Importance of Nitrogen/Manure Management in Corn Production

Stephen J. Herbert and Jay Daliparthy
Department of Plant and Soil Sciences
University of Massachusetts

Potential Problems from Excess Application

- Nitrogen fertilizer either from inorganic source (Ammonium Nitrate, and Urea, etc.,) or from organic sources (dairy manure, poultry manure, crop residues, and composts, etc.) can pollute surface and groundwater resources with **nitrates.**
- Nitrates, when converted into nitrites may cause blue baby syndrome in children.
- Application of excessive amounts of manure to corn more than crop nitrogen requirements could lead to potential **nitrate leaching.**
- Excess presence of nitrates in the soil can lead to significant nitrate accumulations in silage corn, which may cause **health problems in animals** especially in dry years.
- Application of N fertilizer in excess of recommendations sometimes can lead to **reduction in corn silage yields** (Figure 1).
- Corn fields with high levels of soil nitrates are **more susceptible to drought.**

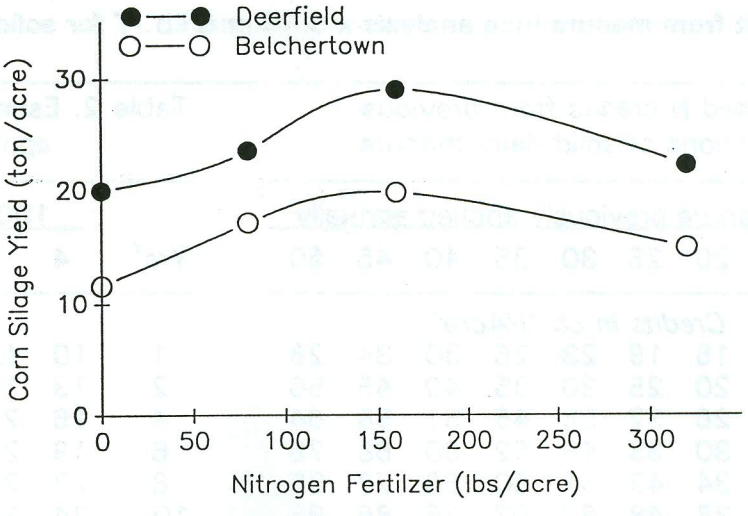


Figure 1. Response of corn to high Nitrogen fertilization.

Solutions

- Use only starter N if needed at planting, **avoid broadcast N** applications, and apply manure based on recommendations (see worksheet).
- Manure spreader **calibration** and manure **analysis** for optimum rates of application.
- Use **spring pre-sidedress nitrogen test** before side or top-dressing corn with urea or ammonium nitrate.
- Use crop **rotations** and rotation of fields for manure spreading.

Worksheet for Determining Fertilizer Rates for Corn Field # _____

1. **Crop nitrogen required based on yield goal for silage or grain corn:** _____Lb. N/A;
   (<20T (100bu)/A 140 Lb.N/A; 20 (100) to 24T (130bu)/A 160 Lb.N/A; >24T (>130bu)/A 180 Lb.N/A)

2. **Nitrogen from previous crop:** _____Lb./A;
   (Grass sod - 20 Lb. N/A; 20 to 60% legume - 40 Lb./A; 60 to 100% legume - 60 Lb./A; 20 to 60% alfalfa 60 Lb./A; 60 to 100% alfalfa 100 Lb./A; grain corn crop with cover crop 40 Lb./A)

3. **Nitrogen credits from previous manure application (see tables 1. and 2. below):** _____ Lb. N/A;
   Number of years applied: _____; Estimated annual application rate: _____ T/A or _____ gal/A;

4. **Nitrogen credits from this year's dairy manure application (from analysis or use average values below):**
   (From Analysis multiply by 0.6 if incorporated in <12 hrs; by 0.4 if <4 days; by 0.2 if not incorporated)
   (Solid Lb./T, Incorporation: Immediate = 5; Delayed = 3; Not incorporated, No-till or Fall applied = 2)
   (Liquid Lb./1000gal, Incorporation: Immediate = 16; Delayed = 12; Not Incorp., No-till or Fall appl. = 8)
   Nitrogen credit = Rate _____ (T/A or 1000 gal/A) x corrected N content _____ (Lb. N/T or /1000 gal) = _____Lb/A; (Note: N content from analysis corrected for availability according to time to incorporation)

5. **Nitrogen fertilizer required:**
   N fertilizer = Crop N required - N from previous crop - N from previous manure - N from manure this year;
   N fertilizer = 1._____ - 2._____ - 3._____ - 4._____ = _____ Lb. N/Acre.

