Effects of Herbage Allowance upon Animal Performance and Grazing Behavior of Strip-Grazed Heifers

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EFFECTS OF HERBAGE ALLOWANCE UPON ANIMAL PERFORMANCE AND GRAZING BEHAVIOR OF STRIP-GRAZED HEIFERS

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Abstract

A trial was designed to test the effect of herbage allowance (HA) on live-weight gain (LWG) and grazing behavior of heifers during spring as part of a combined field-modeling research programme. Low HA (L) and high HA (H) of 2.5 and 5.0 kg DM herbage mass 100 kg animal $LW^{-1}day^{-1}$ were fed respectively. H animals grazed longer and achieved a higher LWG than L ($P<0.05$). H animals left a higher residual pasture ($P<0.051$) with a significantly ($P<0.05$) higher content of green, clover, non-lamina and petiole of a higher digestibility and NSC, with a lower NDF content. The significance of some factors involved in these results on intake and diet selection are discussed in relation to the predictability of animal performance.

Keywords: herbage allowance; LWG, grazing behavior; heifers

Introduction

Animal performance at grazing is dependent upon levels of daily herbage intake. The factors which determine these levels may arise from the animal, the pasture or the physical environment. The complexity of the grazing situation demands approaches in addition to traditional experimentation and simulation models have been suggested to this end (Bywater and Cacho 1994; Dove 1996). In Argentina, high producing temperate grasses tend to be more variable in structure and composition than those of UK or New Zealand. Also in Argentina, Galli (1994) has used a combined modeling-field research approach in order to obtain an understanding of some pasture and animal factors which affect herbage intake. The present report is the first of a series with the objective of studying a range of factors, particularly of the sward, which may help to determine herbage intake and performance under different levels of herbage allowance (HA).

Material and Methods

During spring of 1999, 18 heifers (253±4.8 kg LW) were allotted to a Low HA (L) and high HA (H) of 2.5 and 5.0 kg DM herbage mass 100 kg animal LW $^{-1}$day^{-1}. The trial was carried out in Tandil, Argentina. Fifty rising plate meter (RPM) measurements previously calibrated (Earle and Mc Gowan 1979) were taken daily pre- and post-grazing and used to estimate biomass and then dry matter intakes (DMI). Both treatments were allocated to pasture of similar characteristics containing ryegrass (*Lolium perenne)* but dominated by red clover *(Trifolium pratense)*. Animals were strip-grazed and moved to a fresh strip daily with no back-grazing or re-grazing of experimental areas at any time. A 15 day pre-experimental period was used and actual measurements were taken over a 42-day period. Animals were de-wormed 48 h prior to allocation to treatments. On day 39, quadrats (0.1 m^2) were cut at ground level pre- and post-grazing from previously selected and homogeneous tagged areas of 1 m^2 (5.treatment^{-1}). Samples were sealed in polythene bags and sorted into species, green-dead proportion, lamina and petiole (L&P) and non-L&P within the green component. Total DM was estimated separately by oven-drying at 60 °C for 48 h. A site adjacent to each pre- and post-grazing quadrat, representing pasture of similar characteristics, was also sampled and refrigerated on site. These samples were freeze-dried and ground in a mill (1 mm screen) and analysed for *in vitro* digestibility (Dig), CP, NDF, ADF, NSC. At fortnightly intervals, ten pre-grazing hand-plucked pasture samples per treatment were collected to be also nutritionally assessed as described above. Animals were weighed fortnightly within 1 h of removal from pasture, and at start and end of the trial after a 12 h fasting period. Twice during the trial and related to the pasture measurement (days 32 and 39), 24 h grazing behavior and biting rates were recorded (Jamieson and Hodgson 1979). Data were statistically analysed by ANOVA with a repeated measures design for LWG. A completely randomised design was used for analysing separately the pre- and post-grazing herbage component and nutrient levels.

