

eFields

Ohio State University Extension Corn Nitrogen Rate Trial Protocol

Study Overview

The goal of this study is to determine the agronomic and economic optimal corn nitrogen fertilizer rate in a field. Information from this trial will be used in the corn nitrogen rate calculator (<http://cnrc.agron.iastate.edu/>) and directly contribute to Ohio's corn nitrogen rate recommendation for growers. To maximize learning, a minimum of five different nitrogen rates should be compared. More rates can be added, if adequate space is available. The rates compared in the trial need to be different enough to have the potential to affect yield, a minimum difference of 40 lbs/acre between each treatment is recommended. It may be necessary to adjust these rates slightly based on your equipment capabilities. Many farmers will naturally want to compare a N rate a little less and a little more than their standard application (ex, 160 vs 180 vs 200 lbs N/acre). Although this is logical, it's important to understand that our overall goal is to construct a robust N response curve for the field. When we do this, we will be able to make inferences regarding +/- 20 lbs N/acre. The high and low nitrogen rates are critical to include because they make it possible to observe the response curve to nitrogen. Without this wide range of N rates, field data are often not reliable enough to be useable.

Proper experimental design is important to ensure the validity of the yield results at the season end. Plot replication and randomization make it possible for statistical analysis to account for the natural field variation that occurs. For this study, a minimum of three replications should be used and four replications are recommended. Plots should be randomized within each replication to eliminate bias due to plot order.

Minimum N Rate Criteria

- **5 N rates.** In some cases, 4 rates will be sufficient. Experience has shown that 5 is much better than 4. Including a 5th rate greatly increases the chances of your data being usable.
- **Wide range of N treatments.** This is very important, as again, we've had to throw out trials with the lowest N rate being 100 lb N, or the highest N rate at 200 lb N, if we cannot model the N response robustly.
 - The lowest N rate should not be more than 50 lbs N/acre. A zero N rate provides extremely valuable information and is highly encouraged, but many farmers do not want to do this.
 - The highest N rate should not be less than 250 lbs N/acre.
- **Example Rates**
 - Recommended with 6 rates: 0, 50, 100, 150, 200, 250 lbs N/acre.
 - Recommended with 5 rates: 50, 100, 150, 200, 250 lbs N/acre
 - Recommended with 4 rates: 50, 120, 190, 260 lbs N/acre.

Field Dimensions

The field size will determine the total number of plots that can be installed. Remember, at least 3 replications per rate. Plot length is typically determined by the length of the field. All plots should be at least 500 feet long. Plot width will be determined by equipment size. It is important to take into account the size of both the N application equipment and the combine, as well as any application equipment that might impact the trial. If N is applied with the planter, this needs to be considered, as well.

- Full-width or half-width of applicator width is recommended for a plot width. It will depend on the width of the applicator plus the applicator's ability to independently control rates if a split-width setup is selected).
- If multiple N applications are planned, the plot width should accommodate the size of all applicators. Example: N applied pre-plant anhydrous (8 row) and 28% UAN sidedress (12 row), plots need to be at least 60 feet (24 row).
- Estimate the field width then divide by the selected width (full- or split- width) to determine the number of passes / plots available and if you can meet the 5 treatments by 3 replications (15 plots).
- Passes / plots no less than 500-feet (not counting headland rows) are recommended.
- Plots widths should consist of two or more combine header widths.

Suggestions

- To maximize learnings, at least 2 fields per county is recommended.
- Evaluate application equipment and combine width to make sure the selected plot dimensions align properly. Correct alignment of the application equipment and combine widths will ensure project success.
- Using the variety tracking option using an in-cab display can help manage the project. One can setup the 5 treatments by using the variety name then adding A, B, C, D or E (or similar nomenclature) at the end of each name.
 - Before starting each pass, select the treatment corresponding to the plot.
 - Example help guide for the Precision Planting 20/20 display illustrating how to create custom varieties for a project:
https://fabe.osu.edu/sites/fabe/files/imce/images/Precision_Ag/PP20_20_Adding_CustomHybrid_0.pdf

Data Collection

5 primary data needs for this project

1. Complete worksheet
2. Field boundary (lat/long of field will work at minimum)
3. As-planted data (if available)
4. As-applied data for N applications
5. Yield Monitor Data (calibrated); If a yield monitor is not available, a weigh wagon can be used to weigh the total amount harvested from each plot. Accurate plot dimensions are needed (e.g. width and length of each plot)
6. An optional 6th data point to consider is collecting soil before fertilization and shipping to the Culman lab for soil characterization. Soil can be collected in each strip or over all

strips within a replicate block (minimum 10 cores at 0-8"). Contact Steve Culman (culman.2@osu.edu) to arrange for this.

Example Layouts

Plot layout with 4 replications using 50, 100, 150, 200, 250 lbs N per acre as treatments.

Planter Pass	Replication	Plot ID	Description	TRT Code
1	1	101	200	D
2		102	150	C
3		103	250	E
4		104	50	A
5		105	100	B
6	2	201	250	E
7		202	100	B
8		203	150	C
9		204	50	A
10		205	200	D
11	3	301	50	A
12		302	250	E
13		303	100	B
14		304	150	C
15		305	200	D
16	4	401	250	E
17		402	150	C
18		403	200	D
19		404	50	A
20		405	100	B