Effects of maturity and particle size on physical parameters of corn silage

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Introduction Maturity, packing and processing of the forage are ensiling influence silage quality. The processing and other physical damages provide subtract for lactic acid bacteria (LAB), exposing soluble carbohydrates, facilitating the action of fermenting microorganisms. Small particles become easy the oxygen removal through better packing. This study evaluated physically and fermentative characteristics in whole plant corn silage (WPCS) harvested at two different maturities and three theoretical lengths of cut.

Material and Methods The trial was conducted at the Animal Science Department of the Luiz de Queiroz College of Agriculture, University of Sao Paulo (USP/ESALQ). Whole corn plants were harvested at 30 and 40% of dry matter (DM), chopped in three different theoretical lengths of cut (3, 5 and 7mm) (without kernel processing), and packed in lab scale silos (20L buckets). Silages were stored for 90 days. At opening, silos were sampled to measure the pH and DM content, and also quantification of microbial of LAB and yeast by culture. The DM content was determined on WPCS samples by drying at 55ºC for 48h in a forced-air oven. The samples were used to determine particle size distribution using the Penn State Particle Separator (PSPS) manual shaker box (PSU-SB) with 3 sieves and a pan (Kononoff et.al., 2003). Data were analyzed with the proc mixed of SAS.

Results and Discussion Greater maturity increased the proportion of large particles on the upper sieve and consequently decreased density**,** because larger particles hinder bulk packing. DM contents were significant ($P<0.01$) when maturity was compared, since plant corn was harvest with 30% and 40% of DM (Table 1). However, DM values of silages did not differ significantly in terms of particle sizes (Table 2). The pH values of silages did not differ significantly among treatments, but the pH range between 3.8 and 4.2 is within the optimal pattern of ideal silage (McDonald et.al., 1991). However, when particle size increases (7mm), it hinders packing and decreases density; therefore, decreasing LAB and increasing pH and yeast (Table 2).

Conclusion When plants are harvested late (40% DM) with particle size 7mm, impair packing influencing silo density.

Table 1: Effect of maturity on silage features.

	30% DM	40% DM	SEM	P-value
Particle Size				
Upper (19mm), %	14	18	0.004	< 0.01
Middle (8mm), %	73	69	0.004	< 0.01
Lower (1.18mm), %	11	10	0.002	0.28
Bottom Pan, %	1	2	0.001	< 0.01
Dgm, mm	12.7	13.0	0.070	0.01
Sgm, mm	1.54	1.65	0.030	0.01
LAB, log cfu/g	5.77	6.36	0.120	0.01
Yeast, log cfu/g	4.75	4.09	0.088	< 0.01
pH	4.16	4.19	0.035	0.58
DM, g/kg FM	33.75	37.69	0.358	< 0.01
Density, Kg FM m^{-3}	632.36	617.36	3.830	0.01

DM (dry matter), LAB (lactic acid bacteria), FM (fresh matter), Dgm = geometric mean length as calculated by PSPS. Sgm = geometric standard deviation as calculated by PSPS.

Table 2: Effect of particle size on silage features.

	3mm	5mm	7mm	SEM	P-value
Penn State					
Upper (19mm), %	13	17	19	0.005	< 0.01
Middle (8mm), %	71	72	71	0.005	0.32
Lower (1.18mm), %	13	9	9	0.003	< 0.01
Bottom Pan, %	2	1	1	0.001	0.06
Dgm, mm	12.17	13.13	13.36	0.085	< 0.01
Sgm, mm	1.55	1.61	1.63	0.037	0.35
LAB, log cfu/g	6.07	6.14	5.99	0.146	0.78
Yeast, log cfu/g	4.42	4.31	4.53	0.108	0.37
pH	4.16	4.13	4.29	0.043	0.29
DM, g/kg FM	35.39	35.94	35.82	0.439	0.65
Density, Kg FM m^{-3}	635.37	633.12	606.08	4.690	< 0.01

DM (dry matter), LAB (lactic acid bacteria), FM (fresh matter), Dgm = geometric mean length as calculated by PSPS. Sgm = geometric standard deviation as calculated by PSPS.

References

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