ON-FARM NITROGEN FERTILIZER DEMONSTRATIONS[1]

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ABSTRACT

The Magdoff Pre-Sidedress Nitrate Test (PSNT) has been successfully used in the Northeast and humid parts of Midwest to improve N fertilizer recommendations. A modified version of the Magdoff PSNT was evaluated in 1989 and 1990 in Michigan. Fifty-three large scale on-farm corn N demonstrations were carried out. Two rates of N (a reduced rate and a high rate) were replicated 3 to 6 times in each field. Forty-six sites showed no significant (p=.05) yield reduction due to the reduce N rate. Forty-nine sites had no significant economic loss. Two of the responsive sites where the test failed were irrigated sandy soils. The PSNT has great potential in Michigan for improving N fertilizer recommendations.

INTRODUCTION

The use of a soil nitrate test to adjust corn N fertilizer recommendations has been used very successfully in several western states. Its use in the more humid regions of the U. S. such as Michigan, however, has been slow to develop. Soil nitrate in Michigan soils can fluctuate rapidly due to excess precipitation. As a result, the Magdoff pre-sidedress nitrate test (PSNT) is being evaluated at Michigan State University (MSU). Some modifications of the procedure have been made, such as taking a two-foot soil sample instead of one foot.

The objective of this study was to evaluate the use of the modified Magdoff PSNT as a tool for reducing N fertilizer recommendations. This report includes 54 on-farm N fertilizer demonstrations conducted in 1989 and 1990 on corn. These studies were completed as part of the Michigan Energy Conservation Program (MECP). This is a cooperative effort of the Cooperative Extension Service, the Soil and Water Conservation Districts and the Department of Crop and Soil Sciences at Michigan State University to reduce farm energy use.

METHODS

County Extension agents and Soil Conservation Service personnel were responsible for selecting the cooperator and the field site. In addition to the pre-sidedress sample, fall and early spring soil samples were collected at many of the sites. Two soil samples were collected from depths of 0-12 and 12-24 inches at each demonstration site just prior to sidedressing the N fertilizer. The soil samples were air dried or dried in an oven at 105 degrees F immediately after collection. They were then mixed and screened before analysis by the MSU soil testing laboratory using a 1 N KCl extraction and cadmium reduction procedure.

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The type of demonstration conducted at each location was dependent upon the standard practices of the farmer. Our goal was to present the farmer with a demonstration procedure that could easily be conducted and would relate to his management practices. Each demonstration involved the comparison of a reduced sidedress N rate with the farmers normal sidedress rate or in some cases the MSU recommended rate without the use of the nitrate test. The reduced rate was based on the amount of nitrate N found in the two-foot profile at sidedress time. The two rates of N fertilizer were applied in 4 to 8 row strips the entire length of the field. Each N rate was replicated 3 to 6 times. Corn yields were determined by harvesting each strip with a combine and weighing with a weigh-wagon equipped with an electronic scale. Grain samples were collected from each strip for determination of moisture. The yield and moisture data were analyzed statistically. The economic difference was calculated using $2.10 per bushel of corn times the yield for each N rate minus $.15 per lb of N for each N rate.

RESULTS AND DISCUSSION

Fifty-three large scale N fertilizer demonstrations were conducted on corn in 1989 and 1990 in 25 counties. Sidedress N rates, yields and economic differences associated with each site are shown graphically in figures 1-6.

In 1989, only 3 sites showed a significant (p=.05) yield decrease due to the reduced sidedress N rate (sites "e", "j" and "s" shown in figure 3). The reduced N rate produced equal or better yields at the other 23 locations. Only two of sites, where a significant yield reduction occurred, showed a significant economic loss (sites "j" and "s" shown in figure 5). The yield difference at these sites was 33 and 17 bushels, respectively. The average N rate for all 26 sites was 60 lb/A for the reduced rate and 125 lb/A for the high rate. Average yields for all sites were 124 and 126 bu/A, respectively.

