A Systems Approach to Evaluate Nitrogen Sources, Blends, Additives, Timing along with Application Methods for Improved Nitrogen Efficiency in Corn Production

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Project Location: University of Maryland Poplar Hill Research & Education Farm

Soil Type: Mattapex Silt Loam

Previous Crop: Notill Corn

Purpose of Project: As the cost of plant nutrients, fuel and equipment for application increase, farmers along with Agribusiness are looking for ways to improve the efficiency of these inputs. The studies in 2008 were designed to compare nitrogen sources, blends of N sources, use of additives, timing of N application and method of N application. A phosphorus study was included to improve starter P efficiency.

Objectives:

1. To utilize both dry and liquid forms of plant nutrients.
2. To evaluate the efficiency of N application timing on corn yields.
3. Can blends of nitrogen sources or additives improve N efficiency at different application timings of N? That is can we improve the efficiency of the N source so the total N rate be applied preemergence, at planting or postemergence with no difference in grain yield.
4. To evaluate surface soil conditions following corn harvest, for planting notill wheat.

Background Information: Maryland farmers in the geographic areas of Maryland experience different challenges as to when and how to apply plant nutrients particularly nitrogen. All farmers face the same challenge, what is the best method and timing to apply fertilizer nutrients. Lower and Upper Eastern Shore farmers do not have the same topography challenges that their Western Shore counterparts do. In general it is easier for the Eastern shore farmers to till their soil and they have a wider window to utilize more production practices. This project will utilize several methods and studies to compare N management and efficiency for improved corn yield.

In most studies plots were 15’(6-30” rows) wide by 40’ long with four replications. Plots were harvested using a John Deere 4435 combine. The four center rows were harvested to determine yield. Before harvesting all plots were trimmed to 30’ to remove edge effect from alley ways between plots.

Data Collection:

a. PSNT before N application
b. Grain yields and moisture.
c. Soil samples post harvest.

2008 - Treatments and Results:

Table 1. Fertilizer Sources or Additives That I Have Worked With Previously or Currently Working With to Improve Nitrogen Efficiency. A New Product Evaluating for Increased Starter Phosphorus Efficiency.

Ammonium Sulfate (21-0-0-24)	Agro-Culture Liquid Fertilizer
Ammonium Thio Sulfate(26-0-0-17)	Helena
Agrotain & Agrotain Plus	UAP
Nutrisphere for Nitrogen	Willard's Agri Service
Avail for Phosphorus	YARA

Table 2. Fertilizer N Source (dry or liquid), Application Method (broadcast or dribble) and Timing (all pre-emergence or a combination of pre-emergence, starter and sidedress). Honeywell and IPNI Supported Project. All other studies below derived from this project.

Treatment:	Bu/a
1. Dry Fertilizer Blend of Urea, 18-46-0 & 0-0-60 to = 130-25-80, Applied Before Planting	120.6
2.Same as above, Except the Urea was Treated with Nutrisphere , Applied Pre Plant	110.2
3. Dry Fertilizer Blend of Urea. 18-46-0, 0-0-60 & Ammonium Sulfate, 130-25-80-30, Pre.	130.6
4. Potash (0-0-60) Preplant, Liquid starter of 30-25-5, Sidedress w/Urea 90-0-0(broadcast over corn @ the 6th leaf stage). Total fertilizer applied 130-25-80	*112.8*
5. Same as 4 above except the sidedress urea was treated with Nutrisphere.	*109.6*
6. Same as 4 above except the sidedress N was a blend of Urea and Am. Sulfate. Total Fertilizer Applied 130-25-80-30	*118.6*
7. Liquid Potash (0-0-13) Preplant. Liquid Starter of 30-25-5. Sidedress w 30% UAN(90-0-0) dribbled between corn rows. Corn at the 6th leaf stage3. Total fertilizer applied 130-25-80	117.0
8. Same as 7 above except the sidedress UAN was treated with Nutrisphere.	125.8
9. Same as 7 above except the sidedress UAN was blended w/ Am Sulfate to make a liquid solution of 25-0-0-5. Total fertilizer applied 130-25-80-30	125.7
10. Preplant dry potash(0-0-60) + Am Sulfate(21-0-0-24) to give 26-0-80-30. Liquid starter of 15-25-5. Sidedress w/ 30% UAN treated w/Agrotain to give 89-0-0. N solution was dribbled between rows when the corn was at the 6th leaf stage. Total fertilizer of 130-25-80-30.	127.4
11. Same as 10 except the sidedress N solution was applied using coulter injection	130.0

