OAT GRAZING: FORAGE COMPOSITION AND SUPPLEMENTATION RESPONSE

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ABSTRACT
Oat forage (*Avena sativa*), which has low soluble carbohydrates (SC) and high soluble protein (SP) content, can reduce liveweight gain of grazing animals; supplementation with grain and low degradability protein may serve to counteract the effect. A grazing trial was carried out on two soils with different nitrogen (NO_3^-) availability, from 16 April 1994 to 6 September 1994. Steers were randomly allocated to 3 treatments: low nitrogen (LN), high nitrogen (HN) and high nitrogen with supplementation (HNS). Forage of LN showed lower SP ($p \leq 0.05$) during the first month of grazing, and higher SC ($p \leq 0.05$), than HN during the first two months of the trial. Animal liveweight gain was: 892, 909 and 775 g/an/day for LN, HNS and HN, respectively, with animals in HN of significantly lower liveweight gain ($p \leq 0.05$). Under the conditions of this trial, animals grazing on oat forage with lower SC and higher SP had lower liveweight gain and responded to supplementation.

INTRODUCTION
Oat grazing is the main quality forage for meat production in "Pampa Húmeda" during winter. However, contradictory results on liveweight gain and supplementation response have been reported (Gonella, Cerqueira and Viglizzo, 1987; Rosso and Chifflet de Verde, 1992).

Most workers suggest that lower liveweight gains and higher supplementation responses occur when the forage has high soluble nitrogen (SN) and low soluble carbohydrates (SC). In this case, the availability of energy and protein in the rumen would be unbalanced (Elizalde and Santini, 1992), and supplementation with energy and by-pass protein could bring about increased meat production (Vásquez et al., 1993).

Soil nitrogen availability is one of the environmental factors that can modify SN and SC levels in plants. In response to nitrogen fertilization, it has been demonstrated that there is an increase in SN (Crawford, Kennedy and Johnson, 1961) and a decrease in SC (White, 1973). Fernando and Carter (1970) found in addition to these changes a lower milk production on cows grazing oats.

An experiment was performed to evaluate the liveweight gain of animals grazing oat forage with different nutritional characteristics in relation to the level of nitrogen in the soil. Furthermore, the response to energy and protein supplementation was measured.

MATERIALS AND METHODS
On a Typical Hapludol soil of Pasman (37°11'SL and 62° 11'WL) in Argentina, two adjacent areas, each of 10 Hs, were sown with oats (*Avena sativa* cv Cristal) on 2 March 1994 . One of the areas, which had been under continuous cultivation with annual crops for 7 years, was tilled and drilled immediately. The other was preceded by 2 crops, tilled 70 days before drilling and fertilized with 100 kg/Hs of urea when the oats was in the 3 leaf stage. By means of previous management, two different soil nitrogen availabilities were attained.

Angus steers were randomly allocated to 4 treatments: Low nitrogen (LN), low nitrogen with supplementation (LNS) , high nitrogen (HN) and high nitrogen with supplementation (HNS). Supplement was a mixture of 2 kg of broken corn grain and 100 g of meat meal, per animal per day.

Forage availability in dry matter per hectare (DM/Hs) was estimated from monthly sampling of 12 random samples per treatment per date. Dry matter 'in vitro' digestibility (DIVMS), neutral detergent fiber (NDF), crude protein (CP), soluble protein (SP) and soluble carbohydrate (SC) were evaluated.

The intention was to maintain a minimum of 900 kg DM/Hs to prevent herbage availability being restrictive for intake (Chifflet de Verde et al , 1974).

The effect of treatments was analyzed from the liveweight gain of 14 steers per treatment, with an initial weight of 205.8 ± 44.1 kg, estimated from weighing every 28 days. The grazing period started on May 17 and the first weighing was on May 26.

Liveweight gain values were analyzed using a split plot model, and forage composition parameters were analyzed on a random effects model.

RESULTS AND DISCUSSION
Soil. At the start of the grazing period (May 17) values of pH, available phosphorus, organic matter and total nitrogen had not shown differences between HN and LN ($p \leq 0.05$) . In contrast, available nitrate level of both soils showed significant differences ($p \leq 0.05$) for soil, date and their interaction. Means of nitrate level were 14.325, 29.250 and 18.200 ppm for HN treatment on May 16, July 13 and September 5, respectively, and 7.350, 13.650 and 12.100 ppm for LN on the same dates. Differences between treatments were significant ($p \leq 0.05$) in all cases.

Forage availability. In the first half of the grazing period a decrease of forage availability in two low nitrogen plots was observed. This would have contravened the original objective of maintaining a minimum availability of 900 kg MS/Hs. Elimination of LNS by duplicating the LN grazing area removed this problem. The evolution of dry matter availability during the experiment is shown in Table 1.

LN had a lower forage availability during the whole grazing period. As result of management, only the July 13 sampling showed levels that would be restricted forage intake.