In 1990, 4 sites showed a significant yield decrease due to the reduced sidedress N rate ("d", 'o', "w" and "z" shown in figure 4). Economic losses occurred only at two of these sites (sites "o" and "w" shown in figure 6) where the yield difference was 14 and 11 bushels, respectively. The average N rate for all 27 demonstrations was 60 lb/A for the reduced rate and 127 lb/A for the high rate. Average yields were 137 and 140 bu/A, respectively.

Two of the responsive sites ("j" in 1989 and "o" in 1990) were irrigated sandy soils. Perhaps, the PSNT has some limitations on irrigated sandy soils. Nevertheless, we conclude that the PSNT is a very effective tool for reducing N fertilizer rates without risk of yield or economic loss to the farmer. The test also offers long term benefits for reducing nitrate contamination of both surface and ground water.

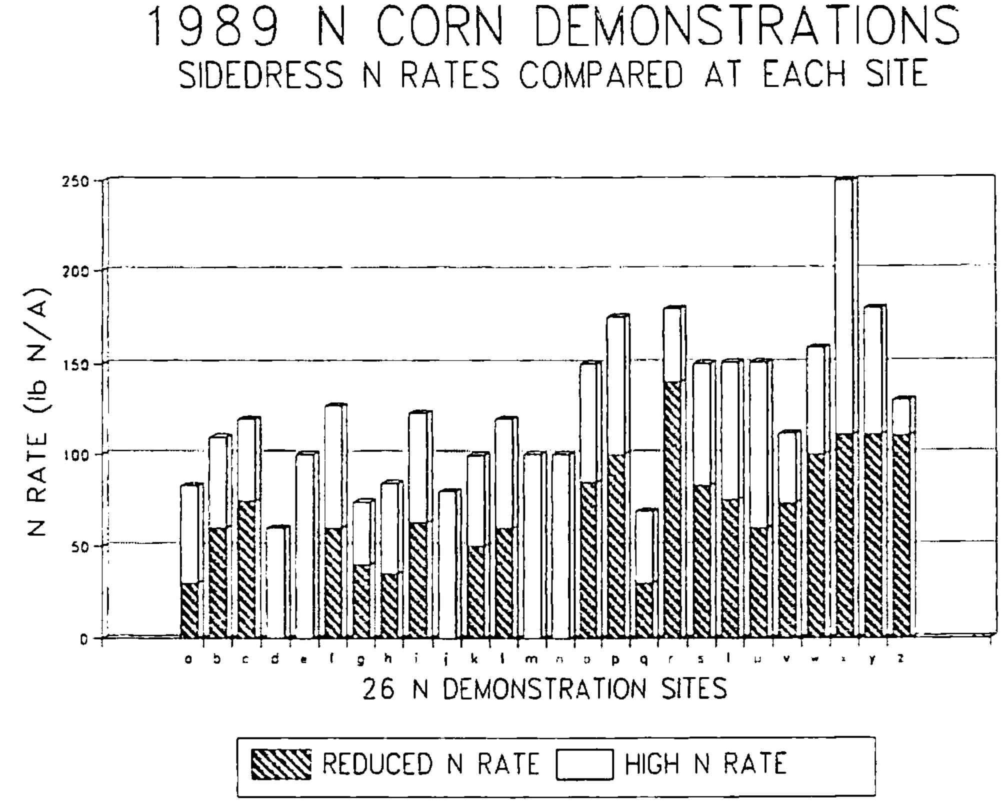

Figure 1. Sidedress N rates compared at 26 on-farm demonstration sites in 1989.