Conclusion: Only one, applying all the fertilizer pre-plant was as efficient as the other application methods. This has been a career goal of this researcher. This study will be repeated in 2009. It has been shown in other studies, blends of fertilizer N sources with Ammonium Sulfate and certain additives can greatly improve the efficiency of a blended N source.

Table 3. Evaluating Corn Yields @ 2 Nitrogen Rates With and Without Agrotain Plus and Nutrisphere in Notill Corn.

Previous Crop: Wheat/Doublecrop Notill Soybeans. Soil Type Mattapex Silt Loam

Starter Fertilizer: All plots received a liquid starter fertilizer of 100 lbs/a of Willard's 8-20-5 in 2x2 placement (2 inches beside the row and 2 inches below the soil surface).

Results:

Nitrogen Treatment:	90 # N/a	120 # N/a	Ave.
Check – No Nitrogen	58.6	e	58.6
30% UAN	115.7 c	118.4 bc	117.1
30% w/Agrotain Plus	107.9 d	121.1 b	114.5
30% w/Nutrisphere	115.8 c	127.6 a	121.7
Ave.	113.1	122.2	

Comments: From this study and others like it in 2009, at Poplar Hill, one could not justify in cutting N rates. One could only justify in cutting N rates if animal manure had been used or the particular soil type has a history of high residual soil N. In this study Nutrisphere improved N efficiency better than Agrotain Plus.

Table 4. Influence of Avail with a Liquid Starter Fertilizer in a 2x2 Placement in Corn Planted Notillage and Conventional Tillage. In 2007 the conventional tilled plots were moldboard plowed. In 2008 the conventional tilled plots were tilled with a Great Plain Turbo Till unit. Previous Crop: 2007 Single Crop Notill Soybeans, 2008 Notill Corn. Soil Type, Mattapex Silt Loam. Starter Fertilizer: Blend of Willard's 8-20-5 + 30% UAN. Treatments with and without Avail for Phosphorus. The Avail was mixed with the liquid starter (8-20-5) before blending the 30% UAN. Plot Size: 4-30" Rows by 200' Long.

Treatments:	**2007**	**2008**	**Ave.**
Notillage without Avail in the Liquid Starter of 30-25-6-1(S)	92.0	88.7	90.4
Notillage with Avail in the Liquid Starter Solution of 30-25-6-1	101.7	94.7	98.2
Conventional Tillage:(2007 moldboard plow/disk 2x, 2008 tillage w/great plains turbo till) without Avail in the 30-25-6-1 starter.	114.4	101.1	107.8
Conventional Tillage:(2007 moldboard plow/disk 2x, 2008 tillage w/great plains turbo till) with Avail in the starter solution of 30-25-6-1.	121.6	100.3	111.0

Comments: Some say that only 25% of the Phosphorus applied is available for plant uptake. Avail mixed with Phosphorus fertilizers (liquid or dry) and applied to the soil, in starters or broadcast, is supposed to sequester the phosphorus for improved uptake of this plant nutrient. The objective of this study was to evaluate a liquid starter phosphorus fertilizer with and without Avail and its influence on grain yields in notill and minimum tillage corn. In 2007 there was a nice yield response in both notill and conventional tillage. In 2008 there was about a 6 bu/a yield response to the avail. There was no response in the minimum tillage treatments. In 2007 the corn was planted on May 03. In 2008 the corn was planted on Memorial Day. It is known that Phosphorus is not as available in cool wet soils like it is after the soil warms up. This could be the reason we did not see the grain yield advantage in 2008 as we did in 2007. This study will be repeated in 2009.

Table 5. Soybean yields following 3 applications of 2 tons/a per year of broiler poultry manure in various tillage systems of corn. The poultry manure was incorporated into the soil, using several tillage systems.