Forage quality. The mean chemical composition of the herbage offered in HN and LN is given in Table 2. The HN versus HNS plots comparisons did not show significant differences ($p \leq 0.05$).

For the last sampling, LN showed a lower level of NDF and higher IVDMD ($p \leq 0.05$). A higher forage availability at the beginning of the grazing period on HN and HNS (see Table 1) should originate from the accumulation of older forage in these treatments with respect to LN and therefore a different chemical composition.

Levels of IVDMD, CP and NDF found in forage were very similar to other reports (Fernando and Carter, 1970; Amigone, Kloster y Latimori, 1995), with the same trends throughout the grazing period and the same response to nitrogen fertilization.

The CP levels in this experiment are similar to those found by Elizalde and Santini (1992), but the SC levels were three times higher.

Liveweight gain. The estimated liveweight gain for a grazing period of 103 days was 909 g/an/day for HNS, 892 g/an/day for LN and 775 g/an/day for HN with significant differences ($p \leq (0.05)$) between treatments. A multiple comparison test performed using Duncan at $\alpha = 0.05$ showed a lower liveweight gain in HN than in LN and HNS.

Therefore, differences in forage composition between treatments seem to be reflected in liveweight gain, although the level of all gains was elevated. Liveweight gain was not different ($p \leq 0.05$) during the grazing period despite the changes in forage composition observed through the time (specially for SP and SCH).

GENERAL DISCUSSION

Probably the whole high liveweight gain observed in this work is related to the higher level of SC in forage compared with that reported by Elizalde and Santini (1992). Furthermore, the difference (117 g/an/day) between HN and LN liveweight gain could be in relation to different SC content of forage in both treatments.

The supplementation with energy and by-pass protein (HNS) had a liveweight gain of 134 g/an/day higher than HN. This figure seems an apparent conversion of grain to meat of 14.9:1 This is lower than the result obtained by Vásquez et al.(1993) of 8:1 using a similar level of broken corn and corn gluten meal (as by-pass protein). However, there was no information on SP and SC forage content in their work that would allow comparisons of liveweight gain in relation to forage composition. The low animal response to supplementation could be related with the high level of SC in our work.

More information about forage composition, and animal performance and supplementation response, in relation to different kinds and levels of supplement is needed in order to increase the predictability of meat production on oat grazing. The soluble carbohydrate level of forage seems to be an important parameter for evaluating winter annual forages.

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Table 1
Forage availability, in kg DM/Hs on each sampling date.

Sampling dates	Treatments	
	LN	HN
May 24	1314 ± 558 b	1600 ± 125 a
June 27	1098 ± 592 b	2966 ± 1835 a
July 13	826 ± 324 b	1382 ± 809 a
August 17	1075 ± 472 b	1825 ± 433 a
September 7	1509 ± 459 a	1018 ± 725 a

a, b: indicate significant differences ($p \leq 0.01$) within each sampling date.

Table 2
Results of analysis of forage sampled during grazing period, percentage of DM

		Sampling dates				
		May 24	June 27	July 13	August 17	Sept. 7
IVDMS%	HN	78.3 ± 0.7 a	79.2 ± 1.6 a	76.9 ± 1.4 a	73.3 ± 2.1 a	68.7 ± 0.5 a
	LN	78.2 ± 1.3 a	76.4 ± 1.2 a	77.1 ± 0.6 a	73.9 ± 4.0 a	74.4 ± 2.6 b
NDF%	HN	40.9 ± 1.3 a	42.7 ± 1.2 a	39.8 ± 1.9 a	45.3 ± 2.7 a	50.0 ± 1.2 a
	LN	39.6 ± 1.2 a	42.7 ± 0.4 a	39.8 ± 1.8 a	45.3 ± 1.1 a	50.0 ± 2.4 a
CP%	HN	23.8 ± 1.9 a	19.1 ± 1.8 a	15.7 ± 0.6 a	15.4 ± 1.5 a	12.1 ± 0.9 a
	LN	18.5 ± 0.7 b	14.8 ± 0.3 b	13.7 ± 0.6 b	14.2 ± 0.6 a	10.7 ± 1.3 a
SP%	HN	12.7 ± 0.9 a	6.5 ± 1.8 a	6.1 ± 1.0 a	—	3.8 ± 0.2 a
	LN	8.9 ± 1.9 b	6.6 ± 1.6 a	6.1 ± 0.8 a	—	4.6 ± 0.5 a
SC%	HN	8.7 ± 0.8 a	14.8 ± 1.5 a	24.6 ± 2.8 a	20.4 ± 3.1 a	12.4 ± 4.7 a
	LN	15.7 ± 2.9 b	19.7 ± 1.5 b	23.5 ± 2.5 a	24.4 ± 5.6 a	23.9 ± 11.0 b

Within each variable and date, means of treatments followed by the same letter are not significantly different ($p \leq 0.05$) .