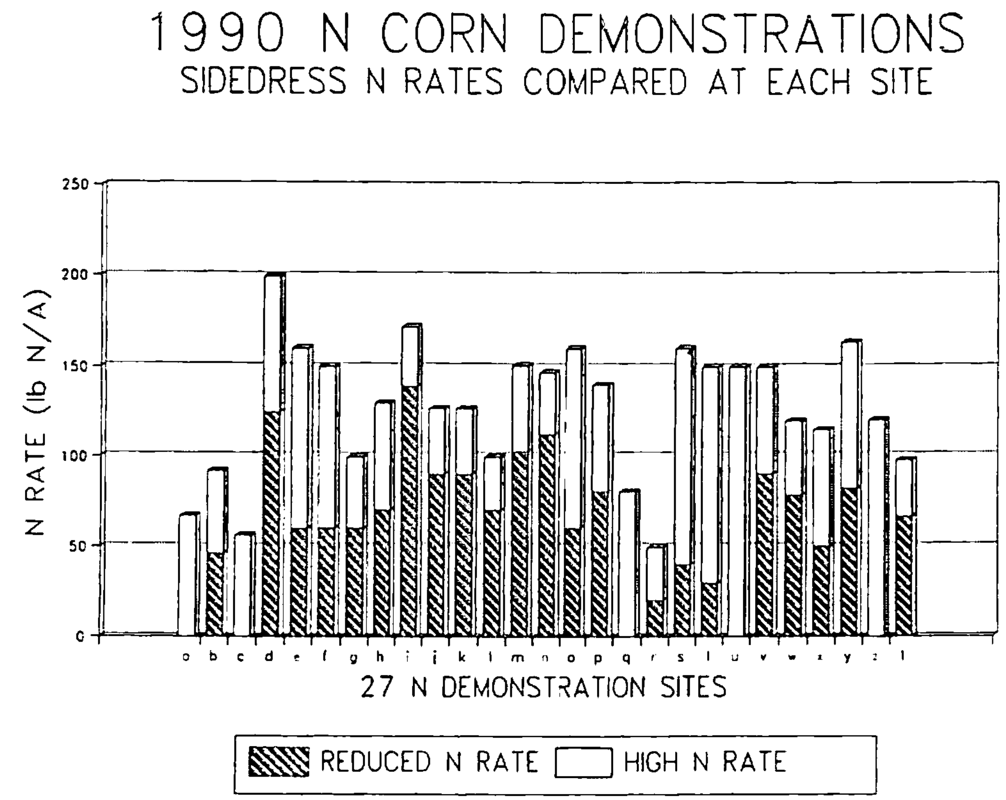

Figure 2. Sidedress N rates compared at 27 on-farm demonstration sites in 1990.

