On Farm Demonstration with ESN – Environmentally Smart Nitrogen

Kevin Lawson[1], Stewart Runsick[2], Jason Kelley[1] and Trenton L. Roberts[3]

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Introduction

Arkansas had 760,000 acres of corn in 2016. According to the University of Arkansas System, Division of Agriculture Corn Research Verification Program, fertilizer accounted for 36% of the total operating costs at $211.32 per acre averaged over the last five years (2011-2015). The University of Arkansas recommended amount of nitrogen (N) on silt loam soils in Arkansas is 220 units per acre, so nitrogen is a significant amount of that fertilizer cost.

Urea is a common nitrogen choice of Arkansas producers. When applied timely and incorporated properly urea is an efficient source that works well. A problem with urea though includes timely application during prolonged wet periods. Significant nitrogen loss can occur when applied to wet soils. Also at sidedress and pre-tassel, urea that is broadcast applied and laying on the soil surface after application can be physically moved down the rows in heavy rainfall situations.

32% UAN is another source of nitrogen that is used in Arkansas. It is not as commonly used or as widely available as urea but is still a good source of nitrogen. UAN is more stable than urea, so there isn't as great a chance of nitrogen loss, but if the fields are wet from prolonged rain, it can be difficult for producers to apply timely.

A new nitrogen product that is available now is Environmentally Smart Nitrogen or ESN which has a 44% nitrogen content with a polymer coating for slow release. The idea is that all of the crop nitrogen requirement can be applied preplant and as the soil warms up it will start suppling the plant with nitrogen. This would eliminate the worry of nitrogen loss due to wet weather and ensure that nitrogen is available to the plant in a timely manner. Some concerns with ESN is whether there will be enough nitrogen to supply the plant all year and proper application since everything is applied once.

Objective

Compare a preplant application of ESN to producer standards of urea and 32% UAN for nitrogen sources.

In 2016, an on farm demonstration was conducted on a producer's field in northeast Arkansas in Clay County to compare a preplant application of ESN compared to a standard producer practice.

Method

This demonstration was conducted on a producer's field in far northeast Arkansas near Pollard. The field was soil sampled during the fall and results recommended that phosphorus, potassium and sulfur be applied at 21-46-90-24. The total recommended nitrogen rate for the field was 220 units of N/acre. Since the preplant mix supplied 21 units of nitrogen, all of the treatments received an additional 200 units of N to achieve a total N of 220 units N/acre.

Treatments Evaluated:

1) Producers standard practice – 87 pounds (40 units N) of urea preplant incorporated, 50 lbs (23 units N) of urea plus 50 lbs (10.5 units N) of ammonium sulfate sidedress, followed by 36 gallons (126 units N) of 32% UAN applied at V5.

2) 445 pounds (196 units N) of ESN preplant incorporated.

3) 57 gallons (200 units N) sidedress at V5.

Plot size was 70 ft x 1140 ft and were replicated three times.

The ESN in treatment 2 and the urea in treatment 1 were applied after the preplant fertilizer all on March 28, the field was bedded to facilitate furrow irrigation later in the season. The field was planted with DeKalb 67-72GENVT2P at 34,000 seeds/acre on a 30 inch row spacing. The soil was a Falaya silt loam.

The urea plus ammonium sulfate in treatment 1 was custom applied at V4 and was followed by 0.58 inch rain one day later. The 32% UAN in treatment 1 and treatment 3 was applied by the producer at V6. The producer could not apply the 57 gallons in treatment 3 all at once so that treatment was applied in two applications. Plots were harvested on September 6, 2016. The center 16 rows were harvested out of the middle of each plot and weighed using a weigh wagon. Yields were adjusted to 15.5% grain moisture.

Results and Discussion

Each treatment emerged at the same time, plant populations were uniform across the trial, and the field looked the same up until sidedress timing (V5). After the sidedress 32% UAN was applied to treatments 1 and 3 (V6), there was a visual difference with the ESN treatment being noticeably smaller. Treatments 1 and 3 started rapid growth while treatment 2 seemed to be delayed and never did catch up to the other treatments. Visually at harvest, the ESN treatment was 10 to 12 inches shorter than the other two treatments.

