Hybrid and harvest management affect the efficiency of silo bag for corn silages in Argentina

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Introduction Corn silage is a common ingredient in diets of dairy farms in Argentina. Dairy farmers invest money in harvesting the whole crop of corn but also in silo structures that varies from bunker to silo bags. The cost per kilo of dry matter (DM) depends on crop yield per hectare but also on the efficiency of usage of those structures. With silo bags, farmers must buy them every year. Therefore, the efficiency of silo bag usage, defined as the filling capacity per meter, is key. Dry matter (DM) content and particle size (PS) distribution are 2 variables easy to measure that could be affect the bag capacity (Muck et al, 2006). Our objective was to run an on-farm survey during 2 consecutive years to investigate the effect of 2 hybrids on silo bag capacity and its relationship with harvest management by DM and PS distribution control.

Materials and methods The corn silage bags survey was conducted at Chiavassa Dairy Farm, (latitude: -32° 02' 60" S, longitude -61° 47' 59" W, Province of Santa Fe, Argentina) in 2015 and 2016 whole-plant corn silage harvest. Before filling each silo bag and during the silage harvesting, each wagon was weight before loading the material into the bag. Every ~2 hours, silage DM was determined with 200 g whole-plant corn chopped sample drying for ~2 hours in forced air oven at 135°C and particle size distributions (PS) was done using PennState particle separator. As feed bag capacity (AFBC) was calculated dividing the total kg AF by bag by meters per bag, and DM bag capacity (DMBC) was calculated as of AFBC multiplying that by the DM percentage. The data set collected during 2 consecutive years included 22 silo bags of Dow 510 PW corn hybrid and 24 silo bags of SYN 969 TD/TG corn hybrids in 2015 and 10 and 14 silo bags in 2016 respectively. Physiological maturity reported by the breeder 135 and 152 days for Dow 510 PW and SYN 969 TD/TG respectively. Corn silage harvest time was determined by DM (~40% DM).The silo bags used in the farm were 2.74m diameter by 75 m long, with effective capacity 66.36$\pm$0.55 m long. The whole-plant corn chopped before to be discharge into the silo bag was calculated by the difference between full and empty wagon weight, through a scale for weighing trucks about 80 metric tons of capacity and digital register. Filling pressure was controlled based on the stretching of control rule in the bag side (max 10% of stretching). The PS was measured using the 3-sieves (%PS1: >19 mm; %PS2: 8-19 mm; %PS3: <8 mm) PennState particle separator with a sample of ~500 g. The dry matter yield (DMY) was calculated by the average from total Kg of DM whole-plant corn chopped from each plot, divided by the numbers of hectares harvested. The variables analyzed with ANOVA and the means of treatments were compared by LSD Fisher Test at 95% confidence level between hybrids per years and Pearson correlations (r; calculated using the CORR procedure) were run for DM, PS and DMBC by hybrid (InfoStat, 2016).

Results and discussions Significant (P<0.05) different were found for DMY, DMBC and DfPtH between Dow 510 PW and SYN 969 TD/TG in both years (Table 1).

Table 1 Mean ± SEM by corn hybrid per year for each variable

Year	2015			2016		
Corn Hybrid	**Dow 510 PW**	**SYN 969 TD/TG**	P-value	**Dow 510 PW**	**SYN 969 TD/TG**	P-value
DMY,kgDM/ha[1]	21455.2±188.3	22939.1±210.8	<0.001	16287.3±993.8	20291.0±296.6	<0.001
DM, %[2]	41.46±0.82	40.24±0.7	0.269	43.53±1.41	39.62±0.59	<0.001
PS1: >19 mm, %[3]	3.65±0.39	5.72±0.4	<0.001	12.77±1.58	13.79±0.54	0.496
PS2: 8-19 mm, %[4]	60.02±1.48	63.00±1.21	0.125	52.89±2.14	63.078±2	0.003
PS3: <8 mm, %[5]	35.63±1.86	31.27±1.37	0.062	34.28±3.55	20.49±1.33	<0.001
AFBC,kg/m[6]	3406.44±65.86	3224.91±57.22	0.042	3564.3±140.9	3477.55±68.58	0.552
DMBC,kg/m[7]	1404.34±24.95	1296.36±31.62	0.018	1537.56±56.72	1383.42±26.19	0.013
DfPtH, d[8]	118.91±1.54	136.53±0.40	<0.001	116.08±2.26	120.71±0.23	0.024

[1]DMY= dry matter yield, [2]DM= dry matter content, [3]PS1= PennState particle separator sieve >19 mm, [4]PS2= PennState particle separator sieve 8-19 mm, [5]PS2= PennState particle separator sieve <8 mm, [6]AFBC= as feed bag capacity, [7]DMBC= dry matter bag capacity, [8]DfPtH=days from planting to harvest.

Pearson correlations showed no significant effect (P > 0.05) between DMBC, DM and PS for Dow 510 PW hybrid. For SYN 969 TD/TG DMBC was positively and significantly (r= 0.47; P<0.05) correlated with DM, but it was not with PS distribution. Muck et al. (2006) reported DM and density positive relationship and negative when particle size increased (PS). Our results are not in agreement with Muck et al (2006) considering DM and PS for DOW 510 PW, while SYN 969 TD/TG DM showed similar results in DMBC.

Conclusions DMY was higher hybrid SYN 969 TD/TG, while Dow 510 PW required less DfPtH to reach ~40% DM content, and was more efficient in DMBC.
PS had not effect in the DMBC for both hybrids. SYN 969 TD/TG DM affected positively the DMBC, but for DOW 510 PW DM was no found effect.

References

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