Nitrogen Rate Trials

Background:
The On-Farm Network® is conducting research on corn response to nitrogen (N) rate in Iowa. The intent of this work is to:
1. Identify key factors for creating variable rate nitrogen prescriptions.
2. Provide farmers with guidance on optimum nitrogen rates for their region.
3. Demonstrate best nitrogen management practices to farmers.

Protocol:
At each site farmers applied predetermined nitrogen rates in replicated strip trials based on previous crop. Plot sizes were the length of the field with a width of one or two rounds of the harvester. In most of the fields, the farmer applied a base low rate as preplant and applied incremental rates of nitrogen to supplement the crop in season.
The seasonal rates in the trials are as follows:
- Corn following soybeans: 80, 110, 140, 170 and 200 lbs N/acre
- Corn following corn: 110, 140, 170, 200 and 230 lbs N/acre

Plots were harvested with a harvester equipped with yield monitor capability. Yield monitors were calibrated, and the data was cleaned according to industry standard practices.

Results:
Locations and farms did not respond similarly to nitrogen rate. Average responses across all nitrogen rates are shown in Figure 1. Note the agronomic economic rate for corn after soybeans was around 170 lbs N/acre while the agronomic optimum for corn after corn was 230 lbs N/acre.

![Corn Response to Nitrogen in a Corn/Soybean Rotation](image1)

![Corn Response to Nitrogen in a Corn/Corn Rotation](image2)

Figure 1: Corn response to nitrogen in corn-soybean and corn-corn rotations for two years.

In terms of profitability, the optimum nitrogen rates mirrored the agronomic optimums. In corn after soybeans, the most profitable rate was 170 lbs N/acre, and 230 lbs N/acre in corn after corn.
The Maximum Return to Nitrogen (MRTN) calculator is a university tool that predicts optimal nitrogen rates based upon costs and results from hundreds of nitrogen rate response trials. The MRTN tool predicts the economic optimum for these trials to be between 125 to 150 lbs N/acre for corn after soybeans and 175 to 200 lbs N/acre for corn after corn. These results do not correlate well with the MRTN tool as the results are based upon years with normal to above normal rainfall and historically high yields. Another potential reason for the difference is our results are from large strip trials where the nitrogen rates were tested across many diverse soil types.

As mentioned previously, individual fields responded differently to nitrogen rate. Nitrogen rate responses for seven locations in 2018 are shown in the following figures. As the On-Farm Network compiles nitrogen response data, more decision aids and guidance for variable rate nitrogen will be developed.

### Nitrogen Rate Responses for Northwest Iowa

**ST2018_065**

- **N price:** $0.50/lb
- **Corn price:** $3.50/bu
- **Median Econ. Optimum:** 176 lb/acre
- **68% Interval:** 160 to 193 lb/acre

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**Figure 2: Profitable responses to nitrogen rates in fields for two years.**
Nitrogen Rate Responses for Northwest Iowa

ST2018_064

N price=$0.50/lb
Corn price=$3.50/bu
Median Econ. Optimum=167 lb/acre
68% Interval=158 to 180 lb/acre

Optimal Range

ST2018_036

N price=$0.50/lb
Corn price=$3.50/bu
Median Econ. Optimum=187 lb/acre
68% Interval=183 to 193 lb/acre
Nitrogen Rate Responses for Northwest Iowa

![Graph showing corn yield vs. nitrogen rate for Northwest Iowa. The optimal range is from 158 to 180 lb/acre.]

- **ST2018_066**
- **N price**: $0.50/lb
- **Corn price**: $3.50/bu
- **Median Econ. Optimum**: 156 lb/acre
- **68% Interval**: 158 to 180 lb/acre

Nitrogen Rate Responses for Northeast Iowa

![Graph showing corn yield vs. nitrogen rate for Northeast Iowa. The optimal range is from 158 to 166 lb/acre.]

- **ST2018_08**
- **N price**: $0.50/lb
- **Corn price**: $3.50/bu
- **Median Econ. Optimum**: 162 lb/acre
- **68% Interval**: 158 to 166 lb/acre
Nitrogen Rate Responses for Central Iowa

N price=$0.50/lb
Corn price=$3.50/bu
Median Econ. Optimum=205 lb/acre

Nitrogen Rate Responses for Southeast Iowa

N price=$0.50/lb
Corn price=$3.50/bu
Median Econ. Optimum=186 lb/acre
68% Interval=177 to 196 lb/acre