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Is fall nitrogen profitable?

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Is fall nitrogen profitable?

Abstract

Crops are maturing rapidly this summer and harvest is likely to occur early this year. This may leave plenty of time for application of nitrogen (N) this fall, and many producers will find it hard to resist the opportunity to get a jump on spring work. However, information gathered by using precision farming technologies indicates that these producers are placing their profits at greater risk than has been generally recognized.

Keywords

Agronomy

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences

INTEGRATED CROP MANAGEMENT

A person is visible in the background of the title image, working in a field. The text 'INTEGRATED CROP MANAGEMENT' is overlaid on the image in a large, stylized font.

Is fall nitrogen profitable?

Crops are maturing rapidly this summer and harvest is likely to occur early this year. This may leave plenty of time for application of nitrogen (N) this fall, and many producers will find it hard to resist the opportunity to get a jump on spring work. However, information gathered by using precision farming technologies indicates that these producers are placing their profits at greater risk than has been generally recognized.

New technologies have greatly increased our ability to assess the importance of time-of-application effects. Such assessments can be made in field-scale studies where various N treatments are applied in replicated strips going the length of the field. Remote sensing is used to monitor the development of N deficiencies in the crop during the growing season. Yield monitors record yields on each strip at harvest.

These technologies were used in three 80-acre trials to compare the effects of fall- and spring-applied N for corn in 1999. Fall-applied anhydrous ammonia with and without N-Serve was compared with 28 percent liquid N injected into the soil when plants were about 1 foot in height. The fall N was applied November 23-25. The liquid N was applied (June 10-14) at three different rates to provide a "calibration curve" for assessing the relative effectiveness of the fall- and spring-applied N.

Some treatments involved applying extra N with a high-clearance applicator at tasseling (R1). These treatments were included to assess the possible benefits of applying "rescue treatments" mid-season in situations where yield-limiting deficiencies of N have been detected.

The studies were conducted in Greene and Boone counties. Both counties had conditions favorable for losses of fall-applied N. Conditions included above-average temperatures during the winter and above-average rainfall in the spring. The temperatures favored rapid conversion of the fertilizer to nitrate, and the rainfall favored loss of this nitrate by leaching or denitrification.

Remote sensing detected strong deficiencies of N where the fall N was applied and where liquid N was applied in the spring at only 50 lb N/acre (Figure 1). Deficiencies of N appear as less green, which is caused by more light being reflected from leaves that are not absorbing light during photosynthesis.

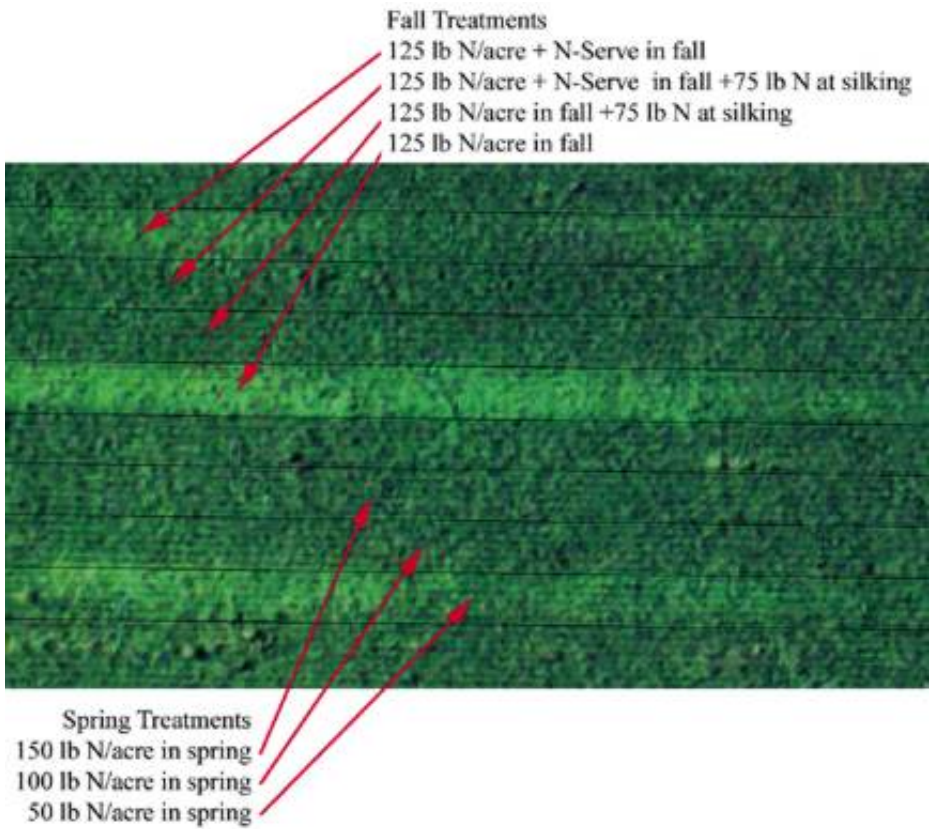


Figure 1. Portion of an aerial image (taken August 27, 1999) enlarged to show an example of differences in reflectance (color) for various treatments in this study.

