Analysis of ensiling suitability of moringa, a woody plant

Du, Z[*]; Yang, F[*]; Lin, Y[†]; Cai, Y[‡]

[*] College of Grassland Science and Technology, China Agricultural University, Beijing 100193, PR China; [†] Beijing Sure Academy of Biosciences, Beijing 100193, PR China; [‡] Japan International Research Center for Agricultural Sciences (JIRCAS), Tsukuba, Ibaraki 305-8686, Japan

Key words: Microbial population; Moringa; Silage fermentation; Woody forage

Abstract

To effectively use the woody plant resources as animal feed, the ensiling suitability of Moringa including the dynamics of microbial community, chemical composition, and silage fermentation were studied. Tender stems and leaves of Moringa at the full-bloom stage of second cutting was used for silage preparation in Guizhou, China. After 3, 7, 15, 30, and 60 days of ensiling, five silos for each treatment were opened to analyze the fermentation characteristics. Moringa before ensiling contained 10^4 lactic acid bacteria (LAB), 10^6 aerobic bacteria, 10^4 coliform bacteria, 10^2 yeast, and 10^4 mold based on colony-forming unit/g of fresh matter (FM). The aerobic bacteria were dominant microbial population in the fresh Moringa. After 3 days of ensiling, the LAB increased as the highest numbers to dominate the silage fermentation. After 7 days of ensiling, the coliform bacteria and mold counts in Moringa silage dropped below the detection levels. The dry matter (DM) of fresh Moringa was 26.57%, their neutral detergent fiber (NDF) and crude protein (CP) contents were 27.40% and 20.90% on a DM basis, respectively. During ensiling, all silages did not emerge great difference in chemical composition. After 7 days of ensiling, all silages displayed a good fermentation patterns, with a low pH value. The result suggested that Moringa can be prepare as silage to be potential woody feed resources for livestock.

Introduction

In tropical countries where livestock production is mainly based on grass-dominated pastures, herbage mass during the dry season is generally not sufficient to satisfy the nutritional requirements of livestock. To mitigate this, silage is one of the alternative feeds as it is relatively simple to produce and utilizes the surplus in herbage production from the rainy season. Moringa *(Moringa oleifera* Lam.*)* is one of the most widely utilized trees species (Wang et al. 2018). The crude protein (CP) concentration in leaves is ranging 200–250 g/kg dry matter (DM) and high levels of sulphur-containing amino acids (Reyes et al. 2006). The use of Moringa as silage could not only relief the feed shortage to guarantee a year-round feed supply, but also overcome the loss during hay production and storage process. However, can Moringa, a woody plant be prepared like silage? A very few information is available on this area. Therefore, the purpose of this work to study the ensiling suitability of Moringa.

Materials and methods

Moringa were cultivated and harvested at the full-bloom stage on 8 Augest 2018, from an experimental field (25°73′N, 106°37′E) of Guizhou University, Changshun, China. Unwilted materials were immediately cut into 1–2 cm lengths by a chopper machine (500-3, Zhengzhou AG Machinery & Equipment Co., Ltd. Henan, China), and approximately 500 g were packed into 1 L polyethylene bottle silos (Changgan, Huizhou, China). The silos were kept at ambient temperature (20–26°C) and opened after 3, 7, 15, 30, and 60 days of ensiling. Five silos per treatment were used for statistical analysis of microbial population, chemical composition, and silage fermentation.

Results and Discussion

The DM content of Moringa is 26.57% including stem and leaf. The neutral detergent fiber (NDF) content was 27.40%, and CP content was 20.90% on a DM basis. The carbohydrate content of Moring was 41.82% of DM (Fig. 1). Total, the Moringa contained 10^4–10^5 LAB, 10^6–10^7 aerobic bacteria, 10^4–10^5 coliform bacterial, 10^2–10^3 yeast, and 10^4–10^5 mold in a colony-forming unit (cfu)/g of fresh matter (FM) (Fig. 2). At 3, 7, 15, 30, and 60 days of ensiling, the contents of CP, ether extract (EE), NDF, organic matter (OM), and carbohydrate within each silage did not differ remarkably. All the silages were preserved well, with pH values (3.65–4.52) and ammonia-nitrogen (NH_3-N) content (0.29–0.34% of FM), and lactic acid content (0.42–1.08% of FM) (Fig. 3). The results indicate that the Moringa can be prepared as good quality of silage, and has a potential as high protein woody feed resources for livestock in the future.

