STRATEGIES FOR PRODUCTION OF ALFALFA SILAGE

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ABSTRACT

Production of high-quality alfalfa silage is challenging due to the crop's high buffering capacity and low sugar content, which hinder effective fermentation. While organic acids like formic acid reduce pH, they sometimes fail to ensure long-term microbiological stability, risking late spoilage. Homofermentative lactic acid bacteria (LAB) lower pH only until sugars are depleted, potentially leaving silage unstable. Combining homofermentative LAB with molasses or buffered formic acid improves silage stability and quality. Practical dosing equipment enables on-farm application of these additive combinations.

Keywords: alfalfa, buffered formic acid, homofermentative lactic acid bacteria, molasses, biogenic amines

INTRODUCTION

Alfalfa silage production faces persistent challenges due to the crop's inherent high buffering capacity and limited sugar availability, complicating effective ensiling. Mixed forage stands with alfalfa and high sugar grasses are difficult to manage and therefore, pure alfalfa stands are more practical and more common. Traditional methods, such as the use of organic acids or inoculants alone, often fall short in ensuring both rapid pH reduction and long-term stability, leading to risks of spoilage and reduced feed quality.

The objective of the studies was to assess the effectiveness of homofermentative lactic acid bacteria (LAB), buffered formic acid (BFA), and a combination of LAB with BFA and LAB with molasses as additives in low dry matter alfalfa silages.

MATERIALS AND METHODS

Two ensilage studies with alfalfa (18.8% DM and 25.5% DM) have been conducted in Schleswig-Holstein Chamber of Agriculture and Agricultural Centre Baden-Württemberg, respectively, in 2007. The studies compared homofermentative LAB ($3*10^5$ CFU/g FM, BIO-SIL®, Dr. Pieper Technologie- und Produktentwicklung GmbH, Germany), LAB with molasses (35 kg/t FM), BFA, and LAB with BFA (3 to 5 L/t FM) to control silages. Silage trials were conducted over 90 days.

RESULTS AND DISCUSSION

Dry matter losses, NH_3-N of total N, biogenic amines and butyric acid were lowest when combining BFA with LAB (Table 1). Good results were also achieved by BFA alone or the combination of molasses and LAB. LAB alone were not effectively reducing dry matter losses, NH_3-N or butyric acid production in low dry matter alfalfa silage. Results indicate that the combination of homofermentative LAB with BFA achieves a better silage quality compared to single treatments.

Tab. 1: Characteristics of alfalfa silage from two different trials over 90 days.

Parameter	Control	LAB	BFA	LAB + BFA	LAB + Molasses
Trail 1 (18.8% DM, FC 23)					
DM loss (%)	20	16.1	7.0	5.9	8.6
pH	5.4	5.7	4.1	4.1	4.2
NH_3-N / total N (%)	26	21	5	3	5
Lactic acid (g/kg DM)	16.5	9.3	44.9	44.9	106.7
Acetic acid (g/kg DM)	52.5	24.5	13.9	6.4	23.2
Butyric acid (g/kg DM)	52.1	51.7	0.5	0.5	0.5
Biogenic amines (g/kg DM)	7.96	6.79	0.86	0.27	1.14
Trail 2 (25.5% DM, FC 30)					
DM loss (%)	3.9	3.3	1.1	0.6	2.7
pH	4.4	4.4	4.2	4.2	4.2
NH_3-N / total N (%)	10.4	10.1	6.5	5	6.3
Lactic acid (g/kg DM)	15.4	15.3	9.0	7.7	73.5
Acetic acid (g/kg DM)	6.2	6.0	1.7	0.7	14.3
Butyric acid (g/kg DM)	0	0	0	0	0
Biogenic amines (g/kg DM)	2.83	2.51	0.97	0.21	0.7

LAB = homofermentative lactic acid bacteria (BIO-SIL®, Dr. Pieper Technologie- und Produktentwicklung GmbH, Germany); BFA = buffered formic acid, DM = dry matter, FC = fermentation coefficient

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CONCLUSION

The integration of homofermentative LAB with sugar sources or BFA presents a viable solution for producing stable, high-quality alfalfa silage. This approach enhances fermentation efficiency, reduces the risk of late spoilage, and improves overall silage stability and nutritional quality. The availability of practical dosing equipment further supports the adoption of these additive combinations at the farm level.

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