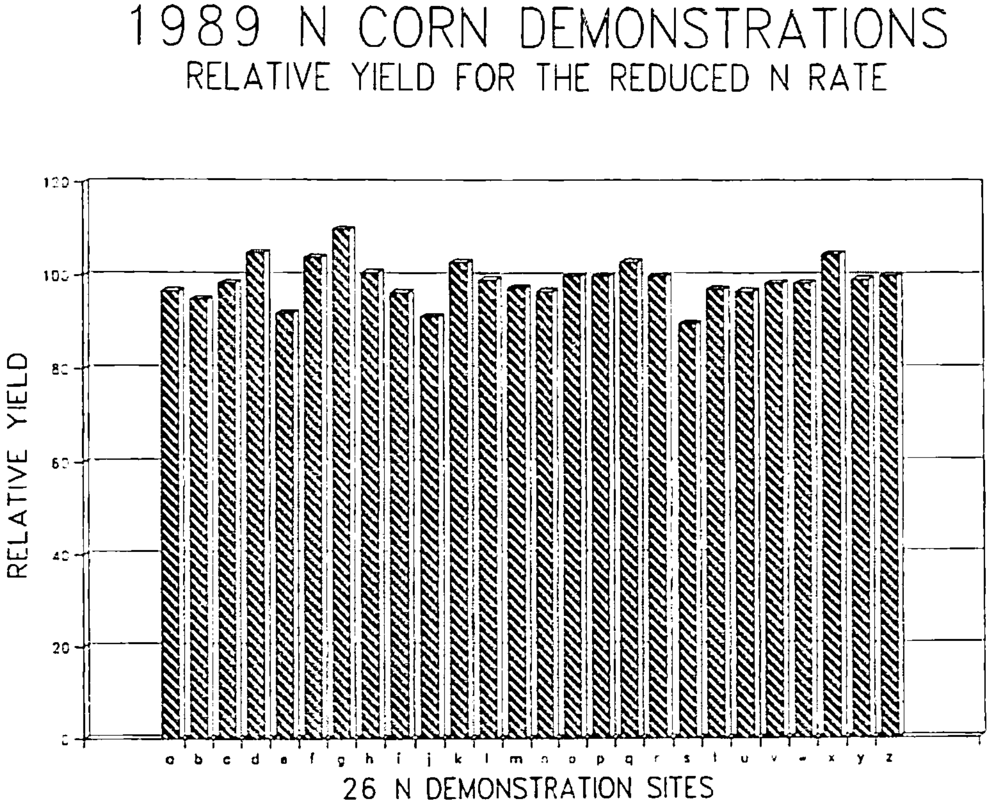

Figure 3. Relative corn yield, expressed as a percent of the high N yield, for 26 on-farm demonstrations conducted in 1989.

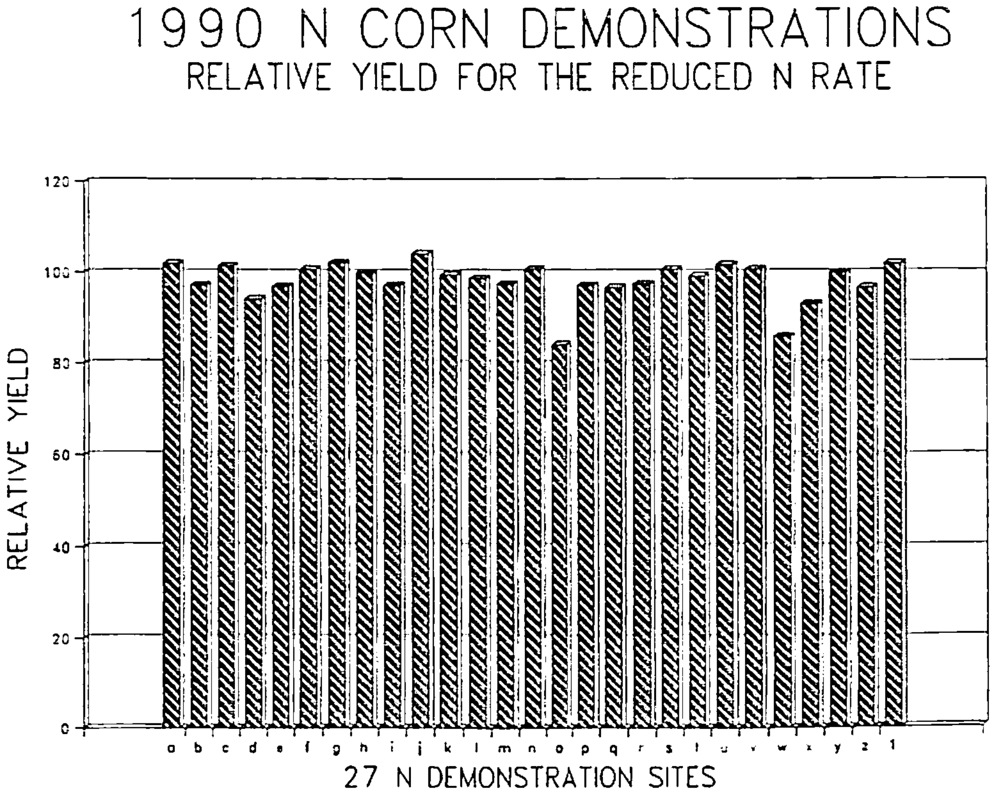

Figure 4. Relative corn yield, expressed as a percent of the high N yield, for 27 on-farm demonstrations conducted in 1990.

