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Improving food & health

UNIVERSITÀ CATTOLICA del Sacro Cuore

XVIII ISC 2018

TU-13

The effect of bacterial inoculant and packing density on corn silage quality and safety

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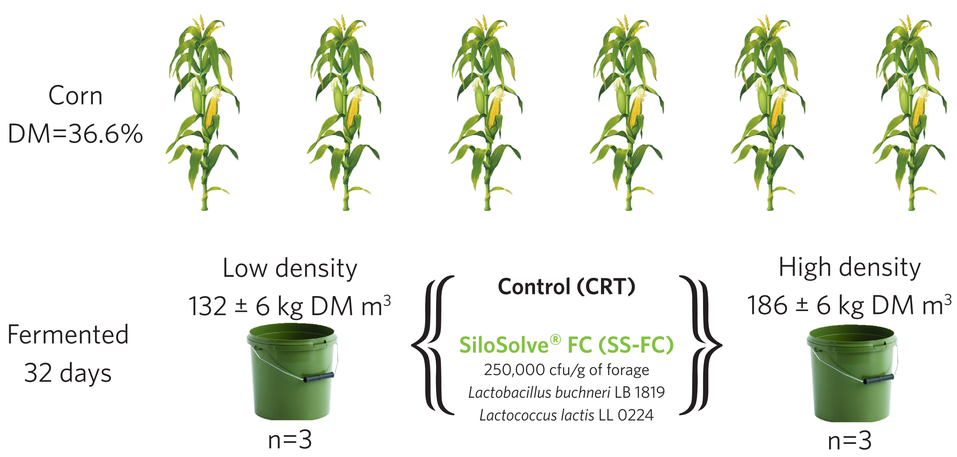
Keywords: Aerobic stability, *Lactobacillus buchneri*, *Lactococcus lactis*, mycotoxin, silage inoculant, spoilage

INTRODUCTION

The use of inoculants containing homo- or hetero-fermentative lactic acid bacteria (LAB) to improve fermentation and reduce nutrient losses in corn silage has been studied largely (Ranjit and Kung, 2000). Variation on the effectiveness of silage inoculants can be caused by poor silage management, especially when proper density is not achieved. Gas-filled porosity within the silage mass can facilitate the growth of spoilage microorganisms causing alteration of quality and hygiene due to undesirable fermentation or mycotoxin production.

The objective of this research was to assess the effect of the **combination** of ***Lactobacillus buchneri* LB1819** (DSM 22501/1k20738) and ***Lactococcus lactis* O-224** (DSM11037/1k2081) on **aerobic stability**, chemical composition and **mycotoxin level** of **corn silage** fermented for 32 days.

MATERIAL AND METHODS



- Fermentation parameters
- Aerobic stability (AS)
- Biogenic amine
- Mycotoxins produced by: *Fusarium spp., Penicillum roqueforti, Aspergillus fumigatus*

Extracted and determined as described previously by Gallo et al. (2016).

RESULTS

Aerobic stability was improved by the **use** of **SS-FC** and this effect was more evident in high than low density mini-silos

(TRT x Den interaction, *P*=0.05).

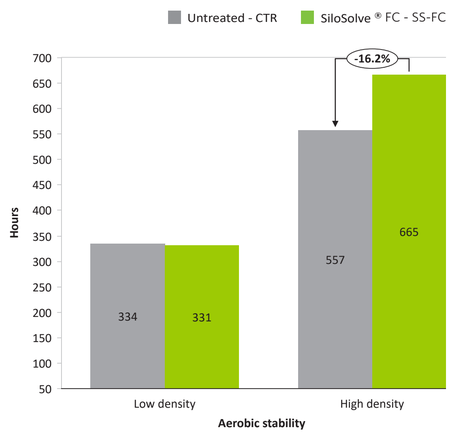


Figure 1. Effects of treatment (CTR vs. SS-FC) or density (Low vs. High) on aerobic stability (hours) of corn silages after 32 days of ensiling.

Table 1. Effects of treatment (CTR vs. SS-FC) or density (Low vs. High) on fermentative characteristics and mycotoxins of corn silages after 32 days of ensiling.

Items	CTR		SS-FC		s.e.m	P-values		
	Low	High	Low	High		TRT	Den	TRT x Den
DM (% as fed)	34.6	34.9	34.5	34.7	0.22	0.537	0.386	0.958
Fermentation parameters:								
pH	3.46	3.43	3.50	3.45	0.012	0.041	0.012	0.442
Lactate (% DM)	4.72	5.10	6.22	6.25	0.691	0.090	0.793	0.805
Acetate (% DM)	1.34	1.01	1.46	1.19	0.043	<0.01	<0.01	0.486
Ethanol (% DM)	0.80	0.58	0.47	0.44	0.086	0.028	0.194	0.295
Mycotoxins:								
Aflatoxin B1 (µg/kg DM)	0.5	0.6	0.3	0.2	0.25	0.346	0.970	0.635
Fumonisin B1 (µg/kg DM)	4107	3882	3678	3249	442.3	0.264	0.480	0.824
Fumonisin B2 (µg/kg DM)	466	285	311	216	65.1	0.123	0.067	0.529
Mycophenolic acid (µg/kg DM)	22	0.1*	4	0.1*	5.8	0.167	0.057	0.167
Roquefortine C (µg/kg DM)	20	20	0.1*	0.1*	5.3	<0.01	0.988	0.988

*These values are considered equal to limit of detection of HPLC-MS/MS method.

In freshly chopped whole crop corn mycotoxins were detected: aflatoxin B1 (0.6 µg/kg DM), fumonisins B1 (4845 µg/kg DM), and B2 (2613 µg/kg DM).

On average, the levels of these mycotoxins were numerically reduced during ensiling without differences among treatments. Other mycotoxins produced by *Penicillium spp.* were not detected in fresh material, whereas they were detected in the silage after fermentation with a higher level of roquefortine C in CTR than SS-FC silos (20 vs. 0.1 µg/kg DM; *P*<0.05).

CONCLUSION

This study shows the potential of **SiloSolve® FC to improve aerobic stability** and **to reduce the presence of different mycotoxins** detected on fresh material (*Aspergillus*-related or *Fusarium*-related mycotoxins) or produced during ensiling (*Penicillium*-related mycotoxins).

DISCUSSION

The presence of *L. buchneri* LB1819 in the SS-FC resulted in an increased concentration of acetate which explains the tendency for higher aerobic stability in the inoculated silages (Kleinschmit and Kung, 2006), at a higher density (TRT x Den interaction, *P*=0.050). Despite the similar number of yeast and mould between treatments, the concentrations of mycotoxins produced by *Penicillium* spp. were lower for SS-FC when compared to CTR. The concern about the presence of mould in silage is due to the potential risk of mycotoxin production by some of those fungi (e.g. *Aspergillus, Fusarium*, and *Penicillium* spp.; Gallo et al., 2015). Recently, Ma et al. (2017) showed how some of the most common silage inoculant bacteria are able to bind aflatoxin B1, with some degree of activity. Additionally, the inoculated silage showed lower incidences of other mycotoxins related to the presence of *Penicillium* spp. thus suggesting that the use of commercial inoculant may impact the growth of different strains of mould depending on the bacteria used as inoculant.

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