2021 REPORT

North Carolina Arclin Wheat, Corn, and Soybean Trials 2021

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Wheat Trial

Materials and Methods

Study Design

A study was conducted to compare the use of NitroGain® 28% applied at GS 23 (tiller development) and/or GS 30 (jointing) with other nitrogen sources applied at those same growth stages on wheat yield. This test was conducted in 2021 on the Tidewater Research Station near Plymouth, NC on a Cape Fear silt loam. The experimental design was a randomized complete block with two replications with treatments consisting of different N sources applied at different N rates at either GS 23 or GS 30 (or at both stages). DynaGro '9811' was drilled using conventional tillage practices in eight 6.67 inch rows in plots that were 30 ft long by 7 ft wide at a seeding rate of 22 seeds ft^{-2} on 18 November 2020. GS 23 treatments were applied on 16 Feb, 2021 and GS 30 treatments were applied on 22 March as shown below. Harmony extra was also applied on 16 Feb (0.5 oz $acre^{-1}$) to control winter annual broadleaf weeds. Excellent season-long weed control was noted as a result of this herbicide application.

Treatments were applied as follows:

1. 30% UAN 128 lb N $acre^{-1}$ Split Application
    a. 64 lb N $acre^{-1}$ applied at GS23
    b. 64 lb N $acre^{-1}$ applied at GS30

2. ESN 128 lb N $acre^{-1}$ applied at GS23

3. 28% NitroGain 128 lb N $acre^{-1}$ Split Application
    a. 64 lb N $acre^{-1}$ applied at GS23
    b. 64 lb N $acre^{-1}$ applied at GS30

4. 30% UAN 128 lb N $acre^{-1}$ applied at GS30

5. 28% NitroGain 112 lb N $acre^{-1}$ applied at GS30

6. ESN 112 lb N $acre^{-1}$ applied at GS30

7. 30% UAN 112 lb N $acre^{-1}$ applied at GS30

8. Check – No N applied

Liquid materials were applied using a boom with flat fan nozzles on 18-inch spacings. ESN was weighed for each plot according to the amount specified and hand applied.

Measurements
Each plot was harvested on 16 June using a Winterstieger plot combine with a HarvestMaster^{tm} H2 classic grain gauge that recorded grain weight, moisture, and test weight.

Statistical Analysis
For each measurement (moisture, test weight, and yield) statistical analysis was performed using a randomized complete block design with treatment as the main plot. When significant differences were determined at a probability level of 0.05 then comparisons were made among the individual treatments using individual contrast statements.

Results

Impact of Treatments on Grain Yield
Wet conditions in December through February limited early tillering resulting in thin stands in many of the treatments where N was lost due to denitrification. There were no significant differences among the treatments for moisture or test weight but there were significant differences in grain yield (Table 1). When N was applied at GS23 either as a single treatment as was the case with ESN (Treatment 2) or in split applications only the 28% NitroGain split treatment (Treatment 3) resulted in grain yield that was significantly greater than the untreated check. 28% NitroGain applied in a split application was not statistically different from the grower standard (Treatment 4 where 30% UAN was applied at 128 lbs N acre^{-1} at GS30), 28% NitroGain applied at 112 lbs N acre^{-1} at GS30, and ESN applied at 112 lbs N acre^{-1} at GS30. The treatment with the greatest yield was 28% NitroGain applied at 112 lbs N acre^{-1} at GS30.

Summary
The environmental conditions in the late winter and spring of 2021 resulted in excessively wet conditions and N losses due to denitrification. 28% NitroGain reduced N losses resulting in greater yield whether applied in a split application or in a single application of a lower rate (when compared to the grower standard) at GS30. This study confirms the capabilities of NitroGain to prevent N losses and improve N use efficiency.

Table 1. Grain yield, moisture, and test weight averaged over four replications of seven different fertility treatments.

