CHEMICAL COMPOSITION AND ENERGETIC VALUE OF CORN AND SUDAN GRASS SILAGE ADDED WITH MOLASSES AND BOVINE FAECES

Guerra Liera, J.E.[1]*, Riveros Acosta, B.J.[2], Gastelum Delgado, M.A.[1], Córdova Izquierdo, A.[3], Rodríguez García, J.[4], Soto Angulo, L.E.[1], Moreno Quiroz, J.[1], López Juárez, L.A.[1], Corrales Aguirre, J. L.[1] and Baca Martinez, S.[1]

[1]Facultad de Agronomía, Universidad Autónoma de Sinaloa, Culiacán de Rosales, Sinaloa, México; [2]Sub Secretaria de Ganadería del Gobierno de Estado de Sinaloa, México; [3]Departamento de Producción Agrícola y Animal, Universidad Autonoma Metropolitana Unidad Xochimilco, México D. F. [4]Inst. de Cienc. Agric., Universidad Autónoma de Baja California, Mexicali B. C., México

SUMMARY

The objective was to evaluate the effect of the addition of molasses and bovine feces in the chemical composition and energetic value of corn and Sudan grass silage. Six treatments were evaluated, containing different percentages of molasses and bovine feces. There was only an increase in crude protein content ($P<0.05$) in corn silage as a result of bovine feces addition. In both forages occurred an increase in net energy of maintenance and in net energy of gain. Treatment consisted of 25% of bovine feces addition improved crude protein and both energies in corn silage. On the contrary, for Sudan grass silage 20% of bovine feces and 5% of molasses addition gave the best result for the same variables.

Keywords: chemical composition, energetic value, corn grass, Sudan grass, silage, molasses, bovine faeces

INTRODUCTION

Corn is the main crop in Sinaloa, according to SAGARPA (2007) during the last two cycles, 2005–2006 and 2006–2007 have been sown more than 400, 000 ha, with a total annual production of at least 4.5 000 000 t in irrigated lands, Sudan grass is the second important grass in Sinaloa. In the case of corn, it has a high energetic value but low protein content and Sudan grass has less quality and is less palatable, and as result of their extensive production in this State, there exist a lot of products to offer to cattle. Therefore, one alternative is to silage the whole plant (plant and young ear or spike) (FEDNA, 2004). This State has several dozen of thousands of milk and meat producing cattle which must be fed and at the same time they produce annually thousand of tons of feces that can be either considered either as an environmental problem or as a by-product to produce solid and liquid composts and in many cases during the last decades to feed cattle, of course with some restrictions (Smith and Wheeler 1979; Uicab-Brito and Sandoval, 2003). The feeding value of a forage product is defined as the capacity to improve animal production (meat, milk, eggs, etc) as result of nutrients availability and its intake by animals (Beever *et al.,* 2000). A way to improve the energetic and protein value of silage is to add no only feces but other products such as molasses, being this a sugar cane by-product (Bhattacharya y Fontenot, 1966; Calvert y

King, 1977; Smith and Wheeler, 1979; Cobos *et al.,* 1988). Having all this into account, the objectives of this research were.

OBJECTIVES

To evaluate the effect of molasses and bovine feces addition to corn and Sudan grass silage on chemical composition and energetic value.

MATERIALS AND METHODS

This research was carried out at the Nutrition and Animal Bromatology Laboratory at the Faculty of Agronomy, Universidad Autonoma de Sinaloa, Mexico. Six silages (treatments) were evaluated (Table 1) and prepared according to Archila *et al.* (1991). Samples were oven dried at 60^0C for 48 h and then analyzed its chemical components such as: Crude Protein (CP), Hemicellulose (HEMI), Cell Content (CC), Acid Detergent Fiber (ADF), and Neutral Detergent Fiber (NDF) (Goering y Van Soest, 1970; AOAC, 1975). The Energetic Composition or Digestible Energy (DE, Mcal kg^{-1}), Net Energy of maintenance (NEm), Net Energy of gain (NEg), Net Energy of lactation (NEl), and Total Digestible Nutrients (TDN %) were also estimated (Jurgens, 1988; Undersander *et al.,* 1993). The statistic analysis consisted of analysis of variance and mean comparisons ($P<0.05$) in a randomize complete block design (SAS version 9.2, 2004).

Table 1. Treatments, ingredients and proportion of each one.

Treatments	Ingredients	Proportion (%)
1	Silage corn	100:00
2	Silage corn + bovine feces	85:15
3	Silage corn + bovine feces	75:25
4	Silage Sudan grass	100:00
5	Sudan grass + bovine feces	80:20
6	Silage Sudan grass + bovine feces + molasses	75:20:05

RESULTS AND DISCUSION

Chemical composition of treatments is shown in Table 2 where can be seen a great deal of variation among treatments; with the exception of Dry Matter (statistic analysis not shown). Treatment of corn silage (1–3) had the lowest results for ADF and NDF; CP was higher in treatments containing Sudan silage (4–6), the smallest value in this variable and in Dry Matter was for treatment with only silage corn (1). Such results are also shown for ADF and HEMI for this treatment. Sudan silage alone had consistently high results for most of variables, but at the same time the lowest for Hemicellulose. NDF was high in the three treatments containing Sudan silage even with the addition of molasses.

Table 2. Chemical composition of treatments.

Treatments	DM (%)	CP (%)	NDF (%)	ADF (%)	HEMI (%)	CC (%)
1	91.25	9.60[c]	55.83[b]	40.49[a]	14.00[a]	49.05[b]
2	92.42	12.10[b]	57.34[b]	46.31[b]	10.20[ab]	47.00[b]
3	93.67	13.00[b]	50.17[a]	47.34[b]	2.65[c]	53.00[a]
4	93.19	14.95[a]	74.68[d]	59.66[c]	14.00[a]	30.40[d]
5	94.58	15.45[a]	65.50[c]	60.74[c]	4.50[bc]	38.05[c]
6	93.73	14.40[a]	64.65[c]	49.55[b]	14.15[a]	39.40[c]
CV*	–	2.24	1.41	2.16	16.41	1.91

* Coeficient of variation
DM (%) =Dry Matter
CP (%) = Crude Protein
NDF (%) = Neutral Detergen Fiber
FDA (%) = Acid Detergen Fiber
HEMI (%) = Hemicellulose
CC (%) = Cell Content

Table 3 presents energetic values, where all six showed a more statistically consistent increase in Sudan containing treatments. Variables Net Energy of maintenance, Net Energy of gain as Mcal kg^{-1} of dry matter were high in treatment 3, on the contrary, the Net Energy of lactation was high for corn silage alone. In this Table can be seen that with the addition of molasses to Sudan silage, there was as slight increase for most of variables when compared with treatments containing only Sudan silage. The lowest Digestible Energy was in this treatment again. Surprisingly corn silage alone had the best results for TDN, showing that it can be in some cases a good food without the addition of other ingredients when feeding cattle. Results in this Table show that corn silage itself or combined with different proportions of bovine feces is a better food for cattle compared with treatments containing Sudan silage even with the addition of molasses, although this ingredient slightly improved some variables. Nutritional value of silaged products is estimated by analyzing its chemical composition (Bogdan, 1997). It is necessary to consider that when using animal feces added to different plant forages easily fermentable there is an increase in crude protein but also in ashes and ADF contents, raising its buffer capacity which has a negative effect over fermentation (Al-Rokayan *et al.,* 1998; Rasool *et al*., 1998; Fontenot y Jurubescu, 1980). The addition of ingredients easily fermentable such as molasses (4–6%) helps to increase fermentation of products during silage process. This results agree with those found by Tjandraatmadja *et al.* (1994) which evaluated in laboratory conditions plastic vacuum sealed bags containing 500 g of silage that were maintained in dark and controlled environment conditions the effect of adding 4 to 8% of molasses to panicum (*Panicum maximum* cv. Hamil), Pangola grass (*Digitaria decumbens*) and setaria (*Setaria sphacelata* cv. Kazungula) silages, concluding that even the lowest doses (4%) was adequate for the preservation of this three grass silage.

Table 3. Energetic composition of treatments.

Treatment	DE	NE_m	NE_g	NE_l	TDN (%)
1	12.48[a]	1.51[b]	0.95[b]	1.28[a]	57.24[a]
2	12.28[b]	1.47[b]	0.90[b]	1.12[b]	50.76[b]
3	12.25[b]	1.67[a]	1.13[a]	1.09[b]	49.61[b]
4	11.84[c]	0.99[d]	0.34[d]	0.76[c]	35.89[c]
5	11.80[c]	1.25[c]	0.64[c]	0.73[c]	34.69[c]
6	12.17[b]	1.27[c]	0.67[c]	1.03[b]	47.15[b]
CV*	0.30	1.75	3.66	2.98	2.66

*Coeficient of variation
DE = Digestible Energy (Mcal kg^{-1} DM)
NE_m = Net Energy of maintenance (Mcal kg^{-1} DM)
NE_g = Net Energy of gain (Mcal kg^{-1} DM)
NE_l = Net Energy of lactation (Mcal kg^{-1} DM)
TDN (%) = Total Digestible Nutrients

CONCLUSIONS

In general there was a great variation among treatments although in most cases those with corn silage had better results and some times similar to treatment of Sudan silage added with molasses. Corn itself gave good values for variables such as ADF and NDF. The addition of bovine feces increased Crude Protein and NEm and NEg but at the same time the ADF. Sudan itself was no good for most of variables but a better result occurred when bovine feces or molasses were added, improving the energetic value.

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