

**Northern NY Agricultural Development Program
2005-2006 Project Report**

**The effect of manure application on yield and quality of alfalfa harvested in
northern New York**

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Introduction

Dairy manure slurry is usually applied to fields cropped to corn or grass. The addition of alfalfa fields could provide an alternative land-base for manure application. While dairy manure can be an excellent source of phosphorus and potassium for alfalfa stands, it must be managed properly to avoid negative impacts on the stand and environment. The potential for alfalfa injury arises from the salts in the manure (including free ammonia), soil compaction and physical damage to the crowns during application (Kelling and Schmitt, 2003). Research conducted in Wisconsin demonstrated that topdressed manure decreased crop yields and damaged alfalfa crowns in wheel track areas (Kelling and Schmitt, 2003). More studies are needed to assess the impact of manure application and compaction of equipment on the survivability and quality of the alfalfa stand. Timing of manure application after harvest should also be evaluated to determine if negative impacts of spreading increase when regrowth has occurred.

Objectives

1. To evaluate the impact of applying dairy manure slurry to harvested alfalfa.
2. To evaluate the impact of applying dairy manure slurry to alfalfa after 4" of regrowth.

Materials and Methods

Following a randomized block design, four plots were divided into three strips per plot. One of three manure treatments were randomly assigned to each strip/plot; 1) Control (no manure); 2) Manure applied after harvest – 0-3 days; or 3) Manure applied after 4 inches of regrowth ~7-10d. After first harvesting at 4-inch cutting height, manure treatments were applied after their respective regrowths at approximately 11,000 gallons/acre. At the time of manure application, flags were used to mark the area where wheel tracks were made. These areas were used for alfalfa plant sampling at the time of second and third harvest.

At the time of second and third cutting, alfalfa was harvested at 4-inch cutting height. Yield was estimated and chopped forages were dried and ground for chemical analysis. Crown damage to alfalfa was qualitatively assessed within wheel tracks following second

cutting. No manure was applied after second cutting to assess the residual effects of the initial manure application on yield and chemical analysis of alfalfa at the time of the third cutting. Crown damage was also assessed following third cutting to determine regeneration of plants damaged at the time of manure application.

Prior to second and third cutting, six alfalfa plants from the wheel track area where manuring equipment passed after initial harvest were randomly selected and removed from each treatment strip. Numbers of shoots per plant were counted and plants were assessed for crown and root health. A rating system (0-5) was used when evaluating the condition of each plant (Table 1) (Undersander et al. 1998).

Table 1. Rating alfalfa crown and roots

Rating	Condition
0	Healthy
1	Some discoloration
2	Moderate discoloration/rot
3	Significant discoloration/rot
4	Greater than 50% discoloration/rot
5	Dead



Statistical analysis

Yield and chemical composition of forages harvested from the field were analyzed as a randomized complete block design using Proc GLM in SAS (version 9.1). When $P \leq 0.05$, orthogonal contrasts were analyzed to determine effect of manure application and comparing times of manure application (3 d versus 7 d post-harvest). Categorical data used for assessing alfalfa plant health were analyzed using the Friedman’s Chi-square statistic.

Results

Dry matter yields of second and third cutting and combined yields are presented in Table 2. Manure application does not appear to have any influence on yield. It should be noted that the high standard errors contributed by a malfunction of a load cell in the scales used to measure crop yields may have reduced the sensitivity of this comparison.

Table 2. Dry matter yield (T/acre) of grass/alfalfa following manure application after first harvest as calculated for second cut, third cut, and combined cutting yield.

Cutting	Manure application treatment*				P
	0	3d	7d	sem	
Second	0.43	0.50	0.49	0.09	0.856
Third	0.66	0.56	0.60	0.04	0.370
Combined	1.09	1.06	1.09	0.10	0.984

*Manure application treatment: 0=no manure applied; 3d=manure applied 3d after first harvest; 7d=manure applied 7d after first harvest.

Manure application after first cutting did not have a significant impact on the quality of forage harvested at second and third cutting (Tables 3-5). While ash content was significantly higher for forages receiving manure application at second and third cutting,

(average of cuttings: 8.14, 8.64, and 8.62 for no manure, manure 3 d, and manure 7 d, respectively $P=0.002$), ash concentration less than 10% is considered acceptable for an alfalfa/grass mix. From the nutrient composition of the forages harvested, it is evident the composition of the field was predominantly grass with smaller percentage of alfalfa than anticipated. This study will be repeated in 2007 using a field with a higher composition of alfalfa.

Table 3. Chemical composition and digestibility of grass/alfalfa following manure application after first harvest – second cutting.

Item	Manure application treatment*			sem	<i>P</i>
	0	3d	7d		
CP (%DM)	17.13	17.32	17.66	0.19	0.206
NDF (%DM)	44.80	45.80	45.85	0.42	0.214
ADF (%DM)	29.63	29.91	29.59	0.33	0.756
Lignin (%DM)	5.92	5.69	5.64	0.13	0.310
Ash (%DM)	8.22	8.75	8.93	0.08	0.003**
DMd ₂₄ (%DM)	79.96	80.68	81.14	0.42	0.208
NDFd ₂₄ (% original NDF)	55.82	57.77	58.69	0.83	0.119

*Manure application treatment: 0=no manure applied; 3d=manure applied 3d after first harvest; 7d=manure applied 7d after first harvest.

**Contrast *P*-value: Control vs. manure application $P=0.001$; 3d vs. 7d $P=0.182$

Table 4. Chemical composition and digestibility of grass/alfalfa following manure application after first harvest – third cutting.