6. **Phosphorus credit from manure (use analysis x 0.8 or 3 Lb./T for solid manure)** _____ Lb. P_2O_5/A.

7. **Potassium credit from manure (use analysis x 0.85 or 6 Lb./T for solid manure)** _____ Lb. K_2O/A.

Table 1. Estimated N credits from previous applications of solid dairy manure

	T/A manure previously applied annually								
Yrs[1]	10	15	20	25	30	35	40	45	50
	Credits in Lb N/Acre[2]								
1	8	11	15	19	23	26	30	34	28
2	10	15	20	25	30	35	40	45	50
4	13	19	26	32	38	45	51	58	64
6	15	22	30	38	45	52	60	68	75
8	17	26	34	43	51	60	68	77	85
10	19	29	38	48	57	67	76	86	95
15	23	35	47	58	70	82	94	105	117
20	27	41	54	68	81	95	109	122	136

Table 2. Estimated N credit from previous applications of liquid dairy manure

	1000 gal/A manure applied annually								
Yrs[1]	4	5	6	7	8	9	10	12	14
	Credits in Lb N/Acre[3]								
1	10	12	14	17	19	22	24	29	34
2	13	16	19	23	26	29	32	39	45
4	16	21	25	29	33	37	41	49	57
6	19	24	29	34	38	43	48	58	67
8	22	27	33	38	44	49	55	66	77
10	24	31	37	43	49	55	61	73	86
15	30	38	45	53	61	68	75	90	105
20	35	44	52	61	70	78	87	105	122

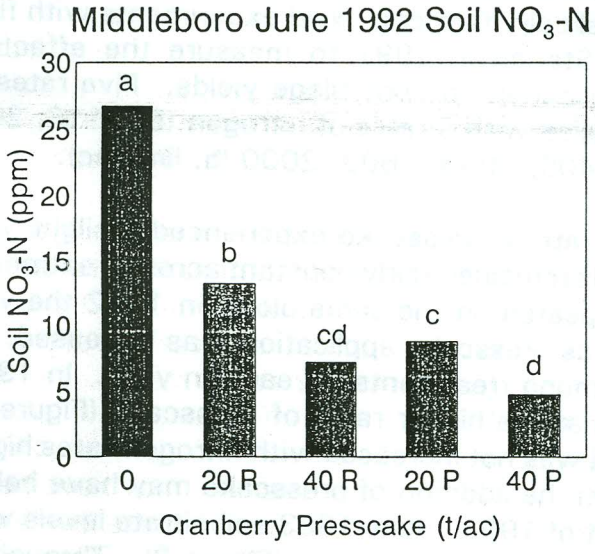
[1]Yrs = number of consecutive years manure has been applied, starting with year before current cropping year. If manure has been added the last two years but was not added certain years before, use total number of years manure was added to calculate Yrs. If not added the previous few years use value for previous years of continuous application less value for present years not applied.

[2]Assumes that the total N in solid dairy manure is 10 lbs N/T and that N becomes available over time as follows:
50% of total N is available in year of application (year 1);
15% of N remaining after years 1 is available in year 2;
6% of N remaining after years 1 and 2 is available in year 3;
4% of N remaining after years 1, 2 and 3 is available year 4;
After year 4, 3% of each year's remaining N is available next year.

[3]Assumes that the total N in liquid cow manure is 32 lbs N/1000 gal and that N availability follows the decay series 50%, 15%, 6%, 4% and 3% thereafter. Also, assumes a manure dry matter content of 10%. To adjust for different dry matter contents, multiply credits by (% dry matter x 0.1). For example, if dry matter = 8%, multiply credits by 0.8.

