ID # 19-24

HIGH MOISTURE SORGHUM GRAIN SILAGE: EFFECTS OF TANNIN CONTENT AND UREA TREATMENT ON THE PERFORMANCE OF DAIRY COWS

L.A. Romero, E.A. Comerón, O.A. Bruno, A.R. Castillo and M.C. Gaggiotti

INTA EEA Rafaela, Casilla de correo 22, 2300 Rafaela, Santa Fe, Argentina

Abstract

Grain sorghum silage tannin content effect was evaluated on milk production and chemical composition of Argentinean Holstein bred cows, and it are described dry matter (DM) and crude protein (CP) in situ digestion parameters and effective degradability. The base diet was constituted by alfalfa pasture, maize silage, and a protein – mineral supplement, differing in three treatments based on high moisture grain silage characteristic: LTS= Low tannin grain sorghum, HTS= High tannin grain sorghum, and HTSu= High tannin sorghum plus the addition of urea. Grain sorghum silage tannin content affects milk production, without significant alteration of chemical composition. Beside the effect of urea addition on grain sorghum tannin content, improvement in animal response was only moderate.

Keywords: dairy cows, high moisture grain silage, sorghum

Introduction

High moisture grain silage from maize and sorghum crops have been incorporated to dairy production systems of Argentinean central milk shed area (central of Santa Fe province and eastern Córdoba province), being the conservation in plastic bags the most popular storage method.

Experimental data indicate that, from a nutritional point of view, there is no practical difference between silage made from high moisture grain or dry grain (Clark y Harshbarger, 1972 ; Clark et al., 1974 a and b ; Chandler et al., 1975 ; Dhiman y Satter, 1992 ; Alvarez et al., 1995, Romero et al., 1997)

Grain sorghum crops have different tannin content, being the most widely used in Argentina those with higher values. Nutrition trials with sorghum in no ruminant have shown that non condensed tannins have a negative impact on animal weight gains (Drinah et al., 1983). The effect of this compound is less important in ruminants, but response might be lower when compared to the use of free condensed tannin sorghums. Russell et al. (1988) and Russell and Lolley (1989) indicated that urea treatment, in addition to providing an adequate conservation, inactivate tannins quickly.

The aim of this study was to evaluate the effect of tannin content and urea treated grain sorghum for silage on production and chemical composition of Argentinean Holstein bred milk, and describe digestion parameters in situ and effective silage dry matter (DM) and crude protein (CP) digestibility.

Material and Methods

The study took place on 1996 winter. Base diet was alfalfa pasture, maize silage, and a protein-mineral supplement, differing in three treatments based on high moisture grain silage characteristic:

1.- Low tannin grain sorghum (LTS, less than 0.4% equivalent tannin acid, Folin-Denis method ; Burns, 1963).

2.- High tannin grain sorghum (HTS, more than 0.8%)

3.- HTS plus the addition of urea at a rate of 15 kg/ton (HTSu).

Grain was previously ground for the LTS and HTS treatments. For the HTSu treatment whole grain was used because it is considered that urea would produce a rupture of external grain cover.

After a 15-day pre-experimental period in which animals where fed with the same diet (a three grain silage and the base diet mix), the essay was developed in three experimental 10-day periods (6 days of adaptation and 4 days of measurements) in a Latin square design.

A total of 30 adult cows were assigned to treatments based on lactation stage (129±21 days) and dairy production (23.3±1.5 l/cow/day) at the beginning of the study.

Anova was performed for individual milk production and chemical composition, taking the model in account treatment, period, and cow variables. Difference among treatments where tested by Duncan ($P<0.05$).

As a complement, it was performed DM and CP “in situ” digestibility, and effective degradability on two cows with rumen cannulae. The study was performed with the nylon bag technique; introducing approximately 5 g of DM of silage by duplicate in the animal’s rumen in nylon bags (Ankom Tech. Co. NY. 50±15 μm mean diameter pores). Sample extractions where done at 0, 3, 6, 12, 24, and 48 hours. Values obtained were adjusted using the model proposed by Orskov and McDonald (1979) and analyzed by a change over design with the following variation sources: period, cow, and treatment.