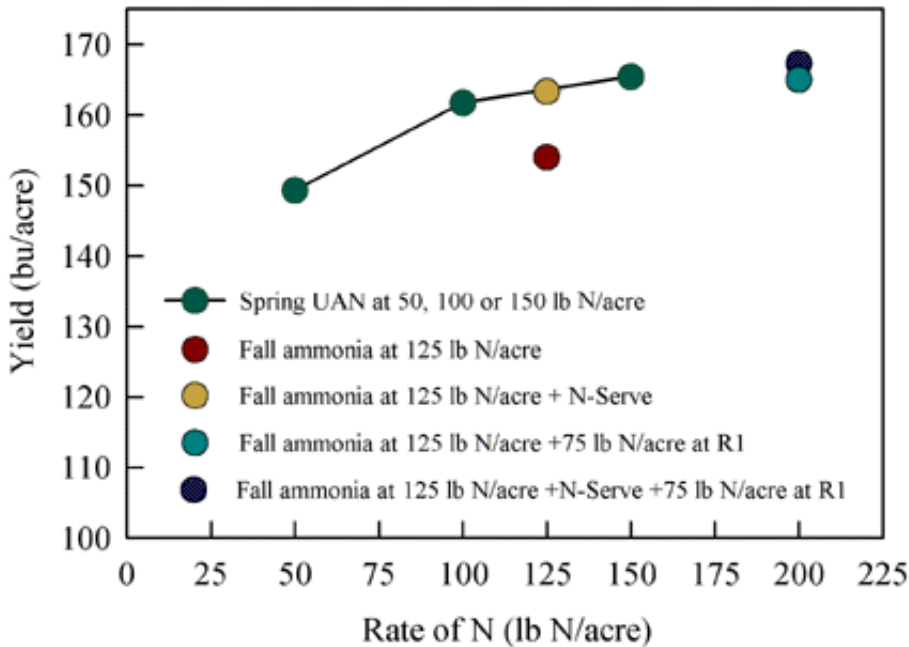


Figure 2. Mean yields across three sites for various N fertilizer treatments.

Yield measurements confirmed that yield-limiting deficiencies had occurred in these treatments (Figure 2). These measurements showed that the yield losses could be decreased by using N-Serve with the fall-applied N or by rescue fertilization at tasseling. The highest mean yields were obtained with a combination of fall-applied N, N-Serve, and

additional N applied at tasseling.

Especially with current prices for corn, the treatments that give the highest yields should not be confused with the treatments that give the highest profits. Some treatments that produce statistically significant increases in yields are not profitable for the producers. Profitable corn production requires selection of the best combination of inputs.

Figure 2 is constructed to enable producers to calculate the net benefits of each treatment by using prices that apply to them. Relevant prices are for fertilizer materials, N-Serve, costs of application, and price of grain at harvest. It is necessary to use the harvest price for grain to distinguish corn production efficiency from grain marketing efficiency.

Here are four noteworthy points about the data in Figure 2.

1. If only spring applications are considered, the 100-lb rate was more profitable than the 150-lb rate if prices were such that 1 bu of grain buys less than 13.5 lb of N. For example, if corn was \$2.00/bu and N was \$0.15/lb then it would not be profitable to apply the additional N. As reported in the May 1999 Precision Ag Issue of this newsletter, the 100-lb rate is most profitable in most years.
2. At common prices, application of 125 lb of N without N-Serve in the fall was less profitable than application of 50 lb of N in the spring.
3. Application of N-Serve significantly increased the efficiency with which fall N was used by plants, but it also significantly increased the cost of fertilization. This cost must be paid before the farmer knows if weather will make the N-Serve effective.
4. Applications of N at silking increased yields and showed that deficiencies of N limited yields. Application of this N to all parts of all fields would not have been profitable at prices normally encountered. The potential value of these treatments, however, is that they can be applied only when and where yield-limiting deficiencies of N are likely after spring weather conditions are known.

The weather conditions were unusually favorable for losses of fall N in this study. However, Iowa's soils often have excess water in the spring, before plants start rapid growth in June. And it is unequivocally established that excess water in soils makes fertilizer N vulnerable to loss by leaching or denitrification. Fertilization strategies that address variability in weather seem to make sense in Iowa.

Agriculturalists from other parts of the world cannot understand how farmers can afford the risks associated with fall-applied N. This question deserves serious consideration as we watch grain prices during harvest this fall and wonder about weather conditions next spring.

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