Anim. Prod. Aust. 2002 Vol. 24: 213-216

GETTING CATTLE TO GROW FASTER ON LUSH AUTUMN PASTURES

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SUMMARY
Average daily gain (ADG), grazing behaviour and feed intake of Hereford steers grazing high autumn quality pastures were measured at two different levels of forage allowance (2.5 and 5.0 kg of dry matter/100 kg of body weight), with no supplement or with whole (WM) or ground (GM) maize grain fed at 1% of body weight. Thirty-six Hereford steers were assigned to one of six treatments in a factorial arrangement. Forage allowance was adjusted weekly for each treatment by varying paddock area. Grain was offered daily and refusals weighed to determine actual intake of each animal. Forage intake was estimated as the difference between forage availability before and after grazing. Grazing behaviour was determined by visual appraisal every 10 minutes during 9 hours of daylight for four consecutives days every second week. The ADG was higher ($P<0.01$) in supplemented cattle (1.12 kg/d) than non-supplemented (0.41 kg/d) controls. Forage allowance did not have a significant effect on ADG ($P=0.07$). There was an interaction ($P=0.11$) between forage allowance and supplementation on forage intake. At low forage allowance, forage intake was decreased ($P<0.05$), only if maize grain was offered ground. Supplementation did not affect grazing time. Steers grazing with a high forage allowance and supplemented with WM spent more time ruminating than those fed with GM.

Keywords: forage allowance, maize processing, supplementation

INTRODUCTION
Cattle grazing lush autumn pastures in the western plains of Uruguay normally have growth rates lower than expected given the apparently high quality of the pastures (Simeone 2000). A considerable amount of research has been done regarding the effect of forage dry matter allowance on performance of finishing steers grazing high quality pastures during winter (Cibils *et al.* 1996), or spring (Hodgson *et al.* 1990). However little is known about forage allowances for the autumn season. Autumn pastures in Uruguay are characterized by a low dry matter and fibre content and high concentrations of crude protein. Cereal grains are commonly used as supplements for beef cattle to improve animal performance during autumn. Many experiments and reviews have examined the effect of different types of grains and processing methods on animal performance in feedlot conditions (Owens *et al.* 1997, Rowe *et al.* 1999). However, responses to grain processing in animals under grazing conditions are not well understood. With maize grain an important question is wether there are advantages in grinding the grain compared to feeding it whole.

The objective of our study was to determine the relationship between forage allowance and supplementation using maize grain offered whole or ground, in terms of average daily gain (ADG), forage intake and feeding behaviour of Hereford steers grazing improved pastures during autumn.

MATERIALS AND METHODS
The experiment was conducted at the Experimental Station of the Agronomy Faculty, in Paysandu, Uruguay, during the period 31 May to 23 August 2001. An area of 11.5 ha of oats and a 12 ha paddock of mixed pasture comprising grass (fescue) and legume (red clover) in approximately equal proportions were used. The experiment was divided into two periods: 31 May to 15 July (Period I), and 15 July to 23 August (Period II), corresponding to grazing of oats and mixed pasture, respectively. Thirty-six Hereford steers weighing 327 ($\pm$ 20.8, sd) kg, 18 months of age were used. Steers were randomly allotted to six treatments with a factorial arrangement. The treatments were as follows:
1) **Control – 2.5**: Grazing at a forage allowance = 2.5 % of body weight
2) **Control – 5.0**: Grazing at a forage allowance = 5.0 % of body weight
3) **WM-2.5**: Control-2.5 plus 1% of body weight supplementation with whole maize grain.
4) **WM-5.0**: Control -5.0 plus 1% of body weight supplementation with whole maize grain
5) **GM-2.5**: Control - 2.5 plus 1% of body weight supplementation with ground maize grain
6) **GM-5.0**: Control - 5.0 plus 1% of body weight supplementation with ground maize grain.