Results and Discussion

The chemical composition of high moisture sorghum grain silage was as follow:

Low tannin : 58.8% DM, 8.5% CP, 81.6% IVDMD.

High tannin : 63.2% DM, 8.4% CP, 75.3% IVDMD.

High tannin + urea : 63.7% DM, 12.5% CP, 74.7% IVDMD

Urea addition produced the hydrolysis of 60% grain tannin content for the HTSu treatment. Russell and Lolley (1989) demonstrated that tannin can be deactivate completely under conditions where urea is an effective preservative of high moisture grain.

Feed consumption (as DM/cow/day) was of 7 kg of alfalfa pasture (20% DM, 28% CP, 44% NDF, and 66% IVDMD), 4.5 kg maize silage, 5.5 kg high moisture grain sorghum, 1 kg soya meal, and 0.025 kg $(PO_4H)_2Ca_2$.

Treatment means for milk production and chemical composition are presented on table 1.

Milk production were significantly different between LTS and HTS ($P < 0.05$), but not between HTS and HTSu. Chemical milk composition was different among treatment groups only with regards to milk fat and urea contents ($P < 0.05$).

Data on table 2 show evaluations performed on rumen cannulae cows.

High moisture grain sorghum silage differed in DM soluble fraction (a), and potential degradable fraction (b) ($P<0.05$), and no differences were observed in digestibility speed of parameter “b” (c) between HTS and HTSu treatments. All though, the last did not affect effective degradability indicating that, for this study conditions, urea addition diminished in a grater extent rumen DM effective degradability than that observed between HST and LST. With respect to CP,

differences were detected between low tannin sorghum (LTS) and the high tannin treatments (HST and HSTu) on every analyzed parameter. Urea addition only increased protein digestibility speed for high tannin, but no differences were observed in protein effective degradability. Russell and Schmidt (1993) concluded that urea treatment improved feedlot steers performance and increased ruminal starch digestion.

For this study conditions it can be concluded that, grain sorghum silage tannin content affects milk production, without significant alteration of chemical composition. Beside the effect of urea addition on grain sorghum tannin content, animal response was only moderate.

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Table 1 - Response of dairy cows fed with different high moisture grain sorghum silage.

Variable	LTS	HTS	HTSu	CV (%)
Milk production (l/cow/day)	23,1 a	21,8 b	22,3 ab	9,3
Milk production MFC (l/v/d) (*)	21,7 a	20,2 b	20,3 b	10,3
Milk composition:				
- Milk fat (%)	3,60 a	3,54 ab	3,42 b	8,9
- Crud protein (%)	3,34	3,28	3,25	7,2
- True protein (%)	3,15	3,04	3,07	7,8
- Casein (%)	2,62	2,54	2,54	7,9
- Dry residue (%)	10,99	10,84	10,83	7,7
- Urea (mmol/litro)	6,06 ab	6,31 a	5,69 b	11,1

(*) milk fat corrected at 4%. CV: variation coefficient.
Values on the same line with different letters differ significantly Duncan (P<0.05)

Table 2 - Dry matter (DM) and crud protein (CP) in situ digestion parameters and effective degradability for rumen retention intervals.

		In situ digestion parameters			Effective degradability		
	Treatments	"a" (%)	"b" (%)	"c" (/h)	50 (h)	25 (h)	12,5 (h)
Dry matter	LTS	61,8 a	38,2 a	0,113 a	94,2 a	88,2 a	84,1 a
	HTS	32,6 b	57,7 b	0,065 b	71,0 b	58,2 b	51,8 b
	HTSu	22,7 c	53,2 c	0,052 b	60,9 c	49,7 c	43,5 c
Crude protein	LTS	78,6 a	21,4 a	0,097 a	96,3 a	92,7 a	90,3 a
	HTS	62,4 b	30,2 b	0,030 b	79,2 b	72,8 b	70,0 b
	HTSu	57,3 b	26,8 b	0,051 c	76,5 b	70,8 b	67,7 b

Values on the same column with different letters differ significantly Duncan (P<0.05)