Treatment	Moist	Test Weight	Yield
	-- % --	-- lb bu^{-1} -	-- bu $acre^{-1}$ -
1. 30% UAN Split @ 128 lbs N $acre^{-1}$	13.5	55.5	23.6 b
2. ESN GS23 @ 128 lbs N $acre^{-1}$	14.0	55.5	25.7 b
3. 28% NitroGain Split @ 128 lbs N $acre^{-1}$	13.6	55.2	41.0 a
4. 30% UAN GS30 @ 128 lbs N $acre^{-1}$	13.2	55.4	43.1 a
5. 28% NitroGain GS30 @ 112 lbs N $acre^{-1}$	13.4	55.5	47.8 a
6. ESN GS30 @ 112 lbs N $acre^{-1}$	13.7	55.7	47.1 a
7. 30% UAN GS30 @ 112 lbs N $acre^{-1}$	13.7	55.6	21.7 b
8. Check – No N	13.7	55.3	11.9 b
LSD ($p < 0.05$)	ns	ns	14.91

Corn Trial

Materials and Methods

Study Design

A study was conducted to compare the use of 30% NitroGain with other nitrogen sources for providing N fertilizer to corn. This test was conducted in 2021 on a farm near Roper, NC on a Pettigrew muck. The experimental design was a randomized complete block with four replications with treatments consisting of different N sources applied at V6 at two different N rates. Augusta '4959' was seeded using conventional tillage practices in four 30 inch rows in plots that were 40 ft long by 10 ft wide at a seeding rate of 34 000 seeds $acre^{-1}$ on 27 April. In addition to the N fertilizer treatments listed below 30% UAN was broadcast applied at a rate of 20 gal $acre^{-1}$ (64 lbs N $acre^{-1}$) just prior to planting. Acetachlor plus atrazine (2 qt $acre^{-1}$) was applied at planting and Steadfast Q (1.5 oz $acre^{-1}$) with atrazine (1 qt $acre^{-1}$) and Status (2.5 oz $acre^{-1}$) was applied at layby (9 June) using drop nozzles to control weeds. Excellent season-long weed control was noted as a result of these herbicide applications.

Treatments were applied as follows:

1. 30% NitroGain @ 15 gal $acre^{-1}$ applied in a 2 x 2 band at planting
    a. 30% UAN applied at V6 at 35 gal $acre^{-1}$

2. Starter – 17-17-0 @ 10 gal $acre^{-1}$ applied in a 2 x 2 band at planting
    a. 30% UAN applied at V6 at 35 gal $acre^{-1}$

3. 30% NitroGain @ 15 gal acre^{-1} + biological products @ 12.8 fl oz acre^{-1} applied in-furrow at planting
    a. 30% UAN applied at V6 at 35 gal acre^{-1}

4. Urea @ 315 lb acre^{-1} applied at V6

5. 30% UAN @ 44 gal acre^{-1} applied at V6

6. 30% NitroGain @50 gal acre^{-1} applied at V6

7. Check – 30% UAN @ 35 gal acre^{-1} applied at V6

Planting treatments were applied in a 2 x 2 band or in-furrow using different orifices and pressures calibrated for the materials to be applied at the correct rates. Liquid materials were applied at V6 using drop nozzles that broadcast the material on the surface of the soil. Urea was weighed for each plot according to the amount specified and then hand broadcast over the plot.

Measurements
The center two rows of each plot were harvested on 16 Sept using a Kincaid 8XP Combine with a HarvestMaster^{tm} H2 high capacity grain gauge that recorded grain weight, moisture, and test weight.

Statistical Analysis
For each measurement (moisture, test weight, and yield) statistical analysis was performed using a randomized complete block design with treatment as the main plot. When significant differences were determined at a probability level of 0.05 then comparisons were made among the individual treatments using individual contrast statements.

Results

Impact of Treatments on Grain Yield
No significant differences were found in moisture, test weight and grain yield (Table 2). 30% NitroGain applied at V6 produced the greatest yield (227 bu acre^{-1}) with the 30% NitroGain plus biological products applied in-furrow at planting close behind at 222.1 bu acre^{-1}. Within each category of total amount of N applied the NitroGain treatments performed better than any other N source (Figure 1).

