

Anticipating silo opening by using the association of *Lactobacillus diolivorans* and *Lactobacillus buchneri* to control aerobic deterioration in corn silage

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Introduction *Lactobacillus buchneri* (LB) has been extensively used as an inoculant to improve the aerobic stability of whole-plant corn silage (WPCS). It has been recommended a minimum of 90 d of conservation when silages are treated with LB in order to increase acetic acid over time. However, producers may need to open silos earlier since they have a demand for feed on the farm. As *Lactobacillus diolivorans* (LD) acts synergistically with LB degrading 1,2-propanediol to propionic acid, we hypothesized that the association between LD and LB could reduce the conservation period (< 90 d) without compromising the aerobic stability of WPCS.

Material and Methods The corn was harvested with a self-propelled harvester when the dry matter (DM) concentration was at 33%. The following treatments were tested: WPCS without inoculant (CONTROL), WPCS inoculated with *L. plantarum* DSM 12837, *L. rhamnosus* NCIMB 30121, and *L. buchneri* DSM 12856 (LB), and WPCS inoculated with *L. rhamnosus* NICMB 30121, *L. buchneri* DSM 12856, and *L. diolivorans* DSM 32074 (LB+LD). The inoculants were added at a theoretical rate of 2.5×10^5 colony forming units (CFU) per gram of fresh forage. After applying the treatments, the forages were compacted to a density of 575 ± 6.8 kg.m⁻³ in 5-L laboratory silos using four replicates per treatment. After compaction, the silos were sealed with plastic caps and then weighed and kept at room temperature for 15, 30, 45, and 90 d. After each period, the silos were weighed again and opened. Duplicate measurements were made of the DM concentration and fermentation end products. Silages were also subjected to an aerobic stability and deterioration tests. A completely randomized design was used, with a 3x4 factorial arrangement. Variables were analyzed with the PROC MIXED of SAS. The means were compared by Student's t-test at 5% level.

Results and Discussion The use of inoculants were the responsible for the higher acetic and propionic acids concentrations in LB and LB+LD silages (Figure 1). The 1,2-propanediol concentration in CONTROL silage was not altered over time. However, the LB+LD silages had higher 1,2-propanediol concentration when stored for 45 d. Simultaneously, the propionic acid concentration increased in LB+LD silages, at the same time period. The LD specie are capable to metabolize 1,2-propanediol, one of the fermentation end products by anaerobic lactic acid degradation by LB, in propionic acid, what reduced the 1,2-propanediol concentration in LB+LD silages. The LB+LD silages stored for 45 d had higher acetic and propionic acid concentration. These silages when stored for 45 d had an increase of 37 h on aerobic stability than CONTROL silages (Figure 2).

Conclusion Silos can be opened at 45 d of conservation when *Lactobacillus diolivorans* and *Lactobacillus buchneri* are inoculated to control aerobic deterioration in corn silages.

