Microbial inoculant, particle size, and storage time effects on fermentation profile and aerobic stability of reconstituted sorghum grain

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Introduction Inoculants, comprising homofermentative species, control the ensiling fermentation by greater production of lactic acid and the consequent decrease in pH. However, high levels of water-soluble carbohydrates from grains, combined with high lactic acid concentrations are substrates for fungi that are associated with aerobic spoilage. It is possible the use of heterofermentative bacteria control fermentation in order to enhance aerobic stability. The aim of this study was to evaluate the effects of microbial inoculant (I), particle size (PS), and storage time (T) on fermentation profile and aerobic stability of reconstitute sorghum grain.

Materials and Methods Sorghum grains were grounded into three PS (8, 2, and 1 mm), rehydrated to reach 650 g DM/kg OM and ensiled in mini silos (300 g). Before ensiling, the mass was inoculated with one of the treatments (1) Control (distilled water); (2) LB, *Lactobacillus buchneri* at 1×10^5 cfu/g OM (Lalsil® AS – Lallemand Animal Nutrition); (3) PP, *Pediococus acidilactici* and *Lactobacillus plantarum* at 1.3×10^5 cfu/g OM (Lalsil® CL – Lallemand Animal Nutrition); and (4) LBpp, LB + PP. Treatments were evaluated in quintuplicate during 0, 15, 30, 120, and 360 days of storage (T). Silos were kept inside the lab within controlled temperature (25 °C). A subsample of 100 g was collected and pressed for pH, acetate, and lactate measurements. Portable digital potentiometer was used for pH measurement, acetic acid was determined by gas chromatography, and lactate by colorimetric method. Silage samples were exposed to air to determine aerobic stability (2 °C increased above ambient temperature) by infrared digital thermometer. Data were analyzed using the Mixed procedure of SAS.

Results and Discussion There was PS×I×T interaction (P<0.01) for pH, where the pH of all treatments decreased until 15 d of fermentation, however only silages inoculated with LB with 2 and 8 mm of PS had the greatest pH among treatments. Lactic acid was influenced by PS×I×T interaction (P<0.01), where the concentration of lactic acid increased rapidly until 15 d of storage time for all treatments, and then varied a little until 120 d of fermentation, but the average of lactate concentration was always lower for LB, and at d 360 the concentration was greater for PP, followed by LBpp, control and LB. There was a PS×I×T interaction (P<0.01) for acetic acid, where the concentration increased for all treatments until 15 d of storage time, and stabilized for all treatments, but LB treated groups showed the highest values. After 15 d of fermentation, greater acetic acid concentration was observed for LB with 2 mm of PS, followed by 1, and 8 mm of PS (P<0.01). Besides LB effects, there was no other difference (P>0.05) among other treatments, regardless the type of inoculant or PS. The aerobic stability was affected by PS×I×T interaction (P<0.01). The mass not ensiled (time 0) increased the temperature after 22 to 36 h of exposition to air. The aerobic stability increased until 30 d of fermentation for the control group, and only until 15 d for the others treats. There was greater stability for LB (120 h of stability), followed by control (88 h of stability), and LBpp and PP (72 to 80 h of stability), with no difference between the last two treated groups.

Conclusions Reconstitute sorghum grain silage presented greater aerobic stability when inoculated with LB, likely due to the lower lactic acid and greater acetic acid concentrations observed, regardless the PS or storage time.

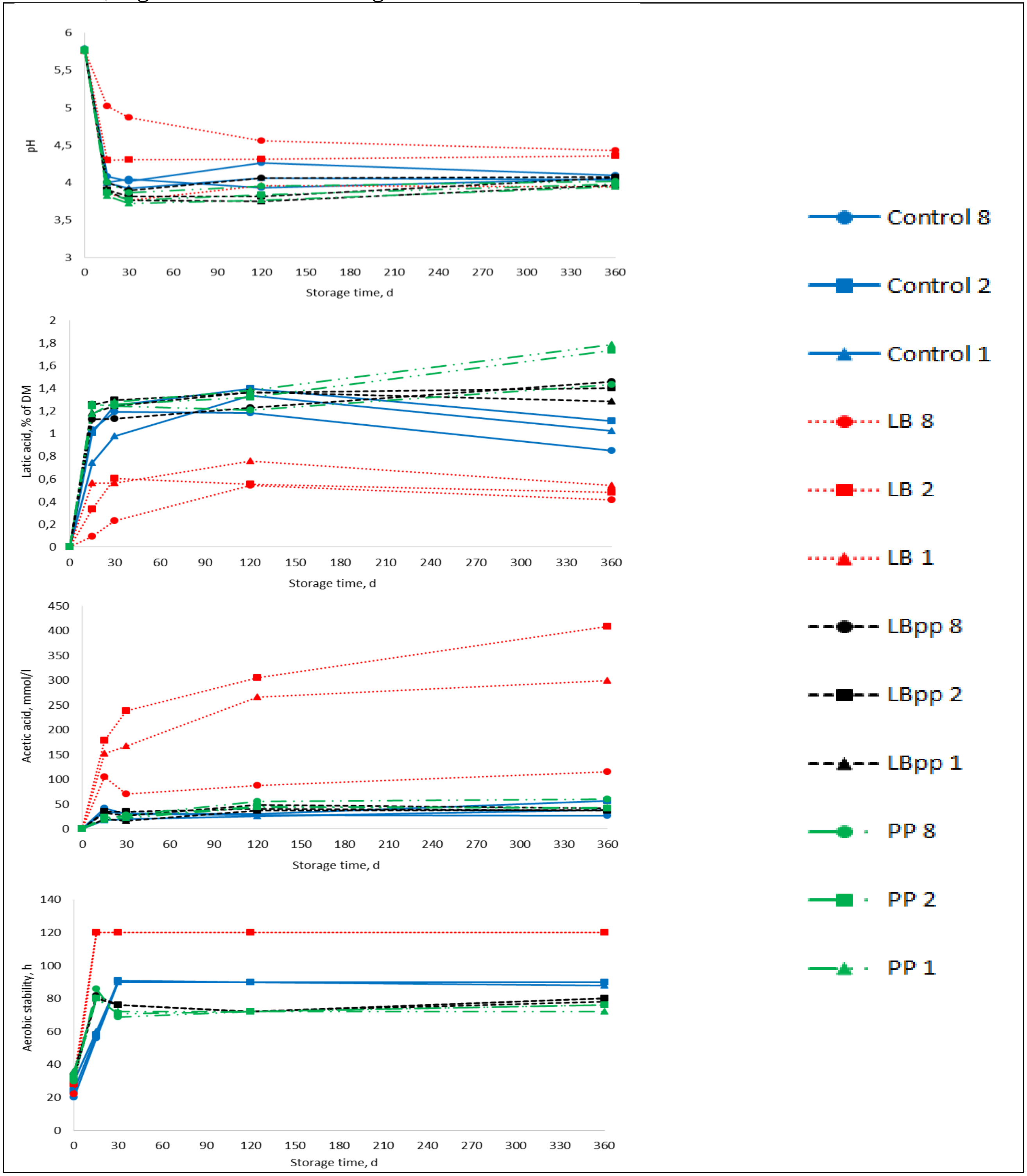

Figure 1 Microbial inoculant, particle size, and storage time effects on pH, lactic and acetic acid, and aerobic stability of reconstituted sorghum grain.