All the animals were treated against internal parasites with ivermectin (Ivomec®; Merial S.A.), before starting the experiment. Steers were weighed at 14 days interval, with no access to feed or water for 12 hours before weighing. Animals were managed in rotational grazing system with grazing strips allocated each day and no access to the previous strip. Forage mass was measured weekly using a double sampling method (Gardner 1967), and forage allowance was adjusted varying the strip area for each treatment. Everyday during three weeks in each period, forage intake was estimated from the difference between forage dry matter on offer and residue in the daily strip for each treatment. Ground maize was fine hammermilled. The quantity of supplement offered to each steer was adjusted for body weight changes fortnightly. During the whole experimental period steers were supplemented in individual pens constructed near the paddock where the cattle were grazing. Grain was offered daily at 0800 h and refusals measured at 0900 h to determine actual intake.

The grazing behaviour of four steers per treatment was determined by visual appraisal. Animal activities such as grazing, rumination or rest were recorded every 10 minutes during 9 hours of daylight for 4 consecutives days every second week during both periods.

Data for ADG and grazing behaviour were analysed by analysis of variance for a two factor randomised complete design, with the steer as experimental unit. The effects of animal (A), period (P), treatments and the interactions between them were included in the regression model for ADG and grazing behaviour. Animal effect was considered as a random factor nested within treatment. Data for forage intake were analysed by analysis of variance based on a repeated measurements design, taking into account the group of steers as an experimental unit. The regression model included week (W) of sampling, as a random effect nested within period, treatments effects and the interaction between them.

RESULTS

The composition of the oats and mixed pasture are summarised in Table 1 together with estimated feed intake and liveweight gain.

Table 1. Composition of the oats and mixed pasture (% of DM)

	Oats	Mixed pasture
Dry matter	15	12
Crude protein	17.8	20.4
Neutral detergent fibre	47.7	37.0
Estimated digestibility	67.5	64.2

Average daily gain and forage intake for each treatment are shown in Table 2. The interaction between forage allowance and supplementation on ADG was not significant (P=0.26). Forage allowance did not have a significant effect on ADG (P>0.05). However ADG was higher (P<0.01) for the supplemented steers (1.12 kg/d) than for those without supplementation (0.41 kg/d).
Steers fed WM tended to have a slightly lower ADG than those fed GM (1.06 kg/d vs. 1.17 kg/d; P=0.09). However, the effect of type of supplement (whole vs. ground) on animal performance seemed to depend on the forage allowance. The effect of processing grain appeared to be more important for steers with more pasture on offer (WM=1.06 vs. GM=1.22, P= 0.07), than on those with less pasture (WM=1.07 vs. GM=1.12; P=0.54).

The interaction between supplementation and period was significant (P<0.01), for ADG. The benefit of supplementation was greater on the fresh oats than on the mixed pasture mainly because the ADG for steers from unsupplemented control treatment was higher during the second period (mixed pastures) than during the first period (0.56 vs. 0.27 kg/d, P<0.01).

There was no significant difference (P=0.10) between intake of oats and mixed pasture (1.55% and 1.47% of body weight, respectively). High forage allowance increased forage intake (P<0.01), while supplementation reduced it (P<0.01). There was an interaction (P=0.11) between forage allowance and supplementation on grass intake. At the high forage allowance, both WM and GM treatments tended to reduce grass intake, while at the low forage allowance, only GM treatment reduced (P=0.06) grass intake. Steers grazing with a forage allowance of 2.5% and 5% had a mean daily herbage intake of 4.65 kg and 6.21 kg, respectively. Taking into account animal performance and intake of different

treatments, feed conversion was of 72 g ADG/kg of consumed grass dry matter and 202 g ADG/kg of consumed grain dry matter, respectively.

