EFFECT OF SUMMER SUPPLEMENTATION ON ANIMAL PERFORMANCE AND CARCASS QUALITY TRAITS OF GRAZING HEREFORD STEERS IN URUGUAY

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Abstract – The objective of this study was to evaluate the effect of different types of supplements on the performance of yearling steers grazing an annual forage crop (*Sorghum bicolor L. moench*) and its subsequent influence on carcass quality traits. 50 Hereford steers (265.3 kg live weight - LW) of 15 months of age grazing at a 7.5 steers/ha stoking rate were randomly allotted to 5 treatments (T): T1 - no supplement; T2 - soy expeller; T3 - sunflower expeller; T4 - rice bran; T5 - maize (T2 to T5 had a 0.5%LW supplementation rate). Final LW and *in vivo* carcass quality traits (Rib Eye Area-REA; Back Fat Thickness-BFT; Rump Fat Thickness - P8; Intramuscular Fat - IMF) were not affected by treatments (P<0.05). Slaughter weight was affected (P<0.05) by treatments (T4 ≥ T5 ≥ T2 = T1 ≥ T3). Treatments did not affect (P>0.05) Hot Carcass Weight (HCW), Chilled Carcass Weight (CCW), Pistola Cut (PC), main cuts (tender and strip loin, rump) nor morphometric measurements. Even though supplementing at a 0.5%LW rate allows higher daily LW gains, no differences were detected on carcass quality traits.

KEYWORDS: animal performance, carcass traits, supplementation, steers.

I. INTRODUCTION

Over the past few years, certain productive, economic and social changes have determined the urgent need to sustainably intensify production systems in order to increase competitiveness against other economic activities.

The development and implementation of specialised feeding and managing strategies aiming to maximise beef production efficiency leads to production increases especially through a decrease in slaughter age [1]. Furthermore, yearling steer fattening during summer has been identified as one of the main restrictions in productivity upgrading of livestock production systems [2]. Thus, the inclusion of a limited area of pastures presenting higher quality and quantity would contribute to the productive and economic sustainability of livestock production systems aiming to preserve productive stability of natural grasslands in Uruguay [3]. Annual forage crops are useful to ensure high and stable dry matter yields in livestock production schemes [4], being sorghum a very tolerant crop which is able to endure water deficits [5]. Both national and international research have proven that summer annual forage crops along with agriculture by-products and/or elaborate concentrates supplementation, is a particularly convenient technique to lift summer restrictions in Uruguay [2].

Taking all this into account, the objective of this experiment was to evaluate whether different supplements would affect animal performance and carcass quality traits of yearling steers grazing an annual forage crop at a fixed stocking rate.

II. MATERIALS AND METHODS

This trial was carried out at "Glencoe" Experimental Unit - INIA Tacuarembó, situated on the Basaltic Region of Uruguay. Fifty Hereford steers born in spring 2013, with an initial average live weight (LW) of 265.3 ± 12.1 kg and grazing a summer annual forage crop (*Sorghum bicolor L. moench*) at a fixed stocking rate of 7.5 steers/ha, were randomly allotted to 5 treatments. These treatments differed from each other on Crude Protein content of four supplements, using a single supplementation rate (0.5%LW). Treatments were as follows: T1 - no supplement; T2 - soy expeller; T3 - sunflower expeller; T4 - rice bran; T5 - maize. Supplements were selected

according to their Crude Protein content, being soy and sunflower expeller considered as "protein feeds", and rice bran as "energy-protein feed" and maize as "energy feed". Steers were allocated into two repetitions for each treatment (5 plots * 2 repetitions), so each plot contained 5 animals. Supplemented animals (T2 to T5) underwent a supplement acclimation period, previous to the beginning of the experiment. Supplements were provided once a day, first thing in the morning. All animals had unrestricted access to minerals and clean fresh water. The experiment took place between 18th December 2014 and 24th March 2015.

Every 15 and 42 days, full LW and fastened LW were respectively recorded. For supplemented treatments (T2 to T5), the offered supplement was adjusted according to the average LW data of each plot. *In vivo* measurements (Rib Eye Area-REA; Back Fat Thickness-BFT; Rump Fat Thickness - P8; Intramuscular Fat - IMF) were assessed using ultrasonography at the beginning of the trail and afterwards every 28 days until slaughter weight was achieved.

After summertime was over and during the fattening period, animals grazed a winter annual forage crop (a mixture of oats and ryegrass) and were supplemented with rice bran at a 1.12%LW supplementation rate, Monday through Friday (i.e. a daily average supplementation rate of 0.8%LW). Once all animals had achieved slaughter weight (26th November 2015), they were slaughtered at a commercial abattoir where Slaughter Weight was recorded, as well as Hot Carcass Weight (HCW). Carcasses were typified according to the official National Meat Institute score [6]. After chilling, (48 h *post mortem*) Chilled Carcass Weight (CCW) was recorded and Pistola Cut Weight (PC) was measured between 10th-11th rib. Rump & Loin cuts (tender and strip loin, rump) were also weighed.

A randomised plot with two repetitions design was used. The *in vivo* data was analysed using MIXED procedures of SAS statistical programme (repeated throughout time measurements). All results related with carcass quality were analised using GLM procedures [7], and they were contrasted using LS means procedures ($P<0.05$).