Summary
This site had a highly productive muck soil where chicken litter had been applied in 2020. Even the Check treatment with a standard N source and rate produced over 200 bu acre^{-1}. While no

significant differences were found among the treatments the 30% NitroGain treatments produced numerically greater yield compared to the other sources of N.

Table 2. Grain yield, moisture, and test weight averaged over four replications of seven different fertility treatments.

Treatment	Moist	Test Weight	Yield
	-- % --	-- lb bu^{-1} -	-- bu $acre^{-1}$ -
1. 30% NitroGain @ 15 gal $acre^{-1}$ (2 x 2)	16.8	61.0	214.2
2. 17-17-0 @ 10 gal $acre^{-1}$ (2 x 2)	16.8	60.8	208.4
3. 30% NitroGain + biological products (In-furrow)	15.0	58.7	222.1
4. Urea @315 lb $acre^{-1}$ (V6)	17.5	61.5	218.5
5. 30% UAN @ 44 gal $acre^{-1}$ (V6)	17.4	61.3	219.7
6. 30% NitroGain @ 50 gal $acre^{-1}$ (V6)	17.2	60.1	227.0
7. Check – 30% UAN @ 35 gal $acre^{-1}$ (V6)	16.5	60.7	210.3
LSD ($p < 0.05$)	ns	ns	ns

