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# Hold nitrogen on manured cornfields in 2000

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# Hold nitrogen on manured cornfields in 2000

## **Abstract**

Nitrogen (N) in fall-applied manure can be lost by leaching and denitrification before crops start to grow in the spring. Although such losses were substantial during the past 2 years, it could be costly to assume that similar losses will occur this year. A more practical approach to handling N fertilization needs is to withhold applications of commercially prepared N fertilizers until fields are tested for nitrate in late spring. This approach makes it possible to adjust fertilization practices for weather.

## **Keywords**

Agronomy

## **Disciplines**

Agricultural Science | Agriculture | Agronomy and Crop Sciences

# INTEGRATED CROP MANAGEMENT

A photograph of a person in a field, possibly a farmer or researcher, with large, stylized text overlaid on the image. The text reads 'INTEGRATED CROP MANAGEMENT' in a serif font. The background shows a person in a field, possibly a farmer or researcher, with large, stylized text overlaid on the image.

## Hold nitrogen on manured cornfields in 2000

Nitrogen (N) in fall-applied manure can be lost by leaching and denitrification before crops start to grow in the spring. Although such losses were substantial during the past 2 years, it could be costly to assume that similar losses will occur this year. A more practical approach to handling N fertilization needs is to withhold applications of commercially prepared N fertilizers until fields are tested for nitrate in late spring. This approach makes it possible to adjust fertilization practices for weather.

Leaching and denitrification must be considered the primary mechanisms of N loss when animal manure is injected into the soil. They also should be considered important when manure is applied by other methods. Losses by these mechanisms were favored in Iowa by relatively high soil temperatures during the winter and abundant rainfall in the spring. Warm soils enable soil microorganisms to transform the N to nitrate, and abundant rainfall promotes loss of N present as nitrate.

Temperatures have been relatively favorable for transformation of fall-applied manure N to nitrate during the past few months, but soil moisture conditions have not been favorable for losses of this nitrate. If weather conditions remain relatively dry, many soils treated with animal manure will have ample nitrate to maximize yields of corn.

Extensive studies (Table 1) have shown that profits for producers are more likely to be decreased than increased by application of commercial fertilizers to manured soils testing greater than 20 ppm by the late-spring test. Such findings are reasonable because nitrate is the primary form of N taken up by plants and because yields are not increased by above-optimal amounts of nitrate.

Mean net returns to fertilization in Table 1 are presented for three ratios of prices for grain and fertilizer because price ratios vary with situation and often determine whether N should be applied. Mean net returns are expressed in bushels of grain per acre to make the information relevant for all prices. Net returns can be converted to dollars per acre by using a relevant price for grain.

Data in Table 1 show that rates of N fertilization had relatively little effect on mean net returns to fertilization when soils test between 15 and 20 ppm by the late-spring test. In this range, costs of fertilization nearly equaled the value of extra crop produced. Small errors in soil testing, therefore, had relatively little effect on the profitability of fertilization in this range.

At prices relatively unfavorable for producers, the average loss of profit from applying unneeded fertilizer tended to be greater than the cost of not fertilizing when it would have been profitable. These observations clearly conflict with the popular notion that extra N

should be applied to ensure against large yield losses. If grain prices remain low, producers are well advised to consider that they cannot afford to apply commercial fertilizers to manured cornfields unless the late-spring test is used to guide this fertilization.

The late-spring test for soil nitrate provides site-specific information concerning amounts of nitrate in soils when plants begin rapid uptake of N. This information provides the best-available estimate of N fertilizer needs at specific sites where animal manure has been applied. When the test is used across many sites and years, the resulting information also can be used to evaluate and improve the manure management practices used on individual farms.

Observations made over the past two decades suggest that corn producers can expect many benefits from moving toward practices that address variability in losses of manure-N that occur before the growing season. These benefits include higher average yields, lower average rates of N fertilization, and a reduction in environmental problems relating to N management.

Guidelines for using the late-spring test for soil nitrate are given in ISU Extension publication PM 1714, Nitrogen fertilizer recommendations for corn in Iowa [1]. The information given in Table 1, however, includes observations that were not available when Pm 1714 was prepared.

**Table 1. Mean net returns to fertilizer N across 205 trials on manured cornfields that are grouped by nitrate concentrations from the late-spring test before fertilization.<sup>a</sup>**

		<b>Mean Net Returns to Fertilizer N at Various Price Ratios (PR),<sup>b</sup> bu/acre</b>		
<b>Soil Nitrate Category, ppm N</b>	<b>Rate of N Fertilization in June, lb N/acre</b>	<b>PR = 6</b>	<b>PR = 11</b>	<b>PR = 22</b>
<10	30	6.9	9.6	10.8
	60	8.0	13.4	15.9
	90	9.6	17.5	21.7
10-14	30	-1.6	1.1	2.4
	60	-1.3	4.0	6.7
	90	-5.6	2.4	6.4
15-19	30	-2.2	0.5	1.8
	60	-2.7	2.7	5.4
	90	-8.1	-0.2	4.0

20-24	30	-5.1	-2.4	-1.1
	60	-7.7	-2.2	0.5
	90	-12.6	-4.6	-0.6
>=25	30	-6.9	-4.1	-2.9
	60	-13.4	-8.1	-5.4
	90	-19.0	-11.0	-6.9

<sup>a</sup>From Blackmer A., N.C. Yang, and D.J. Hansen. 1999. *What does the late-spring soil test really measure?* In Proceedings of the 11th Annual Integrated Crop Management Conference, Iowa State University, Ames. The study included a wide variety of types of manure and rates, times, and methods of manure application.

<sup>b</sup>Price ratios indicate the number of pounds of N that can be purchased by a bushel of corn. Mean net returns are calculated by subtracting the cost of N fertilizer expressed in bushels of grain from the yield increase due to fertilization. An application cost of 1.6 bu/acre was included.

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[1] <http://www.extension.iastate.edu/Publications/PM1714.pdf>

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