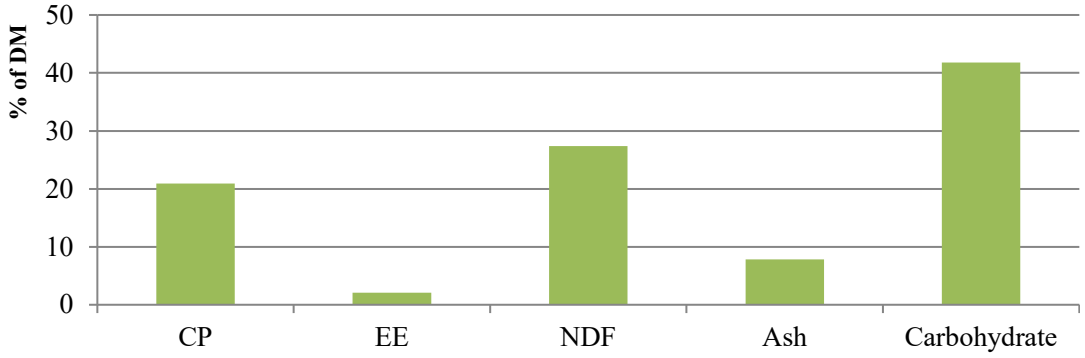

Fig. 1 Chemical composition of Moringa before ensiling

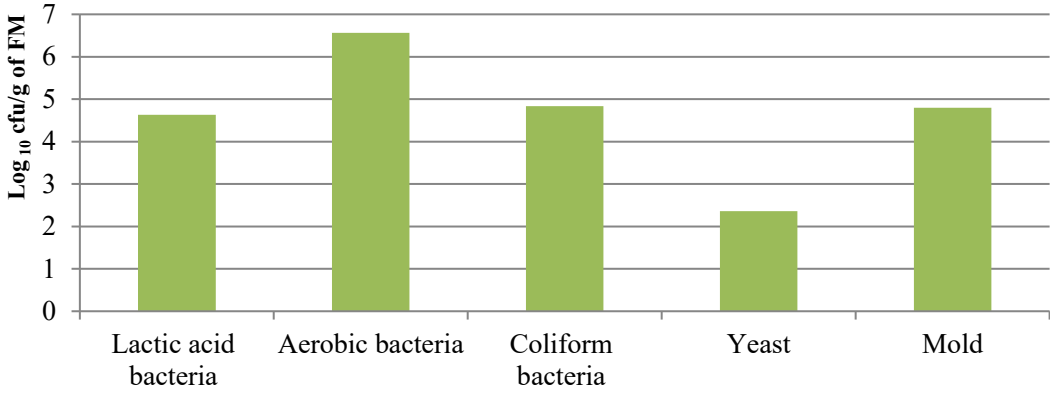

Fig. 2 Microbial population of Moringa before ensiling

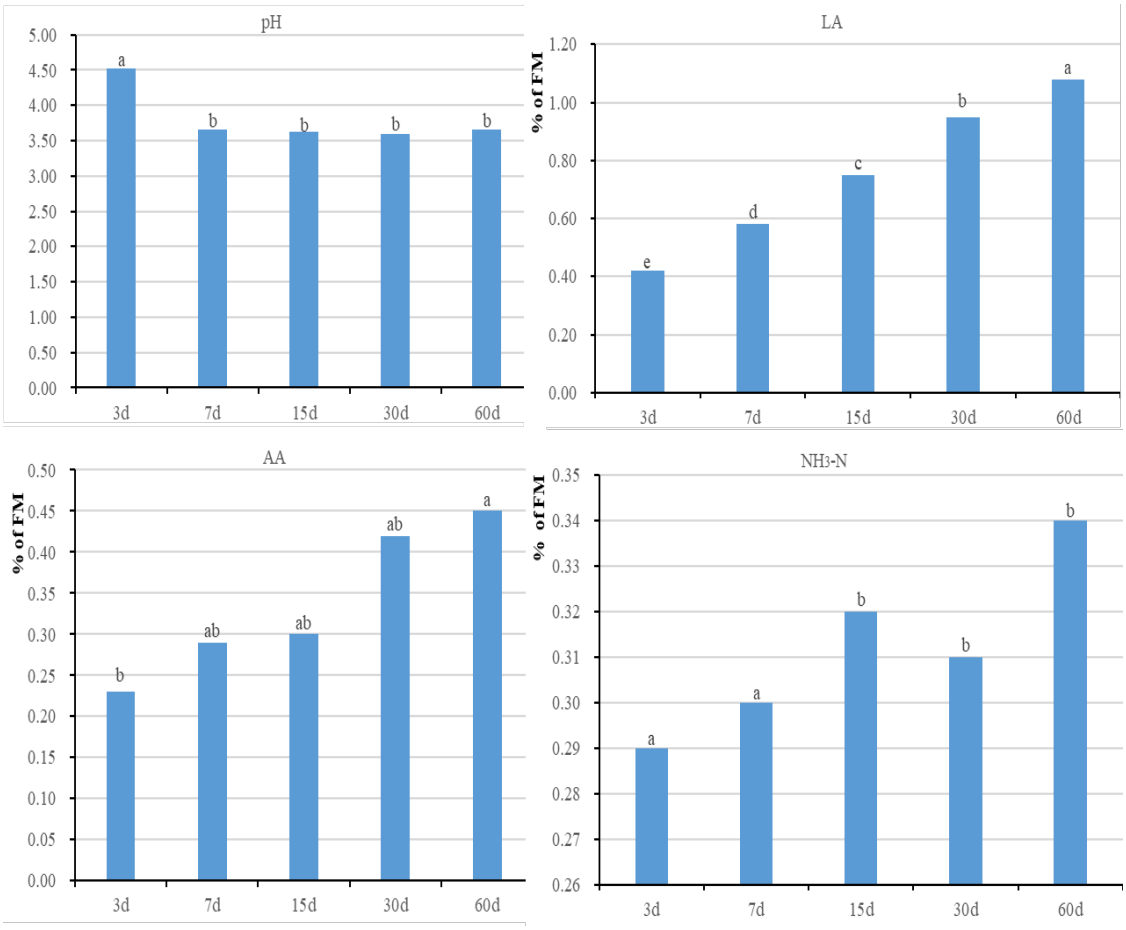

Fig. 3 Fermentation quality of Moringa silage during ensiling

Conclusions

The ensiling suitability of Moringa were studied in China. The fresh Moringa contain abundant feed nutrients, and displayed a suitable ensiling characteristics, which can prepare a good-quality of silage as a preserved high protein sources for livestock production.

Acknowledgements

This work was supported by the project of the 13th Five Year Plan National Key Technology Research and Development Program for "Research and Demonstration of High Quality Forage Silage Modulation and Molding Product Processing Technology" (2017YFD0502102), China.

References

Reyes Sanchez, N., Ledin, S. and Ledin, I. 2006. Biomass production and chemical composition of *Moringa oleifera* under different management regimes in Nicaragua. *Agroforest Syst*., 66 (03): 231–242.

Wang, Y., Wang, C., Zhou, W., Yang, F., Chen, X. and Zhang, Q. 2018. Effects of wilting and *Lactobacillus plantarum* addition on the fermentation quality and microbial community of *Moringa oleifera* leaf silage. *Front Microbiol*., 9: 1817.