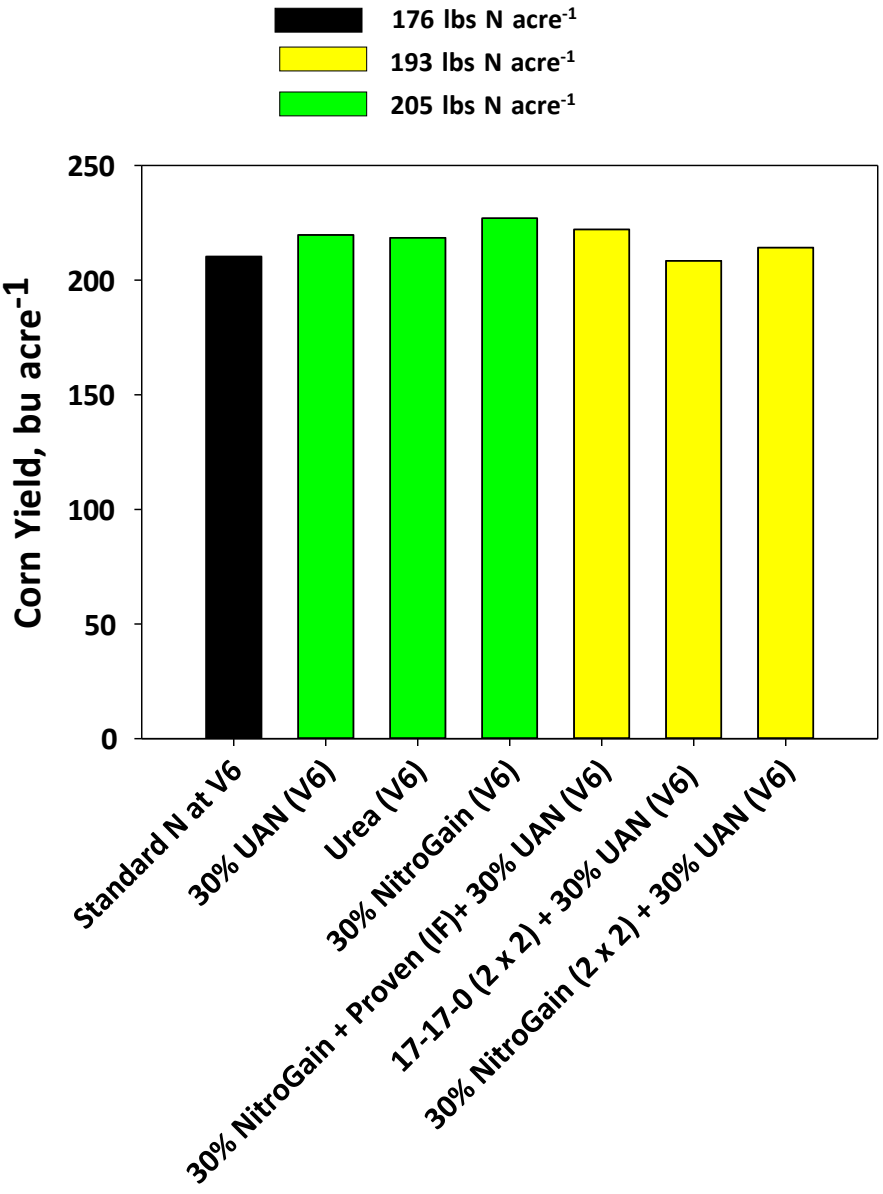

Figure 1. Grain yield from the seven treatments classified by the total amount of N applied to the treatments.

Soybean Trial

Materials and Methods

Study Design

A study was conducted to determine if nitrogen from different N sources applied at planting or R3 could increase soybean yield. This test was conducted in 2021 on the Tidewater Research Station near Plymouth, NC on a Cape Fear silt loam. The experimental design was a randomized complete block with four replications with treatments consisting of 30% NitroGain applied in-furrow or in a 2 x 2 band at planting, 10-34-0 applied in-furrow at planting, and ESN, AMS, and 30% NitroGain applied at R3. Asgrow 'AG52X9' soybean was seeded using conventional tillage practices in four 30 inch rows in plots that were 40 ft long by 10 ft wide at a seeding rate of 120 000 seeds acre^{-1} on 11 May. Prefix (2 qt acre^{-1}) and Roundup (16 fl oz acre^{-1}) were applied at planting and Roundup (32 fl oz acre^{-1} was applied at layby to control weeds. Excellent season-long weed control was noted as a result of these herbicide applications.

Treatments were applied as follows:

1. 30% NitroGain @ 5 gal acre^{-1} applied in-furrow
2. Check – No added nitrogen
3. 30% NitroGain @ 10 gal acre^{-1} applied in a 2 x 2 band
4. 10-34-0 @ 1 gal acre^{-1} applied in-furrow
5. ESN @ 100 lbs acre^{-1} applied at R3
6. AMS @ 200 lbs acre^{-1} applied at R3
7. 30% NitroGain @ 15 gal acre^{-1} applied at R3

Planting treatments were applied in a 2 x 2 band or in-furrow using different orifices and pressures calibrated for the materials to be applied at the correct rates. Liquid 30% NitroGain was applied at R3 using flat fan nozzles on 18-inch centers that broadcast the material over the foliage. AMS and ESN were weighed for each plot according to the amount specified and then hand broadcast over the plot.

Measurements

The center two rows of each plot were harvested on 27 Oct using a Kincaid 8XP Combine with a HarvestMaster^{tm} H2 high capacity grain gauge that recorded grain weight, moisture, and test weight.

Statistical Analysis

For each measurement (moisture, test weight, and yield) statistical analysis was performed using a randomized complete block design with treatment as the main plot. When significant differences were determined at a probability level of 0.05 then comparisons were made among the individual treatments using individual contrast statements.

Results

Impact of Treatments on Grain Yield

There were significant differences in grain yield and test weight but not in grain moisture (Table 3). While significantly different there were no clear patterns to the differences in test weight. In general R3 treatments with AMS and 30% NitroGain had lower test weight compared to planting treatments of 30% NitroGain and 10-34-0, as well as the R3 treatment of AMS. However, none of these treatments differed significantly from the untreated check. There were interesting differences in soybean yield. Several treatments stand out in this study. 30% NitroGain applied in-furrow at 5 gal acre^{-1} produced significantly more soybean yield (8.3 bu acre^{-1}) compared to the check. While not significantly different, 30% NitroGain applied in a 2 x 2 band at 10 