

The effects of commercial microbial inoculants on the fermentation and aerobic stability of barley silage

R. J. Schmidt, B. Kowalke, E. Chevaux, R. C. Charley
Lallemand Animal Nutrition, Milwaukee, Wisconsin, USA
Email: rjschmidt@lallemand.com

Introduction When used as inoculants, some species of heterolactic and propionic acid bacteria may extend the aerobic stability of the silages by the production of acetic acid or propionic acid, respectively (Kung et al., 2003). The objectives of this study were to determine the effectiveness of commercial microbial inoculants on the fermentation and aerobic stability of barley silage.

Materials and Methods Chopped whole-plant barley (41 %DM) was taken to a shed, divided into small piles and the following treatments were applied to each pile: (1) Water, negative control (**C**); (2) Easy Sile Advance (Micron Bio-Systems Inc., Buena Vista, CA) (**M**): 150,000 CFU of *Pediococcus acidilactici*, *P. pentosaceus*, *Lactobacillus plantarum* and *L. brevis* per g of forage; (3) Biotal Plus II (Lallemand Animal Nutrition, Milwaukee, WI) (**P**): 100,000 CFU of *P. pentosaceus* 12455 + 20,000 CFU of *Propionibacterium freudenreichii* R2453 per g of forage; and (4) Biotal Buchneri 500 (Lallemand Animal Nutrition) (**B**): 400,000 CFU of *L. buchneri* 40788 + 100,000 CFU of *P. pentosaceus* 12455 per g of forage. Approximately 6.5 kg of forage was packed into 9-L pails (quadruplicates per treatment) and allowed to ensile for 2 and 60 days in a closed barn at room temperature. Upon silo opening, fermentation products and nutrient profile of the silages were determined, and silages stored for 60 days were also tested for aerobic stability, according to Kung and Ranjit (2001). Data was analyzed by ANOVA according to the GLM procedure of the SPSS 19.0 with treatments as fixed effects and a non-parametric Kruskal-Wallis test for the not normally distributed variable per sampling time.

Results and Discussion The nutrient and fermentation profiles are shown on Table 1. Compared to the other treatments, B treated silages had the lowest level of lactic acid and highest level of acetic acid, which has been normally observed. Treatment B also led to silages with higher contents of starch and lower contents of ADICP; high levels of ADICP can be indicative of heating events in the silage. The aerobic stability of barley silages is shown in Figure 1. Silages treated with B were the most stable when exposed to air, followed by silages treated with P; treatment with M resulted in no improvement in aerobic stability compared to untreated silages.

Conclusion Inoculants containing *Lactobacillus buchneri* 40788 or *Propionibacterium freudenreichii* R2453 were effective at improving the aerobic stability of the resulting barley silages compared to untreated ones.

References

- Kung, Jr., L., M. R. Stokes, and C. J. Lin. 2003. Microbiology of ensiling. Pages 305-360 in: *Silage Science and Technology*. Agron. Monogr. 42. D. R. Buxton, R. E. Muck, and J. H. Harrison, ed. American Society of Agronomy, Inc., Crop Science Society of America, Inc., Soil Science Society of America, Inc. Publications, Madison, WI.
- Kung, Jr., L. and Ranjit, N.K. 2001. The effect of *Lactobacillus buchneri* and other additives on the fermentation and aerobic stability of barley silage. *J. Dairy Sci.* 84, 1149–1155

Table 1. Fermentation and nutrient profile of barley silages treated with different inoculants after 60 days of ensiling.

Item	Treatment ¹				SEM
	C	M	P	B	
DM, %	34.89	32.77	33.35	33.81	1.30
pH	3.97 ^b	4.14 ^{ab}	4.11 ^b	4.46 ^a	0.08*
Lactic acid, %DM	4.14 ^a	4.76 ^a	4.04 ^a	1.77 ^b	0.38
Acetic acid, %DM	0.44 ^c	0.36 ^b	1.60 ^b	1.96 ^a	0.10
Sugar, %DM	2.21 ^{ab}	1.83 ^b	1.60 ^b	2.80 ^a	0.22
Starch, %DM	15.85 ^b	14.86 ^b	13.86 ^b	19.52 ^a	1.00
Ammonia-N, CP	0.35	0.42	0.36	0.42	0.10*
ADICP ² , CP	0.87 ^a	0.88 ^a	0.83 ^{ab}	0.79 ^b	0.03

¹C = Control; M = Easy Sile Advance; P = Biotal Plus II; B = Biotal Buchneri 500;

²ADICP = Acid detergent insoluble crude protein; ^{a,b}Means in the same row with different different superscripts differ ($P < 0.05$); *non parametric Kruskal-Wallis test.

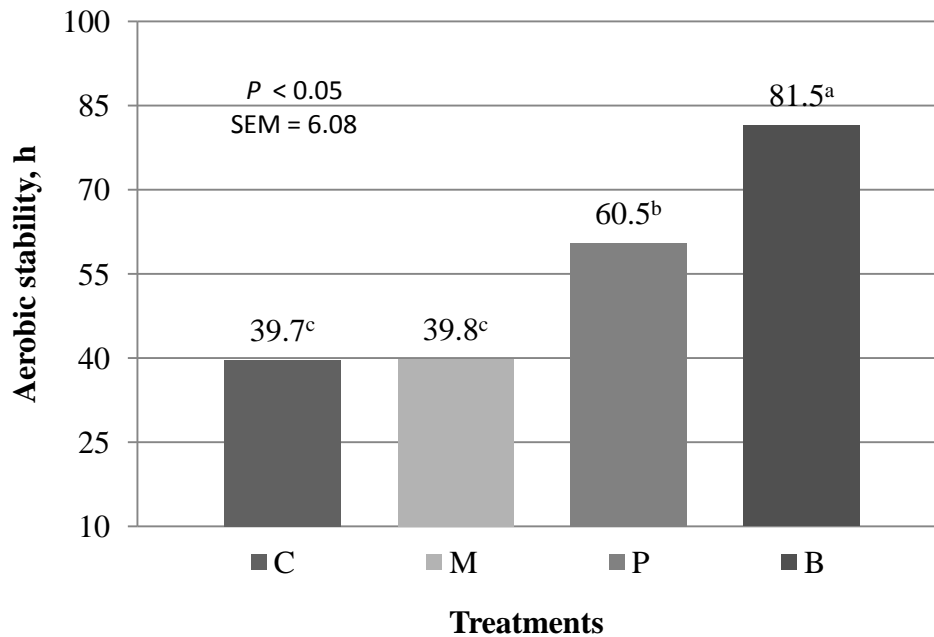


Figure 1. Aerobic stability of barley silages treated with different inoculants after 60 days of ensiling.