**Effects of a novel dual purpose silage additive on aerobic stability and fermentation characteristics of whole crop maize silage after a short time of ensiling**

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**Introduction** Recently, a novel *Lactococcus lactis* O224 DSM11037 lactic acid bacteria (LAB) strain has been introduced, which is superior in oxygen scavenging and also relatively fast in reducing pH (Hindrichsen *et al.*, 2012). Combining this *L. lactis* O224 DSM11037 strain with *Lactobacillus buchneri* DSM 22501 have shown better results on aerobic stability than previously seen with combinations of *L. buchneri* and high lactate producing strains such as *L. plantarum* at 90 days of fermentation. Recent years, though, many producers have faced feed shortage problems due to season variation. This has forced them to shorten the fermentation time of silage with poor aerobic stability as a negative consequence. The objective of the current study was therefore to evaluate the efficacy of the new *L. lactis* O224 DSM11037/*L. buchneri* DSM 22501 combination on fermentation parameters and aerobic stability at even very short ensiling times. The additive was compared to an untreated reference.

**Material and methods** Silages were prepared from whole crop maize containing 34.4 % DM and 3.02 % water soluble carbohydrate (WSC) on fresh matter basis, respectively. Forage was treated the following: no additive (UT) and SiloSolve FC, containing *L. buchneri* DSM22501 and *L. lactis* O224 DSM11037 (TA), Chr. Hansen A/S, Denmark. The target application rate was 150,000 cfu/g forage. The untreated control (UT) received the appropriate amount of sterile water. Whole crop maize was ensiled in 3 l laboratory silos and each treatment was replicated 5 times. Silages were analyzed on day 2, 4, 8, 16, and 32 of storage at 20$^{o}$C. Aerobic stability (AS) of silages was determined from a 7 day aerobic challenge period after each fermentation time (day 2, 4, 8, 16, and 32 of storage). This was done by monitoring the temperature increase in silages stored aerobically in insulated PVC-tubes at 20 ºC ambient temperature. Aerobic stability is determined by the amount of time it takes the silage temperature to exceed the ambient temperature with more than 3°C. Data were statistically analyzed as a randomized complete block by using the GLM procedure of SAS.

**Results and discussion** TA resulted in better preserved silage with significantly ($P<0.05$) lower pH and significantly ($P<0.05$) lower yeast and mold counts. When compared with the control (UT) treatment SiloSolve FC treatment reduced ($P<0.05$) dry matter loss at all ensiling times (Table 1). On an average of the different fermentation periods, TA reduced the fermentation losses with 49% ($P<0.05$) compared to the untreated (UT) silages.
After 7 days of aerobic exposure pH, yeasts, molds, and DM losses were significantly reduced for the TA treated silages compared to the untreated control silages (UT). TA treated silages resulted in a significantly enhanced aerobic stability, on average by 49% ($P<0.05$), at all ensiling periods, compared to UT.

**Table 1** Silage parameters after different ensiling periods, ensiled with or without additive.

| Ensiling time | Treatment | DM, % | pH | Yeast, log10 cfu/g | Mold, log10 cfu/g | Weight loss, % |
|---|---|---|---|---|---|---|
| 2d | UT | 34.3 | 4.55 | 5.08 | 3.49 | 0.48 |
| | TA | 34.3 | 4.39* | 4.32* | 2.52* | 0.42* |
| 4d | UT | 34.3 | 4.42 | 4.72 | 3.12 | 0.78 |
| | TA | 34.3 | 4.22* | 3.63* | 2.41* | 0.54* |
| 8d | UT | 33.4 | 4.24 | 4.63 | 2.86 | 1.06 |
| | TA | 33.8* | 4.05* | 2.47* | 1.97* | 0.61* |
| 16d | UT | 32.9 | 4.11 | 3.93 | 2.71 | 1.18 |
| | TA | 33.8* | 3.95* | 1.34* | 1.78* | 0.65* |
| 32d | UT | 32.7 | 4.01 | 3.32 | 2.67 | 1.3 |
| | TA | 33.7* | 3.89* | 1.06* | 1.45* | 0.69* |

UT = untreated, TA = *L. buchneri* DSM22501 and *L. lactis* O224 DSM11037, *significantly different from untreated control (P<0.05).

**Table 2** Silage parameters after 7 days of aerobe challenge, ensiled with or without additive.

| Ensiling time + aerobic challenge | Treatment | pH | Yeast, log10 cfu/g | Mold, log10 cfu/g | AS, hours | Weight loss, % |
|---|---|---|---|---|---|---|
| 2d + 7d | UT | 8.49 | 7.88 | 6.69 | 32.4 | 4.11 |
| | TA | 8.09* | 7.50* | 6.47* | 49.2* | 2.83* |
| 4d + 7d | UT | 8.30 | 7.64 | 7.18 | 42.0 | 3.33 |
| | TA | 7.83* | 7.37* | 6.79* | 55.2* | 2.35* |
| 8d + 7d | UT | 7.90 | 8.00 | 7.46 | 69.6 | 3.78 |
| | TA | 6.90* | 7.25* | 6.25* | 98.4* | 2.59* |
| 16d + 7d | UT | 7.80 | 8.28 | 8.69 | 78.0 | 3.29 |
| | TA | 6.70* | 7.39* | 7.37* | 109.2* | 2.24* |
| 32d + 7d | UT | 7.58 | 8.30 | 8.16 | 88.0 | 2.91 |
| | TA | 4.77* | 7.24* | 6.30* | 146.4* | 1.79* |

UT = untreated. TA = *L. buchneri* DSM22501 and *L. lactis* O224 DSM11037. AS = Aerobic stability. *Significantly different from untreated control (P<0.05).

**Conclusions** The novel combination of a hetero- and homofermentative LAB (*L. buchner*i DSM22501 and *L. lactis* O224 DSM11037) was efficient at reducing pH, DM loss, yeast and mold counts at all the investigated ensiling periods in this study. TA significantly enhanced the aerobic stability of whole crop maize silage compared to UT.

**References**

Hindrichsen, I. K., Augustsson, E. U., Lund, B., Jensen, M. M., Raun, M., Jatkauskas, J., V. Vrotniakiene, and C. Ohlsson. 2012. Characterization of different lactic acid bacteria in terms of their oxygen consuming capacity, aerobic stability and pathogen inhibition. Page 105 in Proc. 16th Intern. Silage Conf. Hameelinna, Finland.