Results and Discussion

The average pre-grazing pasture quality traits measured during the trial were 0.69, 0.39, 0.17 and 0.11 for Dig, NDF, CP and NSC respectively there being no difference between treatments. The calibration equation for the RPM on herbage mass (HM) ($DM.ha^{-1}$): was: HM: 61.8 x + 661.8 R^2 :0.72 $P<0.01$. Dry matter intake (DMI) as estimated using the RPM were 3.5±0.14 and 6.5±0.29 $kg.day^{-1}$ $head^{-1}$ for L and H treatments, respectively. On day 39, DMI of 8.4±2.6 (SE) and 5.1±1.2 kg DM. $head^{-1}$ d^{-1} were estimated for H and L treatments, respectively. No significant differences were found pre-grazing for HM, plant components or nutrient composition (Table 1). However, H left a higher pasture residual post-grazing

(P<0.051) with a significantly (P<0.05) higher content of green, clover, L&P of a higher digestibility and NSC, and a lower NDF. While these results may be explained in terms of a gradation in herbage quality as grazing down occurs, clearly there is a possibility that selective grazing took place here. This will be investigated using two techniques: microscopic analysis of faeces and n-alkane analysis in this trial. The last mentioned technique may also provide an estimate of the levels of herbage intake in individual animals. Animals at high allowance grazed longer and achieved a higher LWG (Table 2), which is in agreement with (Jamieson and Hodgson 1979). Although some restriction was operating at H group due probably to the low residual HM and high dead content (Table 1), LWG was important and this group achieved a higher degree of herbage utilisation (52%) than L (36%). The factors that determine the selection of plant components or nutrients are not well understood (Hodgson 1990). Similarly, (Hodgson 1984) mentioned that no single parameter is likely to provide a reliable basis for predicting animal performance unless it is applied within well-defined constraints, which highlights the need to identify locally how different sward conditions contribute to the predictability of intake and LWG in beef systems.

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Table 1 - Effect of herbage allowance (High=H and Low=L) on pre- and post-grazing nutrient and component composition

	L	H	#p.s.e	Significance
PRE-GRAZING				
Herbage mass (kg DM.ha^{-1})	3557.5	3927.5	453.6	NS
Components				NS
Dead (DF)	0.33	0.34	0.06	NS
Green (DF)	0.66	0.65	0.06	NS
Clover +	0.58	0.58	0.06	NS
Grass +	0.08	0.07	0.02	NS
Lamina&petiole +	0.19	0.21	0.03	NS
Non-Lamina&petiole +	0.47	0.43	0.04	NS
Nutrients				
Dig (DF)	0.689	0.658	0.013	NS
NDF (DF)	0.353	0.375	0.016	NS
CP (DF)	0.169	0.159	0.010	NS
NSC (DF)	0.080	0.088	0.014	NS
POST-GRAZING				
Herbage mass (kg DM.ha^{-1})	1707.5	2515	235.3	&
Components				
Dead (DF)	0.84	0.53	0.04	*
Green (DF)	0.15	0.46	0.04	*
Clover (+)	0.08	0.40	0.03	*
Grass +	0.06	0.06	0.01	NS
Lamina&petiole +	0.02	0.04	0.009	NS
Non-Lamina&petiole +	0.12	0.42	0.03	**
Nutrients				
Dig (DF)	0.505	0.585	0.020	*
NDF (DF)	0.616	0.504	0.027	*
CP (DF)	0.099	0.113	0.007	NS
NSC (DF)	0.045	0.073	0.006	*

Pooled standard error
DF decimal fraction of dry matter
+ Contribution to green component
NS no significant difference (P>0.1)
& P<0.1
* P<0.05
** P<0.01

Table 2 - Effect of herbage allowance (High=H and Low=L) on LW, gut fill loss, LWG and grazing behavior of heifers

	L	**H**	**#p.s.e**	**Significance**
Initial LW (kg.head^{-1})	249	257	6.9	NS
Final gut fill loss (% full LW in 15 h)	0.07	0.07	0.006	NS
Full LWG (kg.head^{-1}day^{-1})	0.58	0.79	0.05	**
15 h empty LWG (kg.head^{-1}day^{-1})	0.49	0.76	0.07	**
Biting rate (bites.min^{-1})	37.8	35.0	2.4	NS
Grazing time(min)	422.6	468.3	12.9	*
Ruminating time (min)	379.1	397.2	12.9	NS
Idling time (min)	613.2	574.4	17.5	*

Pooled standard error

All activities expressed as minutes per day

NS no significant difference (P>0.1)

* P<0.05

** P<0.01