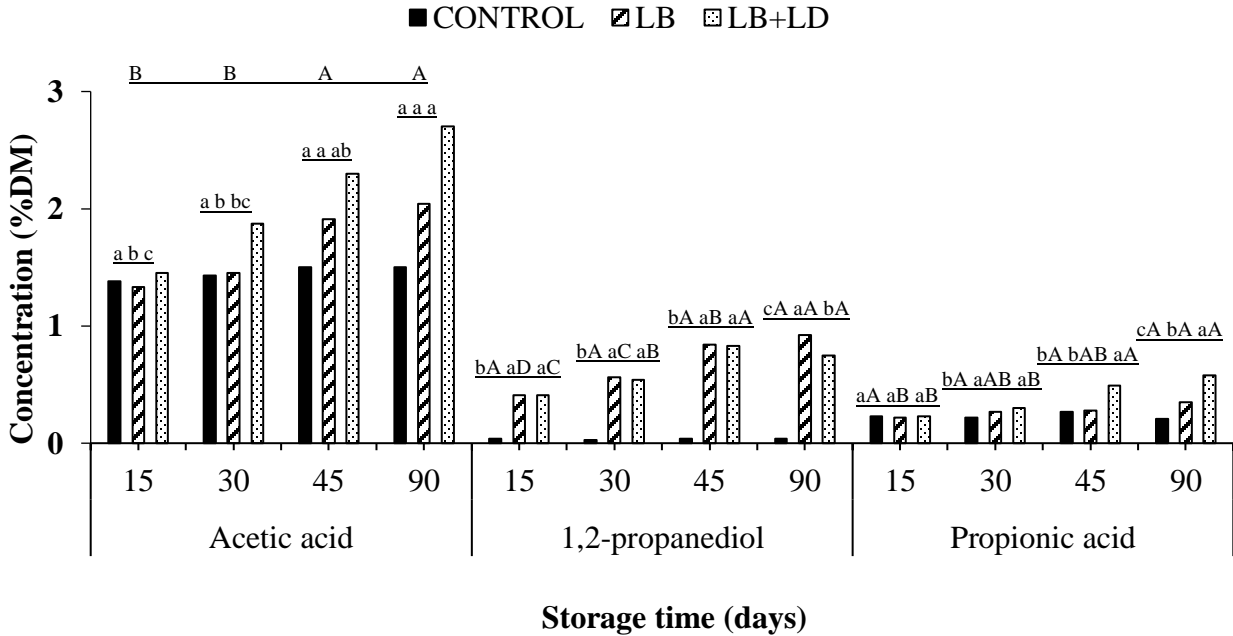


Figure 1 Fermentation end products concentration of WPCS, with or without inoculants, in different storage times. Uppercase and lowercase letters equal, do not differ from each other (Student's *t*-test); *P* value for inoculation: acetic acid $P < .0001$, 1,2-propanediol $P < .0001$, propionic acid $P < .0001$; *P* value for storage time: acetic acid $P < .0001$, 1,2-propanediol $P < .0001$, propionic acid $P = 0.0004$; *P* value for interaction inoculation*storage time: acetic acid $P = 0.0690$, 1,2-propanediol $P < .0001$, propionic acid $P < .0001$.

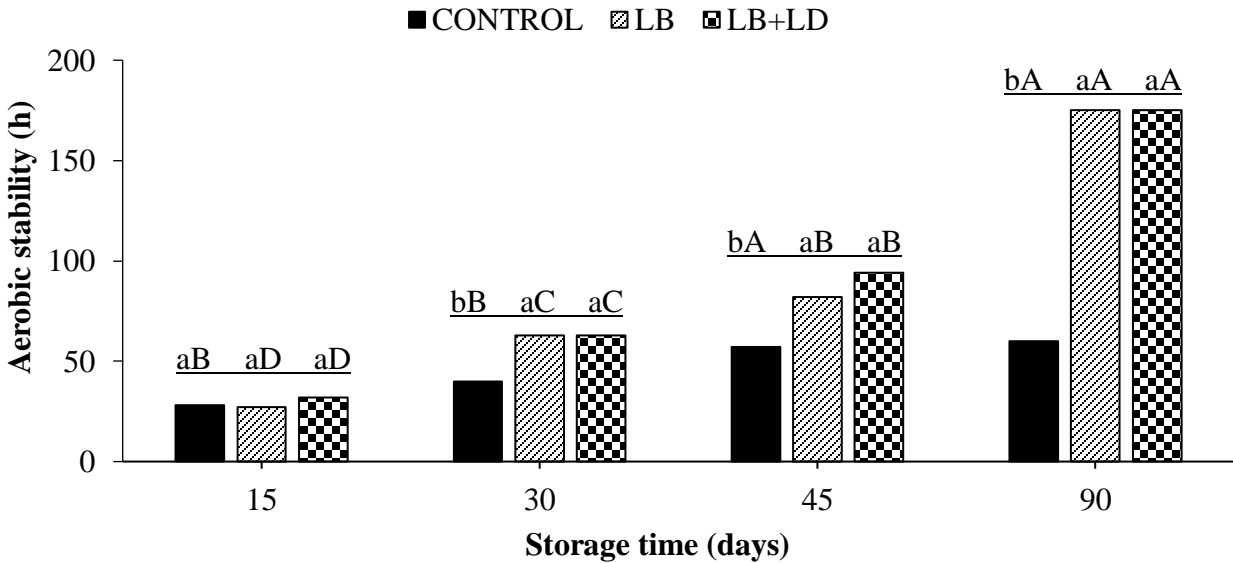


Figure 2 Aerobic stability of WPCS, with or without inoculants, in different storage times. Uppercase and lowercase letters equal, do not differ from each other (Student's *t*-test); *P* value for inoculation: $P < .0001$; *P* value for storage time: $P < .0001$; *P* value for interaction inoculant*storage time: $P < .0001$.