Northern NY Agricultural Development Program
2004 Project Report

Manure Management on Grasses

Project Leader(s):
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Background:
Manure management has received environmental scrutiny in recent years due to potential nitrate contamination in ground and surface waters, and more recently due to similar concerns with phosphorus. Increased recovery and recycling of manure phosphorus (P) by crops on dairy farms is needed to minimize environmental problems. Precise management of P nutrition in dairy cattle to optimize performance and minimize P excretion is also crucial. However, with increasing manure production per unit of cropland available for its disposal, animal waste has become one of the major sources of N and P pollution from agricultural sources.

Perennial cool-season grasses provide alternative land area for in-season manure applications. Spring application of animal manure should maximize efficiency of manure nutrients applied to perennial grass stands, but the impact of manure applications at other times of the year on yield, forage quality, and nutrient recovery is not clear. These studies were designed to assess the relative impacts of N fertilization and manure application on yield, quality and nutrient utilization by perennial grasses. This information should be useful for refining CAFO guidelines for responsible nutrient management practices on dairy farms.

Methods:

These two projects are being conducted at the Cornell Baker Farm in Willsboro, NY, because precise control is needed for successful manure application and measurement on small plots. Small plots are required to successfully compare a number of treatments.

Study #1:
Our objective is to investigate the effect of manure compared to split application of commercial N fertilizer treatments on reed canarygrass, orchardgrass and tall fescue under an intensive 3-cut management system. The study was sown in August of 2000 at the Cornell University Willsboro farm. For each of the three grass species, treatments included: 1) no N or manure applied, 2) 100+50+50 lbs of N applied, 3) 100+100+0 lbs N applied, 4) 200+0+0 lbs N applied, 5) Split application of 40 wet tons of dairy manure, 6) Split application of 40 wet tons of dairy manure plus split application of 150 lbs of N fertilizer (50+50+50). We used an intensive 3-cut management system, with the majority of the yield in two cuts of lactating dairy quality forage, and a 3rd fall cut suitable for heifers or dry cows.

Study #2:
Our objective is to investigate the effect of manure timing on orchardgrass yield, quality and nutrient utilization under an intensive 3-cut management system. In the spring of 2003, 6 replicates of 9 different treatments were established in a field of Pizza orchardgrass at the Willsboro farm (Table 1). These treatments are to determine the impact of timing of manure applications, compared to recommended N fertilizer application.

For both studies dry matter yield was determined and samples taken for forage quality analysis. Soil samples are taken each year, and deep soil cores are taken each fall for study #2 for nitrate analysis.

Results:

Study #1:
2004 was the 4th and final year of treatment applications to this study. Results follow on page 3.

