Performance of dairy cows fed diets containing corn silage from silos with different sealing strategies

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Introduction The horizontal silos have become one of the most attractive options to the storage of forage crops as silage. However, the design of these silos results in large areas of the ensiled material that are exposed to the environment, making the silage prone to spoilage, especially in the upper layer (Borreani et al., 2007) and near the silo walls (McDonell et al., 2007). It has long been known that the practice of sealing horizontal silos with a covering improves silage quality. The traditional method used to cover silos is through the use of polyethylene (PE) films. Borreani et al. (2007) reported that the high O_2 permeability of PE films can contribute to the low quality of silage in the top layer of horizontal silos. New plastic films have been developed with the objective of reducing silage deterioration and improving silage quality, for instance, a coextruded oxygen barrier (OB) film composed of polyethylene and polyamide polymers. Recent studies conducted in several countries have shown that the use of these polymers reduced DM losses and top surface spoilage when compared with the use of standard plastic films. The objective of this trial was to evaluate different plastic films to seal horizontal silos on the performance of Holstein cows.

Material and Methods Fifteen lactating cows were randomly assigned to 5 replicated 3×3 Latin square design with 21-d periods. Animals were housed in sand-bedded tie-stall barn and individually fed ad libitum to achieve approximately 10% refusals twice daily (06:30 and 17:30 h). Treatments were defined according to silo covering method: BW: 200µm black-on-white polyethylene film, BW+SB: BW plus sugarcane bagasse over the film, and PA: 125µm polyamide/polyethylene coextruded film. Diets were formulated to reach isonitrogen content and contained 53% of corn silage (% DM) to meet the nutrient requirements of a dairy cow producing 35 kg/d of milk (NRC, 2001) (Table 1). The deteriorated inedible silage was discarded every day and only edible silage was used to prepare the total mixed rations (TMR). Dry matter intake (DMI) and milk yield were recorded from d-15 to d-21 in each period, as well as milk composition. Data were analyzed using the Mixed procedure of SAS.

Results and Discussion The responses of cows fed the experimental silages are shown in Table 2. Contrary to previous trials, protecting the BW film with sugarcane bagasse (BW+SB) did not improve milk yield, but unlikely decreased DMI and tended to decrease daily milk protein excretion. On the other hand, the PA sealing strategy showed extra protection resulting in higher dietary energy efficiency (Milk NE_L/DMI) due to a tendency for higher fat corrected milk yield and milk energy excretion. In the same way, milk protein excretion was also enhanced for PA treatment.

Table 1 Ingredient composition (% of DM) of TMR fed to lactating cows.

Item	Treatments[1]		
	BW	BW+SB	PA
Corn silage	52.79	52.41	52.33
Citrus pulp	11.47	11.91	11.77
Ground corn	11.59	11.93	11.21
Soybean meal	21.57	21.09	22.17
Mineral-vitamin mix[2]	2.58	2.66	2.61

[1]BW: 200µm black-on-white polyethylene film; BW+SB: 200µm black-on-white polyethylene film plus sugarcane bagasse over the film; PA: 125µm polyamide/polyethylene copolymer film.
[2]Mineral-vitamin mix contained (DM basis) 10% Ca, 2% S, 4% P, 5% Mg, 2% K, 2800 ppm of Zn, 490 ppm of Cu, 18 ppm of Se, 1400 ppm of Mn, 14 ppm of Co, 56 ppm of I, 20 ppm of Cr, 400 KIU/kg of vitamin A, 40 KIU/kg of vitamin D, 1200 IU/kg of vitamin E, 80 mg of biotin, and 600 mg of monensin.

Table 2 Responses of dairy cows fed corn silage stored under different sealing strategies.

Item	Treatment[1]			SE[2]	*P*-contrasts	
	BW	BW+SB	PA		BW + (BW+SB) vs. PA	BW vs. (BW+SB)
DMI, kg/d	24.34	22.98	23.37	1.19	0.47	0.03
3.5% FCM[3], kg/d	27.63	26.84	28.10	3.39	0.09	0.18
Fat, %	3.58	3.55	3.45	0.26	0.22	0.76
Fat, kg	0.96	0.94	0.97	0.09	0.25	0.23
Protein, %	3.48	3.44	3.53	0.20	0.17	0.45
Protein, kg	0.94	0.91	0.96	0.98	0.05	0.09
Casein, %	2.73	2.69	2.75	0.16	0.21	0.38
Lactose, %	4.53	4.52	4.45	0.07	0.27	0.90
Urea, mg/dL	12.24	12.21	11.40	0.93	0.23	0.97
Milk NE_L[4], Mcal/d	19.08	18.49	19.43	2.16	0.07	0.14
Milk NE_L/DMI, Mcal/kg	0.77	0.79	0.82	0.06	0.02	0.46

[1]BW: 200µm black-on-white polyethylene film; BW+SB: BW plus sugarcane bagasse over the film; PA: 125µm polyamide/polyethylene copolymer film, [2]SE: standard error of the mean, [3]3.5% Fat corrected milk, [4]Milk energy excretion.

Conclusion The oxygen barrier property of PA film was effective on maximizing the animal performance.

References

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