Table 1 gives a summary of the results. Treatment 1 and 3 were similar in yield in each replication while ESN treated plots were noticeable lower yielding.

Table 2 shows the average yield of each treatment with no differences of treatment 1 and 3 with yields of 224 and 225 bu/acre. ESN treated plots had a lower yield at 211 bu/acre. Treatment 1 had the highest "variability" of all the treatments, which also had the greatest number of applications- spread out over different times. Treatment 3 had the lowest variability, with basically a small amount of N preplant and the season total N rate applied in 1 application at sidedress. This information is similar to other results from University of Arkansas research. By putting the majority of the nitrogen out in 1 application at sidedress (right before the plant really needs large amounts of N- treatment 3) the lowest yield variability is seen. When the nitrogen is put out in multiple applications and more early in the season (treatment 2) there is more potential for nitrogen loss and higher variability in yield.

Table 3 gives an economic summary of this demonstration. The fertilizer cost listed in table 3 is just the cost of each treatment, the preplant fertilizer mix of 21-46-90-24 is not included in this cost. Treatment 2 had the highest fertilizer cost at $93.50 per acre. One advantage to using ESN is that it only requires one application. The custom application cost was $6.50 an acre making the total cost of treatment 2 $100.00 an acre. Treatment 3 had the lowest fertilizer cost at $78.50 and the producer applied the 32% UAN. According to University of Arkansas economic budgets, it costs a producer $9.30 an acre to apply 32% UAN and at two applications it cost $18.60 to apply the 32% UAN. This brings the total treatment 3 cost to $97.10 which also makes it the lowest total cost. Treatment 1 had a similar fertilizer cost to treatment 3 at $80.50, but with two custom applications at $6.50 and one producer application of 32% UAN at $9.30 it had the highest application costs at $22.30. Total cost for treatment 1 was $102.80 which made it the highest cost. After all treatment costs are accounted for there was only a $5.00 difference in final total cost. Income was figured at $4.00 a bushel. After subtracting total cost, treatments 1 and 3 were not significantly different but both of those treatments were different than treatment 2. Treatment 2 had an approximate 14 bushel per acre yield difference, that is a difference of about $56 an acre in income. Each treatment was close enough in cost, that the major difference between final income comes from the lower yield of treatment 2.

Acknowledgments

The authors would like to thank Mr. Keith Woolverton and Mr. Drew Woolverton for donating their time, labor, equipment and land. Also we would like to thank MFA AgriServices MidSouth and Steve McChristian for taking time to apply the different treatments.

Table 1. Moisture, Test Weight and Adjusted Yield of each Replication

Treatment	Replication	Moisture	Test Weight Lbs/bu	Adjusted Yield[1] Bu/ac
1	1	16.1%	58.4	224.9
2	1	16.0%	59.1	208.4
3	1	16.1%	59.9	224.0
2	2	15.7%	59.7	209.9
1	2	16.2%	59.6	218.9
3	2	16.1%	57.7	224.5
2	3	15.6%	59.5	213.4
3	3	15.6%	59.5	225.2
1	3	16.0%	59.4	227.8

[1]Yield is adjusted to 15.5% moisture

Table 2. Average Yields of Treatments

Treatment	Average Adjusted Yield[1] Bu/ac	Std Dev
1	223.8 a	4.5
2	210.5 b	2.6
3	224.6 a	0.6

[1]Yield is adjusted to 15.5% moisture

Table 3. Economic Summary of Treatments

Treatment	Fertilizer Cost[1]	Application Cost	Total Cost	Income[2]	Income minus Total Cost
1	$80.50	$22.30	$102.80	$895.60	$792.80 a
2	$93.50	$6.50	$100.00	$842.00	$742.00 b
3	$78.50	$18.60	$97.10	$898.40	$801.30 a

[1]Fertilizer Cost does not include preplant mix.
[2]Income is figured at $4.00 per bushel.

1 University of Arkansas System, Division of Agriculture, Little Rock, AR
2 University of Arkansas System, Division of Agriculture, Corning, AR
3 University of Arkansas System, Division of Agriculture, Fayetteville, AR