

Bacterial diversity of forage sorghum silage treated with *Lentilactobacillus buchneri* or organic acids

Edson Mauro Santos¹, Alberto Jefferson da Silva Macêdo¹, Paulo da Cunha Tôres Júnior¹, Luana Milena Pinheiro Rodrigues¹, Juliana Silva de Oliveira¹, Vanessa Maria Rodrigues de Lima¹, Gabriel Ferreira de Lima Cruz², Hilário Cuquetto Mantovani²

¹DZ/UFPB Department of Animal Science, Federal University of Paraíba, Areia, PB, Brazil

²Department of Animal and Dairy Sciences, University of Wisconsin, Madison, WI, USA

Introduction

- ✓ Sorghum silage is considered a valuable alternative for animal feed;
- ✓ However, its production poses significant challenges, such as high levels of water-soluble carbohydrates and low dry matter content at harvest;
- ✓ Chemical and microbial additives have proven effective in improving silage quality by modulating the bacterial microbiota and stimulating the growth of lactic acid bacteria;
- ✓ Our study hypothesizes that combining microbial inoculants with chemical additives during the ensiling process can modulate the bacterial diversity of sorghum silages.

(Muck et al. 2018)

Objectives

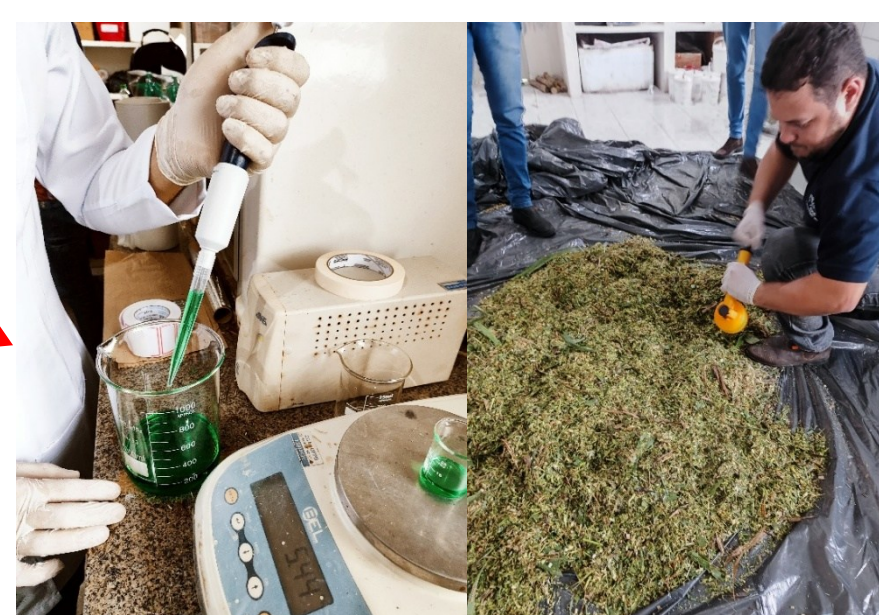
- ✓ The objective was to evaluate the effects of these additives, individually or in combination, on the bacterial diversity of forage sorghum silage.

Materials and Methods

- ✓ The experiment was conducted in the Federal University of Paraíba, Areia, Paraíba, Brazil;
- ✓ Sorghum BRS Ponta Negra was harvested 100 days after sowing. After, it was chopped into a 1.5 cm particle size, treated with chemical and inoculant additives, and packed in 7.5-L plastic buckets.



Sorghum crops:
BRS Ponta Negra



Additives:
CTRL; LB; FCUT; LB+FCUT;
FCUT1



Storage length:
90d

- ✓ The experimental design was completely randomized, with four additives (AD): [Control (no additive); commercial inoculant Magniva Steel™ based on *L. buchneri* (Lallemand®, Brazil), applied at 1 g/t of fresh matter (Lb); the chemical additive FreshCUT Plus™ (Kemin®, Brazil), applied at 0.5 kg/t of fresh matter (OA); and the combination of Lb and OA (Blend)];
- ✓ Five replicates per treatment were used, for a total of 20 silos;
- ✓ Microbial DNA was extracted, and sequencing was performed using the MiSeq platform (Illumina Inc., USA). The V3-V4 regions of the 16S rRNA gene were amplified using paired-end sequencing with V2 kits (2 × 250 cycles);
- ✓ The non-parametric Dunn test was used for pairwise comparisons of diversity indices. Permutational Multivariate Analysis of Variance was performed.