The Middleboro on-farm experiment with cranberry presscake application to field corn, began in 1992. Two different forms of the presscake residue (with and without ricehulls) were applied at the rates of 0, 20, 40 t/ac, with two levels of nitrogen (80 lb. N at planting plus either 50 or 100 lb. N/ac at sidedressing). Plots receiving higher rates of ricehull/presscake residue had significantly lower levels of NO_3-N (Figure 3). At harvest, these plots also had lower silage yields (Figure 4). In 1993 the experiment was repeated, however, only the presscake with ricehulls was land applied. Plots that received the presscake without ricehulls in 1992, had higher soil nitrate levels in June 1993 (Figure 5). Corn silage yields in 1993 were not depressed by the addition of presscake (Figure 6). Also, there were no adverse residual effects to corn from the 1992 land application of cranberry presscake (Figure 6).

There appeared to be no negative long term effects of land application of cranberry presscake to corn land. We feel confident that the application of presscake to corn land will have no adverse effects as long as soil nitrate levels are monitored closely by the farmer.



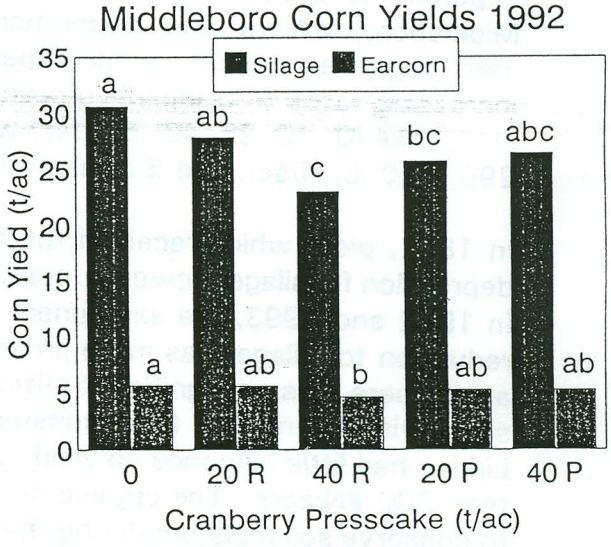
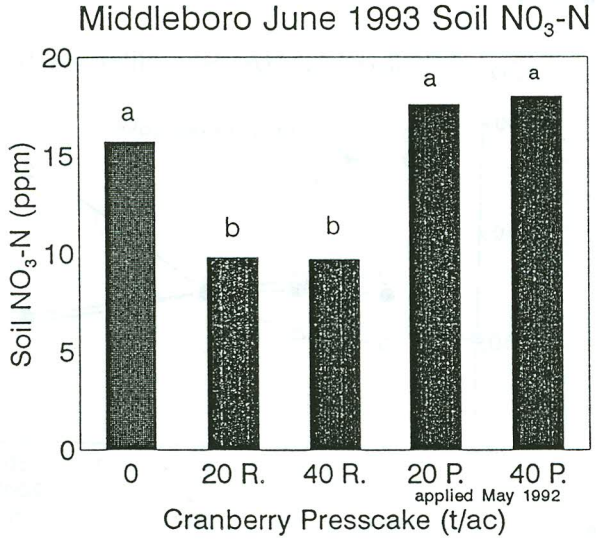


Figure 3. Middleboro Soil NO_3-N June 1992.Figure 4. Middleboro 1992 corn yields.



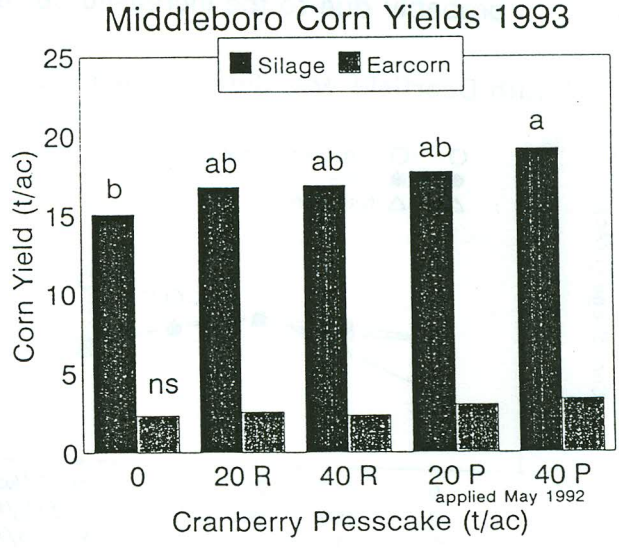


Figure 5. Middleboro Soil NO_3-N June 1993.Figure 6. Middleboro 1993 corn yields.