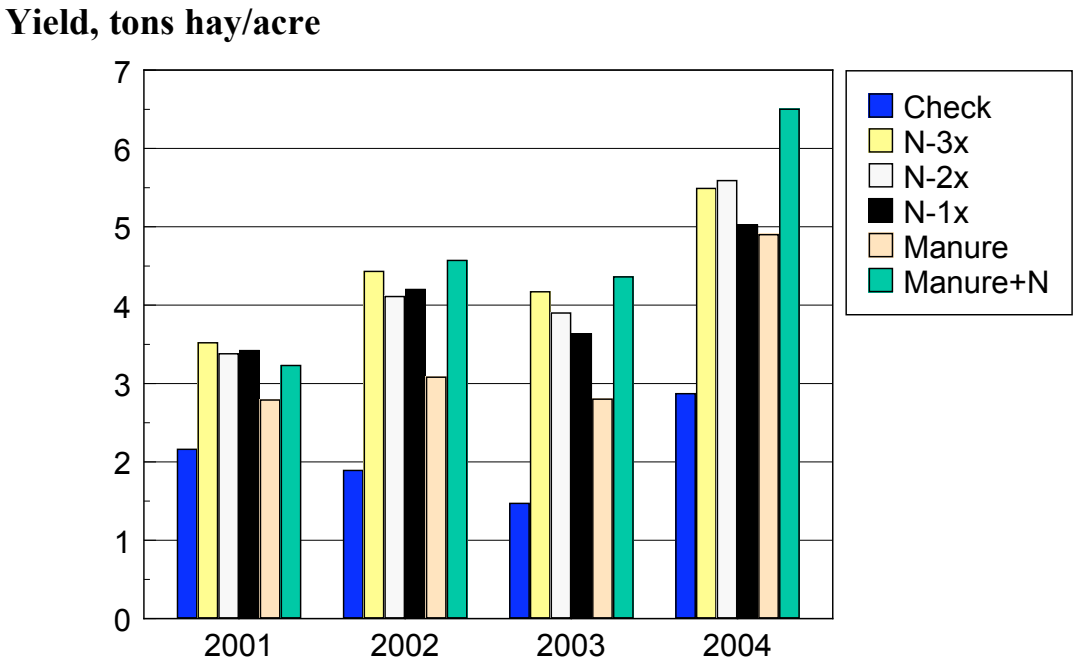

Chart 1. Yield (average of three species) for 0 N check, one spring application of N vs. two or three split-applications, 40 tons of semi-solid manure, and manure plus 150 lbs of N.

Split application of N in 2003 and 2004 resulted in higher yields than a single spring application. After four years of manure applications on this previously unmanured site, the manure treatment yielded as high as the 200 lbs N spring application treatment. Manure plus N fertilizer produced significantly higher yields but would not be environmentally acceptable.

Study #2:
Treatment 8 is the maximum amount of N fertilizer currently recommended. Harvests were taken on June 4, July 13, and Oct. 5, 2004. Treatment differences in yield in 2004 closely followed the level and timing of manure applications. In the second year of treatment application, all 40 ton applications yielded the same, both 60 ton applications yielded the same, and 80 tons of manure produced higher forage yields than recommended commercial N fertilization. Yields with no fertilization were about half that of commercial N in 2003 and 2004. Deep soil samples were taken from each plot to assess changes in soil fertility and potential nitrate loss due to treatments, and are currently being analyzed.

Table 1. Manure applications to orchardgrass* and 2004 Hay Yields.

	Treatment Number								
Timing	1	2	3	4	5	6	7	8**	9
Spring application	10	20	0	0	20	0	20	100 lb N	0
After 1st harvest	10	20	0	0	20	0	20	75 lb N	0
After 2nd harvest	10	0	20	0	20	20	20	50 lb N	0
After 3rd harvest	10	0	20	40	0	40	20	0	0
	Hay Yield, tons/acre								
June 4 harvest	1.41	1.29	1.46	1.69	1.63	1.91	2.12	2.02	0.94
	de***	e	cde	bc	cd	ab	a	a	f
July 13 harvest	0.63	0.77	0.47	0.52	0.76	0.56	0.85	1.29	0.34
	c	b	e	de	b	cd	b	a	f
Oct. 5 harvest	2.08	1.94	2.31	1.80	2.62	2.29	2.92	2.12	1.39
	de	ef	c	f	b	cd	a	cde	g
TOTAL for 2004	4.11	4.00	4.23	4.00	5.02	4.76	5.89	5.43	2.67
	d	d	d	d	c	c	a	b	e

* Tons of semi-solid dairy manure with sawdust bedding.

** Pounds of actual nitrogen applied as ammonium nitrate.

*** Means in a row with different letters are significantly different.

Conclusions/Impacts:

Study #1 suggests that split application of N fertilizer on grasses will increase yields in most years, but splitting N into three applications probably will not increase yield over a two-part split. It takes 3-4 years of manure applications for manure to produce similar yields to commercial N fertilization. Farmer fields with multiple years of manure applications probably do not require additional N fertilization to produce high yields.

Study #2 requires several more years of data before changes to management practices can be suggested.

Next steps if results suggest continued work is needed.

Study # 1:

Spring harvest in 2005, without any treatment applications, will allow us to quantify the residual effects of the previous years of treatments.

Study #2:
It requires multiple years of applications to quantify the use, accumulation and loss of nutrients, and evaluate whether the application of dairy manure later in the season is economically and environmentally acceptable. We hope to continue these treatments through 2007.

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Northern New York Agricultural Development Program:
The Northern New York Agricultural Development Program provided funding for this grass-based agriculture research project. The Northern New York Agricultural Development Program is a farmer-driven research and education program specific to New York state's six northernmost counties: Jefferson, Lewis, St. Lawrence, Franklin, Clinton and Essex.

Thirty-three farmers serve on the Program board led by Co-Chairs Jon Greenwood of Canton (315-386-3231) and Joe Giroux of Plattsburgh (518) 563-7523. For more information, contact Jon, Joe or R. David Smith at 607-255-7286 or visit www.nnyagdev.org
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