Results

- ✓ The main bacterial genera identified in the relative abundance analysis were. *Lactobacillus*, *Lactiplantibacillus*, *Lentilactobacillus*, *Secundilactobacillus*, and *Lacticaseibacillus*;
- ✓ The relative abundance results revealed distinct compositions for each treatment;
- ✓ The Control group displayed a diverse composition of non-lactic bacterial populations, similar to the Lb group, but with *Lentilactobacillus* as the dominant lactic acid bacterium;
- ✓ The OA group was dominated by *Lactiplantibacillus*, *Lacticaseibacillus*, *Secundilactobacillus*, and *Levilactobacillus*, while *Lactobacillus* was the predominant genus in the Blend group;
- ✓ For β -diversity, differences were observed in both metrics evaluated ($P \leq 0.05$);
- ✓ The Control and Lb groups had greater similarity in their bacterial composition, while the OA and Blend groups had more distinct and heterogeneous compositions;

Results

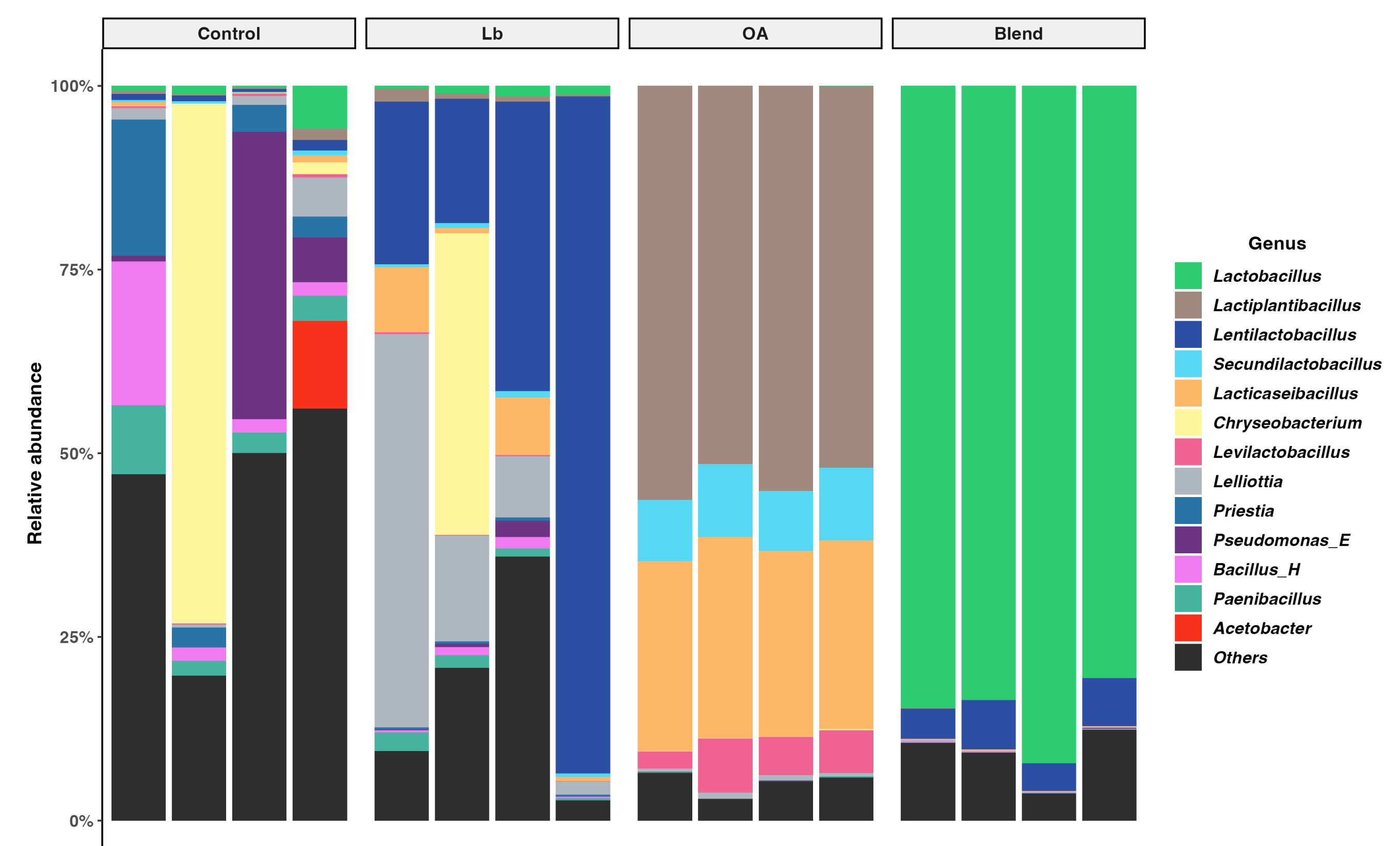


Figure 1. Relative abundance of bacterial genera in forage sorghum silage added with chemical or microbial additives and their combinations during the fermentation period 90 days after ensiling. Control: Control (no additive); Lb: Commercial inoculant based on NCIMB 40788, Lallemand®, Brazil; OA: Chemical additive based *Lentilactobacillus buchneri* on organic acids Fresh CUT™ Plus, Kemin Industries®, Brazil; Blend: Combination of Lb + OA.