In 2008 soybeans were planted notill into the corn plots to measure any grain yield differences to the various tillage systems for incorporating the poultry manure for the corn. Table will show the three year corn averages for the various tillage systems and the 2008 notill soybean yields. Also the table will show the yield reduction from deer grazing the last series of soybean plots next to the woods. These series of plots were about sixty feet from the woods.

2008 Single Crop Soybeans Planted After Corn. 2 Tons/a of Poultry Manure Applied to Corn in Years 2005, 2006 and 2007. No Manure applied to Soybeans.

Tillage System for Corn after Broiler Manure was Applied in years 2005, 2006 and 2007.	3 Year Corn Average	Soybeans Bu/a, 2008
After Manure Application, 1X With Great Plains Notill Drill	144.6	59.9
After Manure Application, V-Ripper(Shanks set to a depth of 10”) between Corn Rows.	158.3	61.4
After Manure Application, Ground Was Chiseled Plowed Then Disked Twice.	157.0	58.5
Check No Poultry Manure, Just Sidedress Nitrogen	122.8	40.4
Influence of Deer Grazing on Soybean Yields	***Without***	***With***
Outside Strip(8-18” rows) of Soybeans Grazed by Deere	60.0	37.0

Summary of Project Number 208227
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Soil Type: Mattapex Silt Loam

Previous Crop: Notill Corn or Wheat/Doublecrop Notill Soybeans

Purpose of Project: As the cost of nitrogen, fuel and equipment for application increase, farmers along with Agribusiness are looking for ways to make nitrogen used in corn production more efficient.

Objectives:

1. To evaluate dry and liquid form of fertilizers for efficiency in application and yield response.
2. To compare broadcast, dribble and coulter injection of liquid nitrogen sources, nitrogen source blends, additives and timing as measure of nitrogen application efficiency.
3. To evaluate 2 and 3 tons of spring applied poultry manure in a corn/wheat/double cropped soybean rotation. Will their be a need for additional P and K along with starter N for the soybeans and wheat respectively. Also will a corn starter be needed following the spring application of broiler manure.

Summary of Data and Value to Maryland Producers:

Seven studies were conducted in 2008 to evaluate the purpose and objectives of this project. In the first two studies the objective was to see if dry and liquid forms of fertilizer along with fertilizer blends and additives could be as efficient when applied before as compared to a starter and then sidedressed. One study was conducted on the Eastern Shore at the Poplar Hill Research and Education Facility near Quantico, MD and the other in Western Maryland at the University of Maryland Research and Education Facility near Keedysville, MD. It was found at both locations that the total soil test recommendation of fertilizer for notill corn was as efficient being applied either before planting, applied preemergence before the corn emerged from the soil as to treatments where some of the fertilizer was either applied before planting or using a starter fertilizer then the balance of N being sidedressed when the corn was about 8” tall. The next study looked at the possibility of reducing rate of sidedressed N. Sidedressed N was reduced from 120 lbs/a to 90 lbs/a. The Nitrogen additives Agrotain and Nutrisphere were also utilized in this study. These two products have shown to improve N efficiency when combined with 30% UAN solution in other studies. Corn yields were reduced when the sidedressed N rate was decreased from 120 lbs/a to 90 with UAN and combinations of UAN/Agrotain and UAN/Nutrisphere. The UAN/Nutrisphere produced the highest yields at the 120 lb/a N rate. The next study evaluated a starter fertilizer with and without the polymer Avail for Phosphorus. This study was continued from 2007. The two year averages for this study show that the starter Phosphorus solution with Avail produced nearly 8 more bu/a of corn in the notill plots and slightly over 3 bu/a in the tilled plots. The final study in this project was soybeans planted after corn that received 2 tons/a of broiler manure in 2005, 2006 and 2007 with different shallow methods for incorporation. There was no real difference in soybean yields between the methods for incorporating the broiler manure but all yields averaged 60.0 bu/a. The check plot that received no manure yielded

40 bu/a. Deer grazed the outside series of plots that were approximately 60 feet from the adjacent woods. The series of soybean plot strips within the experiment only received some or no grazing. Yields were reduced by 23 bu/a in those plots that were grazed by the deer.