Table 2. Effect of supplementation and forage allowance on ADG and forage intake (% of BW), of Hereford steers grazing fresh high quality pastures during autumn

Supplementation (S)	Forage allowance (FA)		Means (main effects)
ADG (kg/d)	2.5 %	5.0 %	
Control (C)	0.316 aA	0.507 aB	0.411 a
Whole Maize (WM)	1.068 bA	1.056 bA	1.062 b
Ground Maize (GM)	1.122 bA	1.217 bA	1.169 b
Means (main effect)	0.835 A	0.927 A	0.881
Forage intake (% of BW)			
Control (C)	1.43 aA	2.03 aB	1.73 a
Whole Maize (WM)	1.26 abA	1.48 bB	1.37 b
Ground Maize (GM)	1.18 bA	1.63 bB	1.40 b
Means (main effect)	1.29 A	1.71 B	

a, b Means in the same column with different superscripts differ significantly (P<0.05)
A, B Means in the same row with different superscripts differ significantly (P<0.05)

Grazing time was not significantly influenced by period (forage type) or the interaction between forage allowance and supplementation (P>0.05). Steers grazing at 2.5% forage allowance spent more time grazing than those at high forage allowance (68.2% of the 9 hours day vs. 65.5% P=0.07). Supplementation reduced grazing time with respect to control (70.8% vs. 64.8% P<0.01) and increased ruminating time (2.6% vs. 6.0% P<0.01), while there was no effect of processing maize grain (Table 3).

Table 3. Effect of supplementation and forage allowance on grazing behaviour (percentage of time between 0900 h and 1800 h of steers grazing fresh high quality pastures during autumn

Forage allowance (FA)	2.5% of body weight			5.0 % of body weight		
	Control	Whole Maize	Ground Maize	Control	Whole Maize	Ground Maize
Grazing time	72.5 a	68.5 b	63.2 b	69.1 a	64.1 b	63.3 b
Ruminating time	2.60 b	4.90 a	5.00 a	2.60 b	8.7 a	5.90 a
Resting time	24.8 b	25.8 b	31.6 a	28.2 b	26.6 b	30.8 a

a, b, c, : Means in the same row with different superscripts differ significantly (P<0.01)

In both, 2.5% and 5.0% levels of forage allowance the GM supplemented group of steers spent more time (P<0.001), resting compared to control and WM groups. Forage allowance influenced pattern of grazing behaviour. During the morning (0900 h -1300 h), steers with a forage allowance of 2.5% spent 80% of the time grazing while those with a forage allowance of 5.0% steers spent 70%. However during the afternoon (1300 h - 1800 h), both groups of animals spent the same amount of time grazing (61%).

DISCUSSION

Feeding supplements of maize grain to steers grazing high quality forage from oats or mixed pasture increased ADG, compared with non-supplemented controls. This response did not seem to depend on the amount of forage dry matter allowance. The average daily intake of maize by supplemented steers was 3.49 kg and resulted in an increase of approximately 0.7 kg/d additional liveweight. The conversion of grain to liveweight (5 kg maize/kg gain) represents an efficient use of grain by ruminants (Cibils *et al.* 1996). Compared to the benefit of supplementary feeding the additional improvement due to processing the maize (approx. 0.1 kg/d) was relatively small and not significant, particularly at the lower rate of forage availability.

Given the fact that there were no significant differences between intake of oats and the mixed pasture it is interesting that cattle grazing the mixed pasture grew nearly twice as fast as those grazing oats. The difference in growth rates does not appear to be explained by estimated digestibility, dry matter content or by crude protein levels in two forages. There was a difference in the neutral detergent fibre content of the two forages but there was not an associated effect on feed intake. Autumn grass offered at 5% of bodyweight was not able to support high levels of live weight gain in beef finishing steers, mainly due to a very low forage intake at this allowance. The composition of the forage was typical of improved pasture during autumn in Uruguay, characterized by a low dry matter and NDF content and a high CP concentration. Under autumn conditions, the dry matter percentage of the grass can decrease even more because of the extracellular water (Gallardo 1991). The high level of moisture and probably the low effective fibre content of the pasture, could explain the low herbage intake and consequently the low ADG of control steers.

Supplementation of steers grazing high quality pasture affected grazing time. Steers at low forage allowance grazed more during the morning than during the afternoon. This difference in grazing behaviour would be expected to alter patterns of rumen digestion because it is well documented that the chemical composition of the grass changes during the day, increasing the carbohydrates content in the afternoon (Bowden *et al.* 1968).

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