1989 N CORN DEMONSTRATIONS
ECONOMIC ADVANTAGE FOR REDUCED N RATE

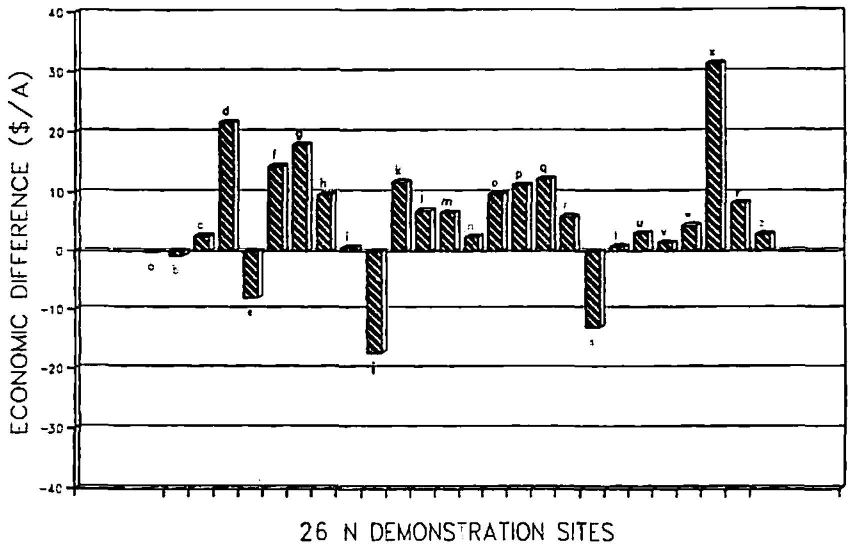

Figure 5. Economic advantage for the reduced N rate, based on the yield difference between the reduced N and the high N treatments using $2.10 per bushel of corn and $.15 per lb of N (1989 data).

1990 N CORN DEMONSTRATIONS
ECONOMIC ADVANTAGE FOR REDUCED N RATE

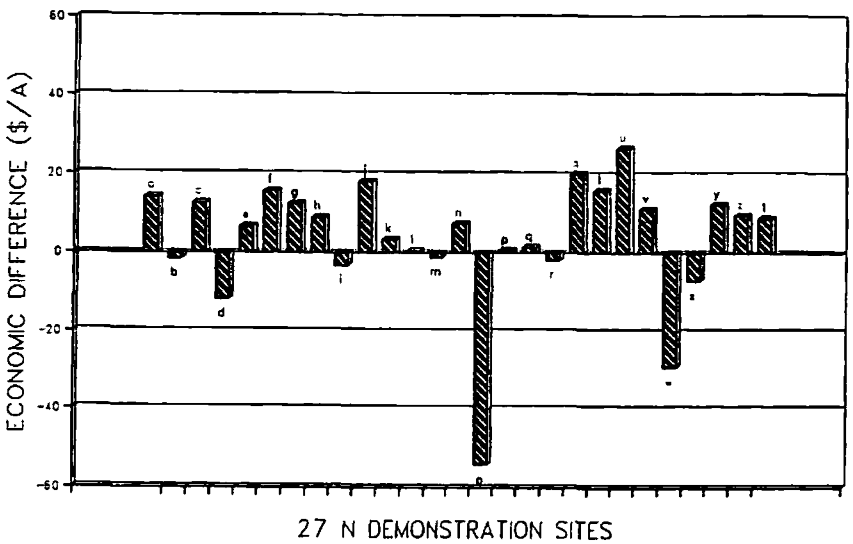

Figure 6. Economic advantage for the reduced N rate, based on the yield difference between the reduced N and the high N treatments using $2.10 per bushel of corn and $.15 per lb of N (1990 data).

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