Evaluation of the quality of sorghum and corn whole plant silages in the Southeast of Salta province, Argentina

Navarro, J.A.[1] and Peiretti, J.[1]
[1]*Salta EEA, National Institute of Agricultural Technology (INTA). National Route 68, km 172 (4403) Cerrillos, Salta province, Argentina Republic. Phone: +54 (387) 4902214/24/87. Email: navarro.jorge@inta.gob.ar; peiretti.jose@inta.gob.ar*

Keywords silage, silo bag, drive-over pile silo, quality, particle size, density

Introduction The use of whole plant silage has been grown notoriously in the livestock farms in Argentina. Argentinian farmers prefer silo bags and drive-over pile silo types. Corn and sorghum are the two most conserved species as silo. The oxygen removal is of great importance in order to provide a rapid production of lactic acid and pH drop to maintain the material conservation. The silage density has influence on this aspect, since higher densities decrease the porosity of the silage. The smallest particle size favors compression and provides a larger surface area for contact with microorganisms. This study was carried out with the purpose of evaluating the effect of different kinds of silo and the species on the physical and nutritional quality parameters of the ensiled material in the southeast of the province of Salta, Argentina.

Materials and methods Throughout the year 2015, 40 whole plant silage samples were collected from drive-over pile silos (DOPS) and bags in livestock farms selected at random. All of them were considered for density, quality and particle size determinations. The particle size distribution was determined by Penn State Particle Separator (PSPS) system (Heinrichs, 2013). The chemical composition parameters were the follows: dry matter (DM, conventional dry oven at 60 ° C for 72 hours), crude protein (CP, by Kjeldahl method), neutral detergent fiber (NDF) and acid detergent fiber (ADF) by ANKOM method (Mertens and Fahey, 1994), in vitro dry matter digestibility (IVDMD) estimated through the production of gas (Theodorou et al., 1994), and silage pH (acidity, peachmeter PCE-PH22). Data were analyzed using Infostat software (Di Rienzo et al., 2001).

Results and discussion Results obtained in this test are shown in table 1 and table 2. There was a significant ($P<0.05$) higher green matter density (GMD) and a trend ($P<0.10$) to a high density of dry matter (DMD), in the treatment drive-over pile (DOP) silo to differ from bag silo. This is due to calibration deficiency in the bagging equipment and the bag mechanical´s resistance, which is less than the soil that supports the drive-over pile silo. The corn silages showed the highest GMD and DMD in contrast to the sorghum silages, due to a larger number of sampled corn drive-over pile silos. The highest percentage of particles larger than 19 mm and the lowest percentage of particles between 4 and 8 mm are due to a higher content of MS and the higher volume per hectare of this crop, which decreased the uniformity of particle size. There were significant differences ($P<0.05$) in the NDF and ADF values in favor of corn, explained by the higher ratio of grain/whole plant of corn in comparison to sorghum, because of the heterogeneity of ensiled biotypes of sorghum (grazing, silage and grain). Significant increases in IVDMD and EC in corn silage are due to their higher grain/whole plant ratio and to a physiological or maturity advanced state of corn at the time to be chopped, resulting in a greater contribution of starch by the grain. The significant difference in pH of the corn silage in contrast to sorghum silage is due to the greater contribution of soluble carbohydrates of corn grain.

Table 1 Physical quality parameters obtained in 40 bag and drive-over pile silos, of sorghum and corn, in the southeast of Salta, Argentina

	Mean				p-value	
	Bags	DOP	Sorghum	Corn	Bags x DOP	Corn x Sorghum
GMD (kg MV/m^3)	186.68	283.71	189.16	281.24	0.0035	0.0054
DMD (kg MS/m^3)	72.21	94.12	65.14	101.19	0.0583	0.0028
Upper (%)	13.80	10.17	8.43	15.54	0.3182	0.0553
Middle (%)	67.06	70.58	68.66	68.98	0.2854	0.9215
Lower (%)	14.68	15.61	18.52	11.77	0.5059	<0.0001
Bottom (%)	4.45	3.64	4.39	3.70	0.1709	0.2427

Value $p < 0.05$ Indicates significant differences between treatments (n=40)

Table 2 Nutritional quality parameters obtained in 40 bag and drive over-pile silos, of sorghum and corn, in the southeast of Salta, Argentina

	Mean				p-value	
	Bags	DOP	Sorghum	Corn	Bags x DOP	Corn x Sorghum
DM (%)	37.46	33.41	34.22	36.65	0.1040	0.3225
CP (%)	6.72	6.33	6.56	6.50	0.3223	0.8752
NDF (%)	51.78	54.29	56.71	49.36	0.2164	0.0008
ADF (%)	28.61	30.52	34.08	25.05	0.3730	0.0001
IVDMD (%)	66.61	65.13	62.35	69.39	0.3728	0.0001
EC (Mcal EM / kg MS)	2.40	2.35	2.25	2.50	0.3827	0.0002
pH	3.88	3.89	4.16	3.62	0.8947	0.0001

Value $p < 0.05$ Indicates significant differences between treatments (n=40)

Conclusions Drive-over pile silo kind had the best GMD and DMD values, without difference on particle size distribution, neither nutritional quality parameters than silo bag kind. Corn silage had the highest GMD and DMD values, particle size, and better nutritional quality parameters. For the area under study, either drive-over pile silo or bag silo kind can be used with equal productive results. Whole plant sorghum silage needs varieties with better grain/whole plant ratio and better harvested stage selection. Corn and sorghum silages need to improve their uniformity in particle size.

References

Di Rienzo, J., M. Balzarini, F. Casanoves, L. González, M. Tablada, W. Guzmán, and C. R. Robledo. 2001. InfoStat: software estadístico. Córdoba: Universidad Nacional de Córdoba.

Heinrichs, J. 2013. The Penn State Particle Separator.DSE 2013 - 186. . P. S. C. o. A. Sciences, ed. Pennstate Cooperative Extension. College of Agricultural Science., Penn State Extension.

Mertens, D. R. and G. C. Fahey. 1994. Forage Quality. Evaluation, and Utilization, ASA, SSSA,CSSA. American Society of Agronomy. Madison 450-493.

Theodorou, M. K., B. A. Williams, M. S. Dhanoa, A. B. M. Allan, and J. France. 1994. A simple gas production method using a pressure transducer to determine the fermentation kinetics of ruminal feeds. Animal Feeding Science Technology 48:185-197.