



Nebraska On-Farm Research: Precision Nitrogen Management Project **Nitrogen Fertilizer Inhibitors for Enhanced Nitrogen Use Efficiency in Corn**

Objective

The objective of this on-farm trial is to evaluate the effect of nitrogen fertilizer inhibitors (nitrification inhibitors, urease inhibitors) on nitrogen use efficiency, inorganic nitrogen fractions (NO₃, NH₄), vegetative growth N stress, crop yield, and profits. Nitrogen fertilizer Inhibitors would be applied in fall and/or spring and compared with split N application without inhibitors.

Why Participate?

Recent wet years in Nebraska has renewed producer's interest in protecting fertilizer nitrogen loss from volatilization, denitrification, and leaching. Participation in this trial will allow you to evaluate the effect of nitrogen fertilizer inhibitors in enhancing nitrogen efficiency and crop yield on your farm. You will work closely with Nebraska Extension to accomplish the project. In addition, this study provides you the opportunity in improving nitrogen management and protecting groundwater resources in Nebraska.

All cooperating producers will receive \$600 per study in recognition of their time and resource commitments.

All cooperating producers will receive \$700 per study to mitigate risk of potential yield (and therefore potential profit) loss.

All cooperating producers will receive up to \$1200 for purchasing fertilizer nitrogen additives.

Study Details

Layout: A randomized complete block design with 4 replications are needed for this trial (Figure 1). Rows planted in each treatment need to be equal to or greater than corn head width. The same hybrid and management practices should be used across the entire study area.

Treatments: Any of the following treatments can be selected to compare nitrogen application with and without nitrogen inhibitors. For example, fall nitrogen with and without inhibitors (A VS B), OR spring nitrogen application with and without inhibitors (C VS D), OR spring nitrogen application with and without inhibitors and split nitrogen without inhibitors (C VS D VS E) etc. See possible scenarios in Figure 1.

- A: Fall nitrogen fertilizer without Inhibitor
- B: Fall nitrogen fertilizer with Inhibitor
- C: Spring nitrogen fertilizer without Inhibitor
- D: Spring nitrogen fertilizer with Inhibitor
- E: Split nitrogen fertilizer application without inhibitor

Depending on farmer's fertilizer use type, urease or nitrification inhibitors would be used in any of the following combinations.

Nitrification Inhibitors option: Urea with Instinct/nitrapyrin, UAN with Instinct/nitrapyrin or DCD, Anhydrous ammonia with N-Serve/nitrapyrin, Ammonium nitrate with nitrapyrin/DCD.

Urease Inhibitors option: Urea with Agrotain Ultra/NBPT or Agrotain or Agrotain Plus, Urea with Limus/NBPT/NPPT, UAN with Agrotain Ultra/NBPT or Agrotain or Agrotain Plus, UAN with Limus/NBPT/NPPT?

Possible treatment comparison scenarios

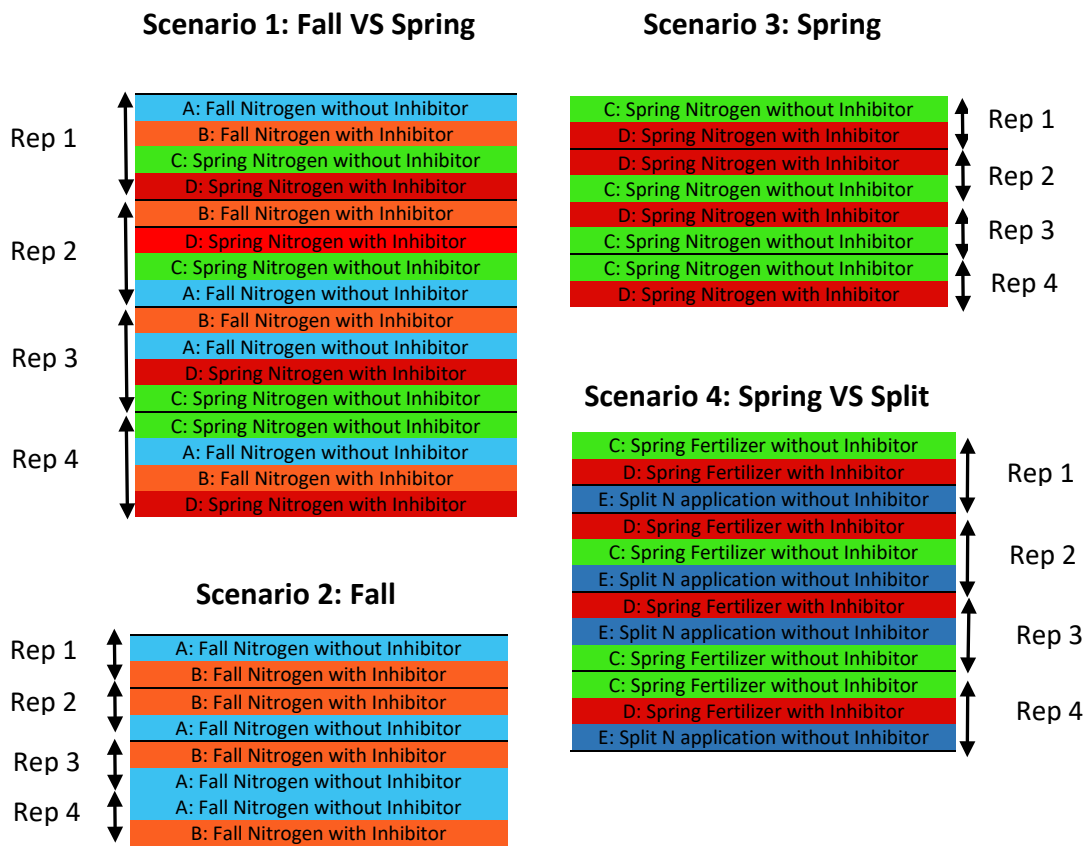


Figure 1. Possible scenarios for comparing nitrogen application with and without inhibitors

