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EVALUATION OF FORAGE SORGHUM SILAGES WITH THE ADITION OF SORGHUM GRAIN

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Abstract

The aim of this experiment was to evaluate the effect of additional sorghum grain and stage of maturity of forage sorghum silage on the animal performance. Two feeding trials were conducted with forage sorghum silage made at different stage of plant maturity. In trial 1, early silage was made with the crop harvested in early bloom stage. Four diets based on different ratios of silage: sorghum grain were evaluated: 100%silage (ES); 80%silage: 20%dry grain (ES20D); 60%silage: 40%dry grain (ES40D) and 60%silage: 40%wet grain silage (ES40W). In trial 2, late silage was made with the forage sorghum crop in dough maturity stage. Four diets combining different proportions of silage and sorghum grain (wet grain silage) were evaluated: 100%silage (LS); 90%silage: 10%grain (LS10W); 80% silage: 20%grain (LS20W); 70% silage: 30%grain (LS30W). In all components and diets, chemical composition was analyzed and animal performance was determined. In all cases the addition of sorghum grain to the forage sorghum silage improved the diet chemical composition. With early silage there was a high response in the daily live weigh gain (DLWG) (g/day) to the addition of sorghum grain (ES: 232; ES20D: 477, ES40D: 788; ES40W: 687), but there was no difference in dry matter intake between treatments

with an average of 92 g DM/ $kg^{0.75}$ BW. With late silage, the DLWG only was higher than LS when grain was added in 30% of the diet (LS: 505; LS10W: 529; LS20W: 583, LS30W: 688). There was difference in the DLWG and in feed intake between the two maturity stages of the silages (ES vs LS).

Keywords: Forage sorghum silage, sorghum grain supplementation, beef steers

Introduction

In the central area of Argentina, the use of silages has been increased (especially corn silage) for milk and beef production (Bragachini et al., 1997). However, there are areas of limited rainfall or have marginal soil fertility was the corn crop is risky and with low productivity. Because its drought tolerance, its safety and high forage production, the sorghum crop is an alternative for making silage (Andewakun et al., 1989). The most important factors, which define the quality of sorghum silages, are the grain content (Young et al. 1996) and the stage of maturity (Kallah et al., 1999). In the particular case of the forage sorghum silage and as its grain production is almost none, the addition of sorghum grain is a way to improve the nutritive value when the forage sorghum silage is used as the base of the diets. Therefore it is necessary to know if corn silage can be replaced by forage sorghum silage for growing beef steers. The aim of this experiment was to evaluate the effect of additional sorghum grain and stage of maturity of forage sorghum silage on the animal performance.

Material and Methods

Two feeding trials were conducted during the winter of 1998 with forage sorghum silage made the previous summer at different stage of plant maturity.

Trial 1. Early silage was made with the crop harvested in early bloom stage. Four diets based on early silage with the addition of different proportions of sorghum grain were evaluated. Twenty Hereford steers with an initial weight of 203 kg average, were assigned randomly to the following treatments of different rations of silage: grain on a dry basis: 1): 100% early silage (ES); 2) 80% early silage: 20% dry grain (ES20D); 3) 60% early silage: 40% dry grain (ES40D) and 4) 60% early silage: 40% wet grain silage (ES40W). The dry sorghum grain was fed cracked while the wet grain silage was fed whole.

Trial 2. Late silage was made with the crop in dough maturity stage. Four diets were evaluated with different ratios of late silage: sorghum grain (wet grain silage). Twenty Hereford x Aberdeen Angus steers with an initial weight of 190 kg average were randomly assigned to the treatments: 1) 100% silage (LS); 2) 90%silage: 10% grain (LS10W); 80% silage: 20%grain (LS20W) and 4) 70% silage: 30% grain (LS30W).

In both trials diets were balanced in protein content with the addition of soybean meal to make them isonitrogenous. In each type of feed and each diet, dry matter content (DM), crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF) were analyzed. Steers were fed once a day *ad libitum* during 100 days and were weighed every 21 days after overnight fasting. Feed intake was individually determined during 14 days, measuring the amount of feed offered and the amount refused daily. Average daily live weight gain (DLWG), dry matter intake (DMI) and feed conversion (FC) were calculated per treatment group. All data were analyzed statistically by ANOVA using GLM procedures of SAS (1988). Difference between treatments means were assessed by the LSD method.

Results and Discussion

The chemical composition DM (g DM kg $^{-1}$), CP (g kg^{-1} DM), NDF (g kg^{-1} DM) and ADF (g kg^{-1} DM) of the diet components was: Early Forage Sorghum Silage 180.6, 121.9, 650.4 and 377.1; Late Forage Sorghum Silage 274.1, 98, 638.9 and 394.8; Wet Grain Sorghum Silage 804, 126.7, 228.7 and 126; Dry Sorghum Grain 892, 98.1, 222 and 55.7, respectively.

The results of the animal performance and the diet composition of each treatment in Trial 1 and Trial 2 are shown in Table 1.

There was a response in the DLWG to the addition of sorghum grain. There was no difference in DMI among treatments with an average of 92 g DM/ kg$^{0.75}$ BW. This DMI is lower than the one obtained by Adewakun et al. (1989) with sweet sorghum silage because of the low %DM of early forage sorghum silage evaluated here, that is a restriction for DMI. There was no difference ($p>0.05$) in DLWG with the same proportion of grain (40%) using dry grain or wet grain silage. This could be because of the high DM of wet grain that produces a low utilization of this whole grain in the gastrointestinal tract. On the other hand the wet grain had a higher ADF than the dry grain.

In late silage, DLWG and DMI only were significantly increased ($p<0.10$) when grain was added in 30% of the diet.

The addition of sorghum grain to the forage sorghum silage improved the diet chemical composition compared to the silage without grain.

The differences observed in the DLWG between the two maturity stages of the silages (ES vs LS) are because of the difference in DMI on account of low DM in early silage that limits DMI.

In conclusion, it could be improved the nutritive value of forage sorghum silage by the addition of sorghum grain and as a result animal performance, without effect on dry matter intake. That produces a better-feed conversion when sorghum grain is added.

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Table 1 - Average daily live-weight gains (DLWG) (g), dry matter intake (DMI) (g/kg$^{0.75}$ per day), feed conversion (FC) (kg feed intake/kg DLWG) and chemical composition of diets: dry matter (DM) (g/kg), neutral detergent fiber (NDF) (g/kg) and acid detergent fiber (ADF) (g/kg) of different diet treatments with early (ES) and late (LS) forage sorghum silage and dry (D) or wet (W) sorghum grain.

	ES				LS			
Treatment	ES	ES20	ES40	ES40W	LS	LS10W	LS20W	LS30W
Ratio silage:grain	100	80:20	60:40	60:40	100	90:10	80:20	70:30
DLWG	232 a	477 b	788 c	687 c	505 ab	529 ab	583 abc	688 c
SEM	±19	±38	±65	±17	±39	±77	±46	±12
DMI	91.6 a	93.0 a	91.5 a	91.6 a	129.5 a	131.9 ab	137.5 ab	139.5 b
SEM	±8.5	±4.1	±8.7	±0.3	±3.0	±8.4	±3.0	±2.1
FC	22.2 a	10.7 b	6.38 c	7.35 c	14.9 a	14.7 a	14.0 a	12.7 b
DM	181	319	459	415	271	330	476	484
NDF	650	564	478	491	551	544	529	518
ADF	377	313	248	277	324	318	314	313

Means with different letters in the same row are different ($P<0.05$) for each forage stage (early or late).
SEM:standard error of means.