III. RESULTS AND DISCUSSION

The effect of the different nutritional strategies evaluated in this trial concerning animal performance and *in vivo* measurements for carcass traits is shown in Table 1. Neither at the beginning nor at the end of the experimental period, differences were found ($P<0.05$) in LW. Nevertheless, by the end of the trial, animals fed with a higher Crude Protein content in their diets (T2 and T3) presented the highest daily LW gain, compared with the rest of the treatments, where T5 presented the lowest average and T3=T2≥T4≥T1=T5. These results were mainly related to the overall Crude Protein intake and the energy-protein balance. Even T5 (supplemented with maize) presented lower figures than T1 for daily LW gain, suggesting that it was not a problem of insufficient Crude Protein intake, but more of the energy-protein balance as a whole.

On the other hand, no *in vivo* measurements (REA, BFT, P8 y IMF) differed between treatments ($P>0.05$), concurrent with LW at the end of the trial.

After the whole trial and the fattening period were over, T5 appeared to catch up with the rest of the treatments, presenting no significant differences compared with the highest final LW (T4). Furthermore, no differences were found ($P>0.05$) between any of the treatments in final LW and daily LW gain, suggesting that all animals had similar performances at this stage. No differences were found in REA, P8 and IMF ($P>0.05$). Only BFT presented a significant effect ($P<0.05$) of treatments, being T2 the highest of them all. In spite of the fact that no significant differences were found in final LW, T2 presented the highest value, corresponding with the significant highest BFT of this treatment.

[8] presented an average *in vivo* REA of finished supplemented Hereford steers of 55.5 cm^2, but with animals approximately 6 months younger than the current trial´s steers, which presented an average REA of 64.6 cm^2 (including non-supplemented animals).

Table 1. Mean animal performance of steers under different feeding strategies

Variable	T1	T2	T3	T4	T5	P
EXPERIMENTAL PERIOD						
Initial LW (kg)	265.4	265.0	265.1	265.2	265.8	ns
Final LW (kg)	313.2	323.7	324.1	321.8	311.6	ns
LW gain (kg/a/d)	0.503bc	0.618a	0.621a	0.596ab	0.482c	*
REA (cm^2)	38.3	40.8	38.1	34.2	31.8	ns
BFT (mm)	2.4	2.7	2.3	2.8	2.5	ns
P8 (mm)	3.1	3.4	3.0	3.3	3.3	ns
IMF (%)	2.6	2.6	2.3	2.5	2.7	ns
POST- EXPERIMENTAL PERIOD						
Final LW (kg)	553.8	570.0	565.6	560.0	551.3	ns
LW gain (kg/a/d)	0.841	0.866	0.712	0.859	0.832	ns
REA** (cm^2)	63.8	64.3	62.2	68.4	64.4	ns
BFT** (mm)	7.4b	10.3a	7.1b	7.5b	8.2b	*
P8 **(mm)	10.6	12.0	12.0	9.8	11.9	ns
IMF ** (%)	3.5	3.7	3.7	3.9	3.7	ns

Note: a, b, c = means with different letters between columns are significantly different; * = P<0.05; ns = not significant.

Table 2 presents the results of the measurements taken at the meat packing plant. No significant effects (P>0.05) were found between treatments on the variables measured in this experience. However, local research comparing contrasting diets in rearing calves (feed-lot vs. pastures) has stated that this type of differential nutritional management influences daily LW gains during the fattening stage of the process and also in both in HCW and P8 [9].

Table 2. Carcass traits of steers under different feeding strategies

Variable	T1	T2	T3	T4	T5	P
HCW (kg)	273.1	280.8	282.4	282.9	273.8	ns
CCW (kg)	267.8	275.2	276.5	279.0	268.8	ns
PC (kg)	67.8	69.8	70.0	70.6	68.3	ns
Rump & Loin (kg)						
Tender loin	1.7	2.0	1.7	1.8	1.7	ns
Strip loin	5.0	4.9	4.9	5.0	4.9	ns
Rump	5.6	5.6	5.7	5.5	5.6	ns
Morphometric measurements (cm)						
Carcass length	151.0	154.1	150.7	143.3	141.2	ns
Leg perimeter	83.1	75.8	76.2	84.4	83.4	ns
Leg length	107.6	108.4	107.7	110.0	109.1	ns

Note: ns = not significant.

In spite of not fining any differences with the contrasting nutritive strategies evaluated in this experience, it is important to highlight the excellent HCW and main cuts weights (tender and strip loin, rump), considering these were animals with 2 years of age. [8] reported an average of 228.8 kg of HCW from supplemented Hereford steers, with animals approximately 6 months older. These same authors, presented Rump & Loin weights of 10.4 kg, while in this experiment the average of all the animals from the 5 treatments averaged 12.3 kg.

IV. CONCLUSIONS

Considering the conditions in which this trial was carried out, adding supplements to beef yearling steers with an annual forage crop as a base diet, presented an improvement in the summer rearing process. However, unsupplemented animals presented relatively good performances and not so far beyond animals from the supplemented treatments. Furthermore, when analysing the system as a whole (rearing and fattening period), no differences were found at the end of the steers´ productive life. Taking into account that supplementing means increasing production costs considerably, no real advantages can be found by supplementing during summer under this trial´s conditions.

As for carcass determinations, even though no differences were found in all *post-mortem* carcass traits, it is important to bear in mind that these nutritional strategies allowed two-year-old steers to present excellent carcasses, especially considering HCW. All of the evaluated strategies enabled a slaughter age decrease, contributing to the Uruguayan Basaltic livestock production systems efficiency.

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