

FERMENTATION OF ALFALFA SILAGE AFTER APPLICATION OF LIQUID DAIRY MANURE ^{1/}

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Introduction

Post harvest application (topdress) of liquid dairy manure to alfalfa has been adopted on Midwest dairy farms as a method to reduce the amount of manure requiring summer storage. Recently, dairy consultants and dairy producers have speculated that topdress manure application on alfalfa may negatively alter alfalfa silage fermentation on subsequent harvest. An exploratory research study was initiated at the Marshfield Agricultural Research Station (MARS) to examine the effects of top-dressed liquid dairy manure on second cutting alfalfa silage fermentation.

Methods

Field Methods

Four strip plots were established at the MARS with the following treatments: a positive control with no manure application (C), top-dressed manure at a rate of 5000 gal/acre on second crop regrowth 5 days (S), 15 days (V), and 32 days (B) after first crop harvest. Within each of the manure treatment plots, four replicates of alfalfa forage after a 16-hour wilt were collected for pre-ensiling analysis. To simulate normal ensiling methods, four replicates of alfalfa forage were also ensiled into 8x24 inch mini-silos fit with gas relief valves. The forage was wilted for 16 hours before harvest. The treatment forages were allowed to ferment for 98 days.

Laboratory Analysis Methods

The pre- and post-ensiling alfalfa forages were evaluated for dry matter by a two-stage oven dry matter determination. Wilted pre-ensiled alfalfas were also evaluated for lactic acid bacteria, enterobacterial and clostridial spores. The treatment forages were diluted 10:1, homogenized in a blender, and analyzed for lactic acid bacteria, enterobacterial and clostridial spores using pour-plate technique for the former two and spread-plate technique for the latter.

Silage samples were also diluted 10:1 and analyzed for enterobacteria, clostridial spores and fungi. The pH of silages was measured on the diluted sample. A portion of the diluted sample was centrifuged and the centrate was analyzed via HPLC for fermentation products. Another portion of the diluted sample was acidified with 25% trichloroacetic acid and centrifuged. The centrate was analyzed for ammonia using a nitrogen autoanalyzer.

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Statistical Methods

Data were evaluated as a completely randomized design using GLM procedures of SAS. Pre-planned contrast were conducted © vs S, V, B) and (S vs V, B).

Results

Pre-Ensiled Forage

Manure application on alfalfa foliage had a significant effect ($P < 0.001$) on the dry matter content of alfalfa forage. We believe these data in part are logical. The negative controls of applying 5000 gal/acre of liquid manure applied to V caused severe burning and senescence of the alfalfa foliage. Liquid manure applied to B resulted in similar effects although the burning and senescence of the alfalfa was less severe as the manure was applied only 2 days before harvest. Therefore, it is our observation that the increased dry matter content of V and B silage was the result of alfalfa foliage senescence and dry manure particles that adhered to the foliage after manure application, respectively.

There was a significant difference between dry matter content of C and S after. The reason for the increased dry matter content of S as compared to C prior to ensiling is more difficult to explain. Liquid manure for S was applied 5 days post harvest to alfalfa stubble nearly devoid of vegetative growth. A total of 2.84 inches of rain fell on day 2 and 3 after application of manure to S. The rainfall events on day 2 and 3 after application of manure to S should have washed manure particles off alfalfa foliage or residual stubble to the ground surface.

Application of liquid dairy manure to alfalfa post harvest, significantly reduced ($P < 0.03$) the number of endemic lactic acid bacteria on the forage. There was no difference ($P > 0.10$) when the manure was applied to alfalfa with manure application to S being equally suppressive of endemic lactic acid bacteria as manure application to V or B. The magnitude of difference in endemic lactic acid bacteria between C and S, V or B was approximately 6.0 vs 4.5 $10 \log$ colony forming units/g/DM. This difference equates to 968,000 less colony forming units/g/DM of endemic lactic acid bacteria when topdress manure was applied to alfalfa.

Ensiled Forage

Control alfalfa silages were well fermented and in contrast the negative control alfalfa silage (B) where manure was applied 2 d prior to ensiling was poorly fermented indicated by high pH, low organic acid production, presences of butyric acid and 2,3 butanediol

Application of manure to the stubble (S) of alfalfa had little negative effect on silage fermentation. There was a significant difference ($P < 0.07$) in silage pH but the biological significance (.13 units) was very small. All other silage fermentation characteristics measured were similar between C and S silages and both were well fermented according to industry standards. As partially and previously mentioned, manure application to the foliage of alfalfa (V and B) had negative effects on fermentation as compared to control or manure applied to the stubble silages.

Conclusion

Liquid dairy manure applications to alfalfa foliage should be avoided. If liquid dairy manure applications are made on alfalfa stubble, it is advisable to inoculate the alfalfa forage with a quality silage inoculant to ensure that adequate levels of lactic acid bacteria are available to rapidly start fermentation.

Implications

This study was conducted to address concerns of local producers and feed industry representatives. The rapid response of valid research results to a local need was made possible by cooperation between ag research station staff, extension specialists, county extension faculty, and dairy industry representatives. The success of this study should be used as a model to help answer future applied research needs on both a local and statewide level.