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Aerobic stability evaluation in artificially contaminated alfalfa silages inoculated with a dual-purpose microbial solution, after a short period of fermentation.

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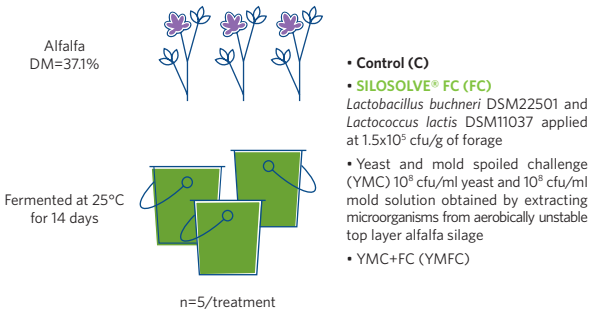
INTRODUCTION

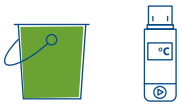
As extensively reviewed by Kung *et al.* (2018), an incorrect silo management could compromise ensiling phases, thus exposing silages to the risk of air penetration. Aerobic deterioration could cause nutrient and dry matter (DM) losses, heat damage of nutrients, proteolysis or proliferation of undesirable microorganisms, such as yeast and mold. The negative effects of aerobic activity could be more severe in specific areas of the silage, especially in the lateral and apical parts of the ensiled crop, which are generally packed and sealed with difficulty (Vissers *et al.*, 2007; Borreani and Tabacco, 2010).

The **objective** of this study was to evaluate the effects of a dual strain silage inoculant on fermentation parameters, aerobic stability (AS) and its ability to control the growth of undesirable microorganisms in alfalfa silage, **fermented for only 14 days**, and **artificially challenged** with yeast and mold isolated from top layer spoilage.

MATERIAL AND METHODS



- **Control (C)**
- **SILOSOLVE® FC (FC)**
  Lactobacillus buchneri DSM22501 and *Lactococcus lactis* DSM11037 applied at 1.5x10^5 cfu/g of forage
- Yeast and mold spoiled challenge (YMC) 10^8 cfu/ml yeast and 10^8 cfu/ml mold solution obtained by extracting microorganisms from aerobically unstable top layer alfalfa silage
- YMC+FC (YMFC)

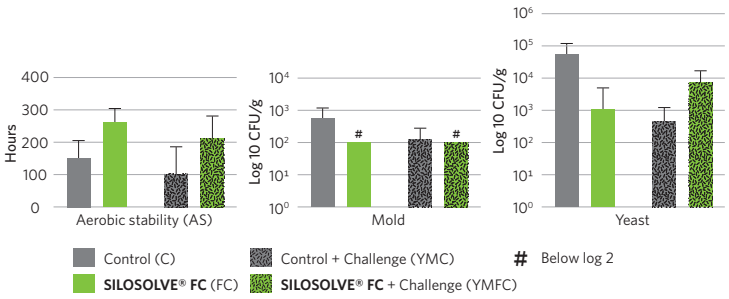


- Fermentation end-products
- Microbiological status:
  - Total count log cfu/g of lactic acid bacteria (LAB), yeast and mold
- Aerobic stability test (AS) for 14 days after fermentation using a data logger

Data were analyzed in agreement with a completely randomized design with a 2 x 2 factorial arrangement of treatments. The tested main effects were use of **SILOSOLVE® FC** (i.e., inoculant), challenged with yeast and mold (i.e., challenge) and their first order interaction. Significance was declared for a $P < 0.05$.

RESULTS AND DISCUSSION

All the **treated silages** (FC and YMFC) were **more stable** (+106 hours on average, $P < 0.05$) than untreated silages (C and YMC) even after only 14 days of fermentation.



After fermentation, the challenge model (addition of yeast and mold solution) increased only the yeast levels (inoculum*challenge effect, $P < 0.05$) while mold levels remained unchanged (P = 0.759).

Acetate levels were higher in **SILOSOLVE® FC** treated mini-silos and increased when yeast and mold were added to the silages (P = 0.051). Higher levels of lactate were observed in **SILOSOLVE® FC** treated mini-silos, but an opposite trend was observed when silages were challenged with yeast and mold (inoculum*challenge effect, P = 0.107). The use of **SILOSOLVE® FC** slightly increased the LAB population (P < 0.05).

Table 1. Effect of inoculant on fermentation end-products, microbial counts and aerobic stability in alfalfa silage ensiled for 14 days.

Items	Treatments				√MSE	P-value Inoculant	P-value Challenge	P-value Inoculant* Challenge
	C	FC	YMC	YMFC				
AS (hours)	157	256	109	222	51.0	<0.05	0.897	0.145
pH	4.57	4.53	4.72	4.69	0.263	0.788	0.207	0.994
DM corrected[1] (%)	41.5	40.3	39.8	38.3	1.34	0.446	0.381	0.341
DM loss (% DM)	2.6	3.0	7.5	2.0	3.53	0.133	0.232	0.083
Fermentation end-products (%DM)								
Acetate	2.3	3.2	3.3	4.8	1.40	0.074	0.051	0.612
Lactate	3.6	3.8	2.0	3.5	0.87	<0.05	<0.05	0.107
Microbial enumeration[2] (log10 cfu/g)								
LAB	8.5	9.1	8.9	8.9	0.29	<0.05	0.400	0.058

[1] The DM concentration was corrected for the volatile losses that occurred during oven drying through equations adopted by NorFor (2011) formula.
[2] When microbiological counts were below the detection limit (log10 cfu/g < 2), the value of 2 was used to carry out statistical analysis.
a-c Means (n = 5) within a row with different superscript differ ($P < 0.05$).

CONCLUSION

This study showed that the use of **SILOSOLVE® FC** in alfalfa silages **increased aerobic stability** even **when bad season conditions where mimicked** by artificially challenging the silage with a top layer yeast and mold suspension (and even challenged with a short fermentation period). The **challenge model** was a good method to artificially increase the yeast level and **mimic challenge conditions** that the farmers could face depending on the season.

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