Data collection:

- Early season stand counts
- Vegetative growth N stress at V10-V12.
- Aerial NDVI imagery during the growing season to observe visual crop canopy differences.
- Routine soil sampling at 0-8" depth (Basic+OM (S-101 at Ward lab)). Sample will be collected prior to N application in Fall or spring. Sampling needs to be done from four reps before fertilization. 4-6 soil

cores per rep can be sampled randomly and composited into one sample bag. In total, there would be four samples per site.

- Soil samples at 0-12" for nitrate and ammonium analysis on the following sampling dates (Please see the soil sampling procedure at page 5 and 6).

Sampling times	Fall Application	Spring Application	Split Application
1	November-after fertilization	-	-
2	March (pre-plant)	March or April – after fertilization	March-April after fertilization
3	2 weeks later	2 weeks later	2 weeks later
4	2 weeks later	2 weeks later	2 weeks later
5	2 weeks later	2 weeks later	2 weeks later
6	2 weeks later	2 weeks later	2 weeks later
	Note: Soil sampling dates and number of sampling dates would depend on several factors. E.g. fertilizer application, and spring temperature etc. Sampling interval (2-3 weeks) and sampling times (4-6) can be adjusted depending on spring temperature. Please discuss the sampling dates and times with me for each site.		

- Yield monitor data for study year and previous crops.
- Variable rate fertilizer N map for previous year, if any.
- Site rainfall and temperature records.

Grower Requirements

Site Selection:

- Poorly drained or well aerated soil
- No previous cover crop
- No manure applications in last 5 years
- Corn-soy or corn-corn rotation
- Will plant 1 hybrid in field
- Follow same management practices for all treatments

Are you willing to:

- Flag or mark GPS location of each treatment.
- Provide all necessary inputs for crop production
- Complete background agronomic form about site and practices e.g. soil type as defined by USDA, previous tillage conditions, hybrid planted, tillage system, residue type, and planting depth etc.
- Collect yield data with a **well calibrated** yield monitor. (Contact UNL Extension if assistance with this process is needed.)
- Submit harvest data to UNL Extension within 30 days of harvest or by Dec. 15.
- Allow UNL Extension to use submitted and collected data for research, educational, and informational purposes.
- Willing to work closely with the UNL researchers to set up treatments in field length strips. UNL researchers (Dr. Iqbal and Laura Thompson) will manage the platform, set up the fields, the inputs, and running the prescriptions.

Study Questionnaire (to help us plan the best study scenario):

- What nitrogen fertilizer application method do you use at your farm? _____
- Which nitrogen fertilizer and inhibitor are you interested in using (see above or provide other options)? _____
- Do you have capability of applying inhibitors with nitrogen fertilizer? _____
- Do you have in-season N capabilities or willing to hire in-season N application _____
- Irrigated or non-irrigated? _____
- Farm/field location? _____
- Describe you current N management plan _____

- Field history (was there a study conducted on this field in the past 5 years? Manure use? Variable management? Broadcast, incorporated, or banded fertilizer?) please describe.

Soil Sampling Protocol for fertilized plots

Supplies

- i. Plot plan
- ii. 2 clean pails
- iii. Soil probe
- iv. Tool to clean out probes
- v. Cooler
- vi. Ziploc bags
- vii. Sharpie

Sampling procedure

Sampling in Broadcast strips (sampling depth = 1 foot):

When the fertilizer N is broadcast-applied, collect 5 to 10 random soil cores per sample in the bucket in each replicate. Take subsample to store in a Ziploc bag that is appropriately labeled with

1. Your location
2. The rep #
3. plot #
4. Depth
5. Date

Discard the rest of the sample in the bucket. Between each plot the probe needs to be cleaned of chunks of soil inside the tube.

Example for Number of samples: For two treatments with four reps (2 treatments x 4 reps = 8), there would be 8 samples.

Sampling in fertilizer banded strips (sampling depth = 1 foot):

Note: After banding fertilizer, put a flag in the fertilizer band to locate the band for soil sampling in case it disappears after rainfall events.

If fertilizer N is banded, collect 1 group of 5 soil cores that each proportionally represent areas with and without banded fertilizer (see illustration below). In case of different management zone, collect 1 group from each management zone. For the five cores, one should come from the band, 2 should come from 25% away from the band, and 2 should come from 50% away from the band. For example, with 30" fertilizer application spacing, 1 sample would be on the band, 2 samples would be 7.5" from the band, and 2 samples would be 15" from the band. All five cores should be placed together in a sample bag. Each group of 5 should go in its own bag. Label the bag with:

1. Your location
2. The group #
3. The rep #
4. The plot #
5. Depth

6. Date

Example for Number of samples for one management zone: With two treatments with four reps (2 treatments x 4 reps x 1 groups/rep = 8), there would be 8 samples.

Example for Number of samples for two management zone: With two treatments with four reps (2 treatments x 4 reps x 2 groups/rep = 16), there would be 16 samples.

