The effects of a silage inoculant on aerobic stability and quality of whole crop barley fermented for 120 days and the impact on total mixed ration stability.

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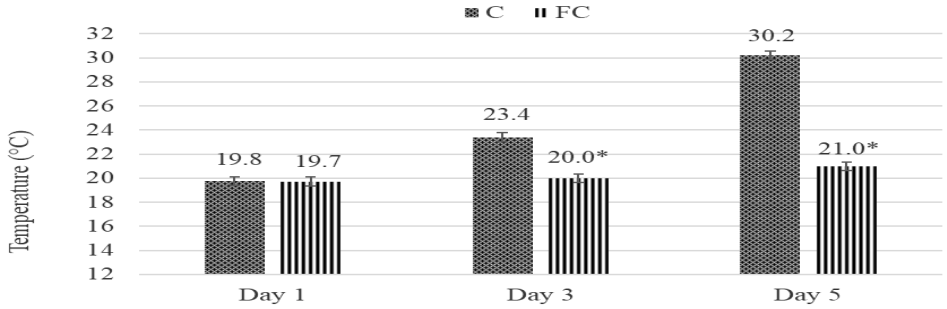
Introduction Due to the low buffering capacity and high level of fermentable carbohydrates whole-crop barley (*Hordeum vulgare* L.) is considered as easy to ensile crop (Acosta *et al.*, 1991). Microbial inoculants have been added to silages to improve the fermentation and the aerobic stability (AS) of the treated silages. Shifts in fermentation products, and improvements of aerobic stability and DM recovery, may in themselves be sufficient to warrant utilization of a silage inoculant. Nowadays the benefit of using a silage inoculant is well known, however, the impact of including treated silage into total mixed ration (TMR) needs to be investigate more. The aim of this study was to evaluate the effects of a dual strain silage inoculant on silage hygiene, AS and subsequent impact on silage-based TMR stability.

Materials and Methods Whole-crop barley – *Hordeum vulgare* L. – was ensiled into cylindrical bales (DM 38%, total n=20, 700-750 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 57 % of whole crop barley silage and 43 % 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 treatment enhanced all fermentation parameters ($P<0.01$ for all reported parameters). DM losses were lower (76 vs. 107 g/kg DM, $P<0.05$), whereas levels of lactate and acetate were higher, (40.1 vs. 20.1 g/kg DM and 17.5 vs. 7.30 g/kg DM, respectively) in FC treated compared to C silage. Butyrate level was also lower compared to control (1.43 vs. 4.45 g/kg DM). Less alcohols production was observed in the treated silage (10.7 vs. 16.5 g/kg DM). Regarding the silage hygiene before and after AS test, results are reported in Table 1.

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	258.00	>720.00	14.325	P<0.01
pH (after AS)	4.13 (6.18)	3.98 (4.08)	0.015 (0.132)	P<0.01 (P<0.01)
Yeast, Log_{10} CFU/g (after AS)	2.42 (4.06)	1.00 (1.88)	0.038 (0.159)	P<0.01(P<0.01)
Mold, Log_{10} CFU/g (after AS)	1.70 (5.69)	1.51 (2.06)	0.068 (0.173)	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 lower in the TMR containing FC silage compared to TMR containing C silage after 3 or 5 days of aerobic exposure of the silages (Figure 1). Similar results, using grass/legume mixture silages, 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 9.2 °C, with the lowest registered in the FC-TMR. DM losses estimated using the model presented by Pires *et al.* (2018), indicates a difference of 4.5 % less DM losses in the FC-TMR.

Conclusions These results demonstrate that use of SiloSolve® FC in whole crop barley 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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