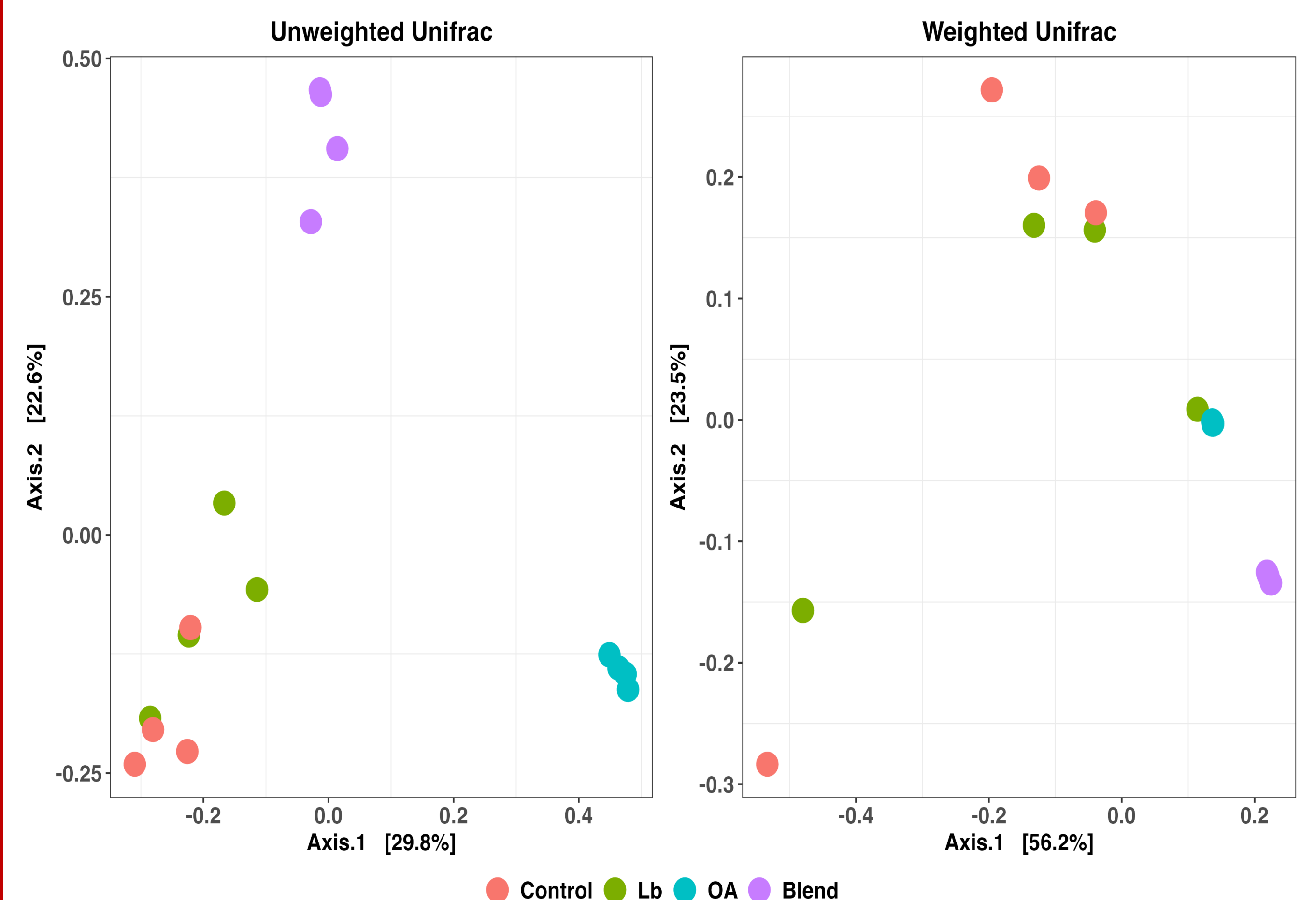


Figure 2. Bacterial beta diversity indices (Unweighted Unifrac and Weighted Unifrac) in BRS Ponta Negra forage sorghum silage added with chemical or microbial additives and their combinations during the fermentation period at 90 days after ensiling. Control: Control (no additive); Lb: Commercial inoculant based on *Lentilactobacillus buchneri* NCIMB 40788, Lallemand®, Brazil; OA: Chemical additive based on organic acids Fresh CUT™ Plus, Kemin Industries®, Brazil; Blend: Combination of Lb + OA.

Conclusions

- ✓ The addition of chemical or microbial additives, applied individually or in combination, improves the quality of forage sorghum silage and contributes to modulating the bacterial community by stimulating the growth of lactic acid bacteria.

Acknowledgements

- ✓ The authors acknowledge to CNPq, CAPES, FAPESQ, and INCT-CA for financial support.

References

- ✓ Muck, R. E., Nadeau, E. M. G., McAllister, T. A., Contreras-Govea, F. E., Santos, M. C., & Kung Jr, L. (2018). Silage review: Recent advances and future uses of silage additives. *Journal of Dairy Science*, 101(5), 3980-4000.