# Nitrogen Rate Comparison in Corn with Poultry Litter

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## Objective

Compare the impact of varied sidedress nitrogen (N) rates on the yield response of corn.

## Background

The role of N fertilization in a corn crop is one of the most impactful variables that can affect a field's production and economic viability. The impact of N fertilization is affected by various factors, from rate and timing to production strategies and environmental variation. The natural variation of production systems supports the utilization of regional studies to make generalized recommendations more comprehensive (Sawyer et al., 2006 & Tremblay et al., 2012). On-farm trials are an excellent way to localize imperative agronomic decisions. This study aims to assess the yield production and economic viability of variable N rates at sidedress on corn.

## Methods

Nitrogen fertilizer at two rates was applied to the corn trial at sidedress. Each treatment was replicated four times in a random complete block design. The field was planted at a population of 34,000 seeds/ac. The entire field received starter fertilizer at planting, at a rate of 12 lbs/A of N (4 gal. of 28% UAN).

Poultry litter was applied at 2 tons/acre on 11-1-2023. The two N treatments were an application of 65 gallons of 28% N at sidedress and 45 gallons of 28% N at sidedress. In addition to both treatments, 5 gallons of Thio-Sul (12-0-0-26 S) was applied at sidedress. A further description of the field operations is available in Table 1.

Sidedress application was at V6 (6 collared leaves) and Treatments 1 and 2 were 135 lbs/A and 195 lbs/A of N, respectively (Table 2). Yields and moisture were obtained by a calibrated yield monitor. Yields were adjusted to 15.5% moisture. A simple economic analysis was conducted using the adjusted yield and the values of $3.75/bu for corn and $350/ton UAN N ($1.75/gal).

Table 1. Description of Trial Field Operations

| | |
|---|---|
| Crop Year: 2024 Corn | Herbicides: Pre-plant Glyphosate, 2, 4-D, |
| Previous Crop: Soybean | Atrazine, Resicore XL |
| Location: Hicksville, Ohio | Fungicides: Miravis Top |
| County: Defiance | Variety: Pioneer PO720AM |
| Soil Type: Hoytville clay loam | Seeding Rate: 34,000/A |
| Drainage: Pattern | Planting Date: 5/14/2024 |
| Tillage: No-till/ Strip-till | Harvest Date: 11/7/2024 |
| Soil Test: pH 6.7, P 99 ppm M3, K 282 ppm, CEC 16.8, O.M. 3.6 % | |



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| Table 2. Trial Fertilizer Description |
|---|
| Starter Fertilizer: 12 lbs/A (4 gal. 28% UAN) of N for both treatments |
| Treatment 1: 135 lbs/A (45 gal. 28% UAN) of N |
| Treatment 2: 195 lbs/A (65 gal. 28% UAN) of N |

## Results

The trial resulted in no significant difference in yield response to the varied nitrogen rates. The higher rate of nitrogen incurred a relative loss of $33.50 per acre since the value of the increased corn yield (0.4 bu/ac) did not make up for the additional cost of the excess nitrogen. The value of the yield realized and the cost of inputs make the 45 gallons of 28% UAN per acre treatment the more economical practice (Table 3), when grown after a fall application of poultry litter.

Table 3. Corn Yield and Economic Response to Nitrogen Rate

| Sidedress N Rate | Yield | Value of Corn | Cost of Nitrogen | Gross Returns |
|---|---|---|---|---|
| (gal/A of 28% UAN) | (bu/A) | ($/A) | ($/A) | ($/A) |
| 45 | 228.0 A | 855.00 | 78.75 | 776.25 |
| 65 | 228.4 A | 856.50 | 113.75 | 742.75 |
| **C.V. = 2.01** | **LSD (0.10) 6.3** | | | |

Table 4. Weather Data for the 2024 growing season at the trial site

| | April | May | June | July | August | September | Total |
|---|---|---|---|---|---|---|---|
| Precipitation (inches) | 5.90 | 3.81 | 2.76 | 4.23 | 2.68 | 1.88 | 21.26 |
| Cumulative GDD | 207 | 675 | 1323 | 2011 | 2656 | 3181 | 3181 |

## Summary

The rate of nitrogen applied can greatly impact the yield response of a corn crop, however, the two do not have a linear relationship. It is important to assess the upper yield limit of nitrogen application and the economic outcomes for any given situation. Treatment 1 for this trial is close to the maximum return to nitrogen (MRTN) recommendation of 156 lbs of total N. This trial provides an example of lower economic returns when further from the MRTN recommendation. To build on this research, additional growing seasons can test nitrogen rates between or below the two seen in this study to better understand the most economic practices for this producer. Further research is needed on other N management strategies, such as cover crops or the nitrogen balances used for the split application.

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