Effects of applying lactic acid bacteria on fermentation quality and aerobic stability of forage-based total mixed ration silage

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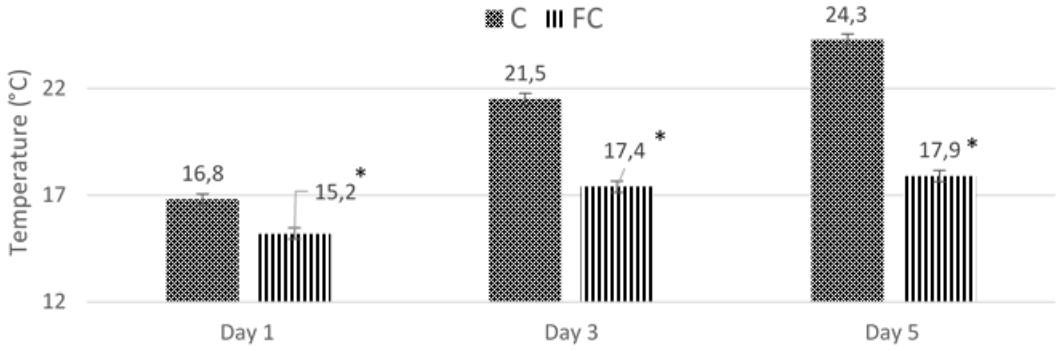
Introduction Preserving forage via ensiling should ensure a uniform feed in the farm for a long period of time. Silages may be mixed with other feeds to create a balanced and stabilized feed (total mixed ration, TMR). Feeding the same TMR to ruminant for long periods will ensure stable ruminal condition and homogeneity in production. Very often rations are mixed and fed to the animals once a day. Meaning that undesirable secondary fermentation processes occurring in the TMR for at least 24 hours should be inhibited to ensure good quality feed. Farmers use silage inoculants to enhance the fermentation process and ensure a high silage hygiene by reducing yeast and molds, especially during the feed out. The effects of silage inoculant on the forage crop are well known, but their role in improving the quality and the aerobic stability (AS) of the TMR (containing silage) are less clear. The aim of this study was to evaluate the effects of a dual strain silage inoculant on hygiene, AS and subsequent impact on silage-based TMR stability.

Materials and Methods Wilted grass/legume mixture was ensiled into cylindrical bales (total n=20, 500-600 kg/bale). The Control bales (C; n=10), with no inoculant, and the experimental bales, inoculated with SiloSolve® FC (150,000 total CFU/g of forage) (FC; n=10) containing 50:50 of *Lactobacillus buchneri* (DSM22501) and *Lactococcus lactis* (DSM11037), were fermented for 120 days. Bales (n=5/treatment (trt)) were tested for fermentation parameters, AS and hygiene before and after AS. The AS was performed on unwrapped bales by monitoring the temperature increase inside the mass for 30 days (until they reached +3°C above T ambient). The remaining bales (n=5/trt) were used for TMR preparation. TMRs containing 54 % of grass/legume silage and 46 % concentrates on dry matter basis were prepared after 1, 3, and 5 days of aerobic exposure of the bales, respectively. TMR temperature was monitored for 24 hours. Data were analyzed in a randomized block design using the GLM procedure (SAS, 9.4), fixed effects of the model were trt, aerobic exposure duration and their first order interaction.

Results and Discussion Compared to C, FC treated bales reported better fermentation characteristics ($P<0.01$ for all reported parameters) in term of higher lactate (70.2 vs. 51.6 g/kg DM) and acetate level (21.1 vs. 32.9 g/kg DM), lower butyric acid (0.26 vs. 1.09 g/kg DM) and less alcohols produced (7.0 vs. 10.3 g/kg DM). Regarding the silage hygiene before and after AS test, results are reported in Table 1. The TMR prepared with FC treated silages were colder after 24h of preparation compared to TMR containing C silages (Figure 1) ($P<0.001$).

Table 1 Silage hygiene parameters before and after aerobic stability (AS) of silage ensiled for 120 days.

Items	Treatment		SE	*P*-values
	C	FC		
Aerobic stability (AS), h	347	>720	6.60	P<0.01
pH (after AS)	4.37 (5.00)	4.21 (4.31)	0.030 (0.153)	P<0.01 (P<0.01)
Yeast, Log_{10} CFU/g (after AS)	2.33 (5.60)	1.00 (1.12)	0.049 (0.209)	P<0.01 (P<0.01)
Mold, Log_{10} CFU/g (after AS)	2.44 (6.87)	1.22 (1.40)	0.080 (0.237)	P<0.01 (P<0.01)



* The values are significant different $P < 0.001$

Figure 1 Temperature after 24 hours of preparation (°C) of TMR included Control (C) or SiloSolve® FC treated silages fermented for 120 days and exposed to the air for 1, 3 or 5 days.

TMR temperatures registered after 24 hours of preparation were always lower in the TMR containing FC silage compared to TMR containing C silage (independently if the silages were exposed to the air for 1, 3 or 5 days). Similar results have been reported by Copani *et al.*, 2019 even when the treated silage was fermented for shorter period (7 days). The difference in terminal TMR temperature (24 hours), when prepared from silages exposed to air for 5 days, was 6.4 °C, with the lowest registered in the FC-TMR. Estimating the resulting DM loss, using the model presented by Pires *et al.* (2018), indicates a difference of 2.2 % less DM losses in the FC-TMR.

Conclusions

These results demonstrate that use of SiloSolve® FC in grass/legume mixture improves silage hygiene, aerobic stability, as well as TMR stability after 120 days of fermentation. Inclusion of SiloSolve® FC treated silage into the TMR helps keeping the TMR from heating and prevents DM losses even after 5 days of aerobic exposure of the silage.

References

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