 months with an average liveweight of 323 kg were divided into 11 groups of 6. They were offered fresh areas daily to provide herbage allowances of 10, 15, 22.5 or 33.8 kg DM/head on pastures yielding approximately 2000, 3000 or 4000 kg DM/ha. The allowance of 10 kg at a yield of 2000 kg/ha was omitted. Treatment combinations were imposed in an incomplete changeover design of 5 periods of 10 days beginning November 3, 1972.

Each day, yield of pasture DM above ground level was visually estimated before and after grazing. Twice weekly, DM yield on 22 quadrats of 0.297 m² was similarly estimated and then measured by cutting to ground level. The regression of measured yield on estimated yield was used to correct estimates made in the preceding 3 or 4 days. Corrected yields provided estimates of "dry matter disappearance" which is equated with dry matter intake.

RESULTS

Mean herbage yield per period ranged from 1820 to 5280 kg/ha and herbage allowance from 9.9 to 42.3 kg DM. Because of this variation from planned levels of yield and allowance, the relationship between DM intake (kg/head/day, Y), allowance (kg/head/day, X_1) and yield (kg/ha, X_2) was expressed by the equation:

$$Y = 0.0945 X_1 - 0.000542 X_2 + 7.03 \quad \dots\dots (1)$$

($R = 0.554$, $RSD = 1.61$)

The standardized partial regression coefficients of X_1 and X_2 were 0.486 and 0.269 and the correlation between X_1 and X_2 was 0.006.

The data revealed no evidence of Equation (1) being affected by animal groups, but suggested marked effects of "periods" (Table 1), with intakes being lower than average in the first period and higher than average in the last.

TABLE 1: MEAN DM INTAKE AND MEAN LEVEL ADJUSTED FOR DIFFERENCES BETWEEN PERIODS IN HERBAGE ALLOWANCE AND HERBAGE YIELD (kg/day)

Period	Mean Intake	Adjusted Mean Intake ¹
1	5.03	5.16
2	7.16	7.30
3	7.76	7.66
4	7.50	7.27
5	9.13	9.19
All	7.32	

¹ At a herbage allowance of 23.3 kg and herbage yield of 3540 kg/ha.

Covariance adjustment for differences between periods in allowance and yield made little difference to the mean values (Table 1). Most of the difference between periods arose from differences in intake at a given allowance with a much smaller, though still significant ($P < 0.01$) contribution from differences in regression coefficients relating intake to yield and allowance.

The average within-period relationship was:

$$Y = 0.0902 X_1 - 0.000527 X_2 + 7.08 \quad \dots\dots (2)$$

($R = 0.740$, $RSD = 0.96$)

with standardized partial regression coefficients of X_1 and X_2 of 0.646 and 0.343.

Other regression models allowing the coefficient of herbage allowance to vary with yield or to be curvilinear did not result in significant reductions in residual error.

Percentage pasture utilization ($100Y/X_1 = U$) was inversely related to herbage allowance by the relationship:

$$U = 10.55 + 571.1/X_1 \quad \dots\dots (3)$$

$$(R = 0.876, \text{RSD} = 7.39)$$

Addition of herbage yield to Equation (3) did not significantly reduce residual error ($0.1 > P > 0.05$).

DISCUSSION

The present data, contrary to previous reports with cattle (Hodgson, 1976; Reardon, 1975), indicated that, at a given level of herbage allowance, dry matter intake decreased with increasing pasture yield. The experiment was conducted when pasture species were maturing rapidly so that yield and maturity were confounded. At other seasons, this association is likely to be weaker so that high-yielding pastures might then have less effect on intake. Yield was only about 55% as important as allowance in predicting intake. In absolute terms, the effect of yield was small, a change of about 0.5 kg in DM intake in response to a change of 1000 kg of DM/ha.

Considerably larger differences in intake resulted from the effects of "periods" (Table 1). Among the possible explanations for such differences are adaptation by the animals to experimental conditions, changes in pasture composition, increase in liveweight, and bias in estimating pasture yield, but none of these explanations is satisfactory by itself. What does seem clear is that intake varied in response to factors other than herbage allowance and yield, so that intake data derived from short-term grazing treatments must be regarded with caution.

To relate present data to published data (Hodgson, 1976; Marsh and Murdoch, 1974) assumptions are necessary because of differences in techniques and units of measurement. If pasture DM is assumed to contain 90% organic matter and 67% digestible organic matter, intakes at most herbage allowances in the present experiment were lower by about 0.5 kg DM/100 kg liveweight than those for cows and calves reviewed by Hodgson (1976) and found for steers by Marsh and Murdoch (1974), (Fig. 1). Despite the limitations to such comparisons, most data indicated a dry matter intake of about 2% of liveweight when a herbage dry matter allowance of 3% of liveweight was offered.

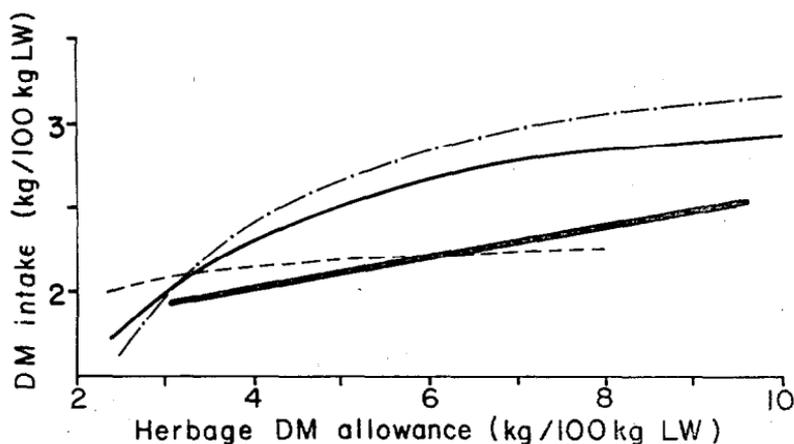


FIG. 1: Relationships for grazing steers between dry matter intake (kg/100 kg liveweight) and herbage dry matter allowance (kg/100 liveweight) measured to ground level.

- Equation (2) (above) when yield = 3000 kg/ha and mean liveweight = 337 kg.
- Marsh and Murdoch (1974) when digestible organic matter = 67% dry matter intake and DM allowance to ground level = $2 \times$ DM allowance to "mower height".
- Wright *et al.* (1976) — Hypothetical curve when yield = 3000 kg/ha.
- Hull, Meyer and Kroman (1961) when liveweight = 363 kg and 1 kg pasture DM = 2.82 Mcal of digestible energy. (Herbage allowance was measured to 2 in.; pastures were grazed for 7 days.)

As herbage allowance was increased above this level, dry matter intake increased at a rate of 94 g/kg of extra herbage DM in the present data and at initially higher but declining rates in the published data.

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