Item	Manure application treatment*			sem	<i>P</i>
	0	3d	7d		
CP (%DM)	17.73	17.81	17.62	0.26	0.873
NDF (%DM)	46.18	46.41	46.34	0.30	0.862
ADF (%DM)	28.28	29.18	28.84	0.28	0.145
Lignin (%DM)	5.59	5.79	5.70	0.11	0.484
Ash (%DM)	8.05	8.52	8.31	0.07	0.007**
DMd ₂₄ (%DM)	82.24	81.85	82.05	0.38	0.778
NDFd ₂₄ (% original NDF)	61.51	60.90	61.24	1.01	0.915

*Manure application treatment: 0=no manure applied; 3d=manure applied 3d after first harvest; 7d=manure applied 7d after first harvest.

**Contrast *P*-value: Control vs. manure application $P=0.004$; 3d vs. 7d $P=0.063$

Table 5. Chemical composition and digestibility of grass/alfalfa following manure application after first harvest – 2nd and 3rd cutting combined.

Item	Manure application treatment*			sem	P
	0	3d	7d		
CP (%DM)	17.43	17.56	17.64	0.21	0.776
NDF (%DM)	45.49	46.10	46.10	0.39	0.466
ADF (%DM)	28.95	29.55	29.21	0.28	0.339
Lignin (%DM)	5.76	5.74	5.67	0.08	0.721
Ash (%DM)	8.14	8.64	8.62	0.09	0.002*
DMd ₂₄ (%DM)	81.10	81.26	81.59	0.42	0.702
NDFd ₂₄ (% original NDF)	58.67	59.34	59.96	1.10	0.712

*Manure application treatment: 0=no manure applied; 3d=manure applied 3d after first harvest; 7d=manure applied 7d after first harvest.

**Contrast P-value: Control vs. manure application $P < 0.001$; 3d vs. 7d $P = 0.910$

There was no difference in number of shoots per alfalfa plant at second cutting when no manure was applied, manure applied 3d after harvest or 7d after harvest, 4.3, 4.0, 4.2 respectively ($P = 0.929$). Understandably, no difference was also seen in number of shoots per plant at the time of third cutting, 7.8, 8.8, and 8.1, respectively ($P = 0.787$).

The amount of damage to alfalfa plants caused by applying manure after first cutting was negligible as demonstrated by the condition rating crown size and symmetry of alfalfa crowns of plants after second and third cutting (Tables 6-8).

Table 6. Condition rating of alfalfa plants at time of second and third cutting after manure was applied 3d or 7d following first cutting (% plants in each rating classification).

Rating	Second Cutting			Third Cutting		
	0*	3d	7d	0	3d	7d
0	4.17	0.00	0.00	4.17	0	8.33
1	4.17	0.00	0.00	8.33	4.17	4.17
2	50.00	57.14	70.83	45.83	70.83	66.67
3	16.67	19.05	12.50	0	8.33	8.33
4	16.67	14.29	4.17	20.83	4.17	12.50
5	8.33	9.52	12.50	20.83	12.50	0
P-value	0.375			0.072		

*Manure application treatment: 0=no manure applied; 3d=manure applied 3d after first harvest; 7d=manure applied 7d after first harvest.

Table 7. Crown size of alfalfa plants at time of second cutting after manure was applied 3d or 7d after first cutting (% plants in each rating classification).

Crown Size	Second Cutting			Third Cutting		
	0	3d	7d	0	3d	7d
Large	16.67	9.52	4.17	16.67	29.17	29.17
Medium	25.0	33.33	25.0	37.50	41.67	29.17
Small	58.33	57.14	70.83	41.67	25.0	37.50
Extra small	0	0	0	4.17	4.17	4.17
<i>P</i> -value	0.405			0.487		

*Manure application treatment: 0=no manure applied; 3d=manure applied 3d after first harvest; 7d=manure applied 7d after first harvest.

Table 8. Symmetry of alfalfa plant crowns at time of second cutting after manure was applied 3d or 7d after first cutting (% plants in each rating classification).

Crown Symmetry	Second Cutting			Third Cutting		
	0	3d	7d	0	3d	7d
Symmetrical	29.17	28.57	12.50	39.13	45.83	50.0
Less symmetrical	29.17	14.29	20.83	26.09	20.83	16.67
Poor symmetry	41.67	38.10	54.17	26.09	20.83	20.83
No symmetry	0	19.05	12.50	8.70	12.50	12.50
<i>P</i> -value	0.803			0.770		

*Manure application treatment: 0=no manure applied; 3d=manure applied 3d after first harvest; 7d=manure applied 7d after first harvest.

Conclusions

Application of manure after first cutting did not appear to cause notable damage to alfalfa plants recovered from areas trafficked by the manuring equipment. Impact of manure application on forage quality as assessed by nutrient composition and digestibility will need to be reassessed in 2007 using a field with higher alfalfa composition.

Education and Outreach Plan

Results of this research will be published in the monthly Miner Institute Farm Report, with readership of over 10,000. This newsletter is not copyrighted, and articles are often used by farm newspapers and county Cooperative Extension publications. Ev Thomas presented the results of this study at the 2006 Dairy Day held at Miner Institute.

References

Kelling, K. A., and M. A. Schmitt. 2003. Applying Manure to Alfalfa: Pros, cons and recommendations for three application strategies. North Central Regional Research Report 346.

Undersander, D., C. Grau, D. Cosgrove, J. Doll, and N. Martin. 1998. Alfalfa stand assessment: Is this stand good enough to keep? University of Wisconsin-Cooperative Extension Bulletin A3620.