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Silage for Cattle Feeding in Venezuela

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ABSTRACT

Silage is the most economical food to guarantee animal feeding throughout the whole year. Lack of information, economic resources, and farming equipment restrain many farmers from applying this agro technology. Based on these reasons, the present research examines the current trends in animal food conservation in Venezuela. So far, silage is manufactured out of entire maize plants and silos store harvested pastures, forage grass independently cultivated, and forage-legume mixture. The last feeding variant is highly profitable due to its excellent productive results and low costs. Nutrient contents in maize silage are dry matter (28 %-35 %) and raw protein (8.3 %-15.2 %). Ruminal degradability levels range between 76 % and 82 % due to legume content and urea supplementation to the bulk. These findings are consistent with average milk production over 3 kg/cow/day and milk products sales. It should be noted that the best silage for cattle feeding consists of a grass-legume mixture in which legume content is not above 30 %.

Key Words: *forage, silage, legumes, bovine*

INTRODUCTION

Ruminant feeding systems in the tropics are mainly based on pasture land. Quality and quantity fluctuations lead to nutritional stress and mortality, thus causing productivity losses. Drought periods and floods are blamed for irregularities in forage supply (Guevara *et al.*, 2012).

Silage is the most economical way to guarantee animal feeding during the year. Many producers stay away from these conservation technologies out of lack of information, economic resources and equipment (Sánchez, 2000; Ojeda and Esperance, 2009; Guevara *et al.*, 2012). The aim of this paper is to know the current tendencies in forage preservation by means of ensilage for bovine feeding in Venezuela.

DEVELOPMENT

Silage is the final product of feed preservation, through anaerobic fermentation in humid state. This technology does not improve forage quality levels, but keeps the original nutritional value, with minimum losses of dry matter and no formation of harmful toxic products to productive work and animal health (Ojeda and Esperance, 1990; García, 1991 and García, 2003).

Implementing this method allows epiphytic bacteria to ferment forage-hydro soluble carbohydrates, thus producing lactic acid and acetic acid in lower quantities. A material (pH 4.2-3.5) is produced, with 65-70 % humidity, to inhibit plant enzymes, bacteria, yeasts, and fungi causing putrefaction (Ojeda and Esperance, 1990; Betancourt and Caraballo, 2000; Ojeda and Esperance, 2009).

In modern cattle raising systems, forage is mowed at a stage where yielding and nutritional values are close to highest. Silage is used mainly in developed countries. Estimates show 200 tons of dry matter are ensiled every year in the world, at a production cost of US $100 and $ per ton. The costs comprise the land and crops (50%), mowing and polyethylene (30 %), silos (13 %) and additives (7 %). Farmers from Holland, Germany and Denmark store more than 90 % of their forage as silage. Even in countries with optimum climatic conditions for hay mowing, like France and Italy, about half of forage is ensiled (Wilkinson *et al.*, 1996; García, 2003; Ojeda and Esperance, 2009).

Pros and cons of silage (Sánchez, 2004; Ojeda and Esperance, 2009).

Pros:

- Availability of forage and crops from the rainy season all year round, including the most critical stage.
- Efficient use of the farm´s resources (soil, machinery, workforce, etc.).
- Forage silage at the optimal time, with the best nutritional value.
- Increase of in-farm productivity.

- Cut down on costs due to lower commercial concentrate supply.
- Preservation is longer, with minimum losses.
- Fire hazards are not a threat, as with hay.

Cons:

- Production costs of silos.
- Machinery is required (major producers).
- More time is spent on handling and preparing.
- Use of additives. (Some cases).
- Quality loss in ensilage.

The degree of quality loss in ensilage is only known when it is used. It comes as losses in dry matter and other parts that can be used due to the type of silos, roofs, tightness, type of effluents or the presence of gas in the aerobic phase, and decline in the nutritional value as a result of soluble carbohydrate transformation. The losses are inevitable, but they should not exceed 10 %. They are generally caused by air or water entry, faulty compressing or sealing. Also due to the materials used and delays in filling and sealing the silo. When the silos are small this process should not take longer than a day.

Any kind of high quality pasture or forage can be ensiled (corn, sorgo, and sugar cane, improved pasture legumes like cratylia, caupi and lablab, mixed with graminaceae or alone). Appropriate levels of dry matter, previously dried, if possible, particle size, compressing, tightness, proven levels of soluble carbohydrates, additives and capacity to prevent putrefaction must be ensured to achieve high quality of ensiled material (Ojeda and Esperance, 1990; Sánchez and García, 2003).

The optimum point to cut graminaceae is 25-40 days of re-shooting after cuts to prevent blossoming. For corn, in milky state, 70-80 days; sorgo, in molasses, 60-80 days; sugar cane of 8-10 months; and legumes, (caupi y lablab) at the start of flowering and cratylia, every 90 days after cut. For legumes and pasture like brachiaria or king grass, additives should be added to enhance fermentation and reduce nutrient losses. There are some criteria in the tropics stating that brachiaria is not good for its low silage capacity and poor tampon efficiency. (Ojeda and Esperance, 1990; Guevara *et al.*, 2012).

Corn silage

Ramírez, Catani and Ruiz (1999) and Weinberg *et al*. (2004) have said that corn silage is one of the most importantly preserved forages in modern production systems, as it poses great advantages, like high yield/high-energy feed hectare, palatability, ready storage, short harvest times, low costs and minimum losses when work is done right. It is helpful that corn silage has 30-50 % of grains dried, so it is considered a forage-grain mixture, used as supplement for energy per servings, or as a diet supplement. Corn silage producers should make a great effort to maximize energy/ha. Therefore, the areas allotted to silage must have high grain yields, considering that excellent corn for harvest is as good as corn for silage.

Sorgo silage

Sorgo is a cereal ready for silage, though its tampon capacity is higher than that of corn. Nevertheless, it is possible to quickly reach a pH close to 4 and get ammoniacal nitrogen and soluble nitrogen levels below total nitrogen (10 and 50 %, respectively). The optimal moment to harvest sorgo for silage is when the dry matter content from the whole plant is 28-30 %, which means soft sticky grain. Sorgo silage accounts for 75-80 % corn silage, with similar nutritional value and higher fiber and ash contents. The high content of structural carbohydrates explains its lower digestibility (80-85 %) tan corn silage (Colombatto *et al.*, 2003 and Reiber *et al*., 2006). State of the art machinery should be used for crushing, thus allowing use more of the grain´s energy in the rumen. (Colombatto *et al*., 2003).

Materials for silage

The best materials for silage have thinner stems and let the grain turn sticky and hard (milk-producing) with the plant still green. That is also known as stay-green, which ensures silage with low content of indigestible fiber and high energy concentration (Weinberg, Chen and Gamburg, 2004).

Whole-plant corn and sorgo silage have 100 % crop usability and more energy yields in comparison with grain harvest alone (40-60 %). High corn and sorgo sugar and starch contents made them excellent materials for silage, by enabling good fermentation and high nutritional value, especially energy. Large production of milk and weight gain (Ashbell and Weinberg, 1998; Betancourt and

Caraballo, 2000; Sánchez, 2004; Ojeda and Esperance, 2009).

In practice, corn should be crushed when it is 40-50 % of lower leaves dry. The ideal crop is one with hard grains (impossible to leave nail marks on them) and 20 to 30 % of lower leaves dry. This favors maximum energy concentration (more starch) with low levels of neuter-detergent fiber (FDN), high levels of soluble sugars and moderate protein contents (Muhlbach, 2000; Sánchez, 2004; Ojeda and Esperance, 2009).

Mixed silage of graminaceae and legume

The current strategy —especially in tropical areas where graminaceae have significant nitrogen and, or soluble carbohydrate losses— is to mix the graminaceae with the legumes, handled as protein stocks or forestry raising arrangements. In such a way the beneficial effects produced by legumes on the soil and graminaceae; as well as its nitrogen contribution to the diet. Several trials have been performed to different production systems in Colombia, with local materials.

Sánchez and García (2003) achieved important increases in product quality by ensiling sugar cane knots and king grass mixed with legumes and tree foliage from sugar cane plantations west of Cundinamarca. By ensilage of 30 % leucaena (*Leucaena leucocephala*), matarraton (*Gliricidia sepium*) and nacedero (*Trichantera gigantea*) with sugar cane knots or *king grass*, with 3 % molasses as additive, the quality of the product was increased, by raising the levels of crude protein and reducing cell Wall levels, regarding the green forage, without affecting temperature or pH of ensilage (see table). Those were advantages seen in the animal productivity and the production system.

Colombatto *et al*. (2003) and Reiber *et al.* (2006) also report improvements in the quality of silages in tropical areas, by increasing protein levels and decreasing high levels of cell Wall in the graminaceae of the region. In fact, when they were ensiled with variable legume levels, the pH achieved was adapted for the process and only showed some differences in the production of lactic acid and ammoniacal nitrogen, thus leading to decreases in the level of nitrogen supplements in the diet and feeding costs.

González *et al.* (2002) improved the energy and nutritional balance in the diet and weight gains in Romosinuano bovine males (117; 470 and 601 g/animal/day, for control, elephant alone and elephant plus morera, respectively). Feeding efficiency is improved by including morera in ensilage of elephant.

CONCLUSIONS

A great variety of forage is produced in Venezuela, which might, through ensilage), be transformed into a more nutritive and economical feed for cattle. Ensilages made of graminaceae and legume mixtures, when the latter do not exceed 30 % of the mixture.

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Chemical composition of forage and mixture of green forages (green and ensiled) of mid tropical areas.

Forage and mixtures	Composition and indicators					
	PC	FDN	FDA	Lign	pH	T (°C)
	%					
Sugar cane knot	6.2	65.42	47.72	7.18		
Knot + legume silage						
Knot + leucaena (70:30)	11.96	55.73	44.78	7.15	4.6	23
Knot + matarraton (70:30)	14.71	55.22	40.52	5.49	4.6	23
Knot + nacedero (70:30)	11.78	56.84	41.75	6.61	4.3	23
King grass (55 days)	11.8	57.60	39.13	6.34		
King grass + legume ensilage						
King grass + leucaena	17.32	44.24	36.72	6.40	4.3	23
King grass + matarraton	14.67	55.77	37.26	4.06	4.2	23
King grass + nacedero	12.86	54.63	38.61	6.23	4.5	23

PC: crude protein; FDN: neuter-detergent fiber; FDA: acid-detergent fiber; Lign: lignine; T: temperature
Source: Sánchez y García (2003)