Variability of yield, composition and quality in sorghum hybrids for making silage

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Introduction The use of corn or sorghum silage is a strategic tool for the intensification of livestock systems not only due to its high production potential and quality, but also because of its versatility. However, there are areas of limited rainfall or of marginal soil fertility were the corn crop is risky and of low productivity. Because of its drought tolerance, its safety and high forage production, the sorghum crop is an alternative for making silage mainly in the regions where there is high potential of production and the livestock production is increasing. In Argentine, especially in recent years, a lot of sorghum hybrids are suggested for making silage. The different types of plants according to its main usage destination (grain, forage, bioenergy) will produce differences in yield and quality of the whole plant destined to silage making. This paper aims to determine the variability in the forage productivity, the plant composition and the quality of the whole plant of sorghum hybrids for silage production.

Materials and Methods The experiment was conducted at the Agriculture Experimental Station of Manfredi in Cordoba Province, Argentine (latitude: 31º 49' 12'', longitude: 63º 46' 00''and an altitude of 292 m). In late October 2010, forty five hybrids of different sorghum types were sown in 1200 m^2 plots each one with three replicates in a randomized block design. The sowing was 0.52 m between lines and with 16 seeds per lineal meter. The hybrids were grouped into four categories according to the grain yield and treatments would correspond to the following genetic groups: G grain (grain main purpose) n = 20, DP: double purpose (grain and forage) n = 12, S: silage n= 11, and F: forage type n = 2. They were chopped when grain maturity was at paste stage and the % dry matter of the whole plant was near 35%, about 120 days from sowing. Before the silage making, 10 samples of 1 m^2 of each hybrid were taken in order to establish the total forage yield (kg DM/ha) and the relative participation of the different fractions of the plant (leaf, stem, grain and Brix grades). Three samples were taken to determine the nutritive value of the silages through NDF, ADF, CP and lignin content. The digestibility and energy concentration were estimated from the ADF. In order to perform a statistical analysis of the results, the data was subjected to an analysis of variance (ANOVA), processed by means of Infostat Professional v2007p, whereas the difference between means obtained for the treatments were determined by the LSD Fisher method.

Results and Discussion Rainfall during the growing season was 420 mm. The forage yield (t DM/ha) shows significant differences between the hybrids (with a maximum of 34.6 and a minimum of 16.5) with a coefficient of variation (CV) = 11.4% and between the different sorghum groups as presented in Table 1. There were significant differences in the proportions of the plant components among hybrids and groups. The highest coefficient of variation within all hybrids was in the proportion of grain (44.5%). These differences were reflected in the silage quality as shown in the nutritive values of the silages presented in Table 2. The digestibility shows the lowest CV (3.5%) but the difference between the

maximum (73.2%) and the minimum (61.2) is relevant to animal production. There is a decreasing tendency in the silage quality among sorghum groups when grain contain decreases and yield increases, but the variability within the groups do not allow definite conclusions.

Conclusions Although there are some tendencies, high variability in yield, composition and quality of sorghum hybrids within and among groups of plant types, require better understanding of the characteristics of each genotype and the purpose of each case to select the best alternative.

Table 1 Yield, proportion of the plant components and Brix grades of different sorghum hybrids grouped in four types.

		Groups of sorghum types[1]				
Item		G	DP	S	F	All hybrids
Yield (kg DM/ha)	average	19635^{a}	21208^{b}	22217^{b}	25624^{c}	22171
	CV (%)	9.9	12.3	15.2	49.6	11.4
Leaf (%)	average	16.5^{bc}	16.8^{c}	15.7^{ab}	14.3^{a}	15.8
	CV (%)	7.9	13.6	17.9	3.1	7.2
Stem (%)	average	30.8^{a}	37.2^{b}	41.9^{c}	72.1^{d}	45.5
	CV (%)	6.9	9.8	22.5	18.5	40.2
Grain (%)	average	52.7^{d}	46.1^{c}	42.4^{b}	13.6^{a}	38.7
	CV (%)	4.9	9.2	20.4	94.6	44.5
Brix grades	average	5.8^{a}	8.3^{b}	9.1^{bc}	12.2^{c}	8.9
	CV (%)	29.2	27.1	30.5	s/d	29.8

[1]G: grain; DP: double purpose; S: silage; F: forage
[a-d] Means within a row with different superscripts differ (P <0.05)

Table 2 Nutritional quality of silages in different groups of sorghum hybrids.

		Groups of sorghum types[1]				
Item		G	DP	S	F	All hybrids
CP (%)	Average	7.6^{c}	6.9^{b}	6.9^{b}	5.8^{a}	6.8
	CV (%)	7.5	11.3	13.0	38.2	11.2
NDF (%)	Average	48.3^{a}	51.8^{b}	51.4^{b}	58.8^{c}	52.5
	CV (%)	7.3	6.8	5.4	11.7	8.6
ADF (%)	Average	25.4^{a}	28.0^{b}	28.3^{b}	33.5^{c}	28.7
	CV (%)	9.4	9.8	8.0	20.2	11.9
Lignin (%)	Average	5.2^{a}	5.7^{a}	5.6^{a}	5.0^{a}	5.4
	CV (%)	12.7	15.7	13.5	29.7	5.5
Digestibility (%)	Average	70.1^{c}	68.3^{b}	68.1^{b}	64.5^{a}	67.8
	CV (%)	2.4	2.8	2.3	7.3	3.5
ME (Mcal /kg DM)	Average	2.5^{c}	2.5^{b}	2.5^{b}	2.3^{a}	2.4
	CV (%)	2.4	2.7	2.3	7.3	3.6

[1]G: grain; DP: double purpose; S: silage; F: forage
[a-c] Means within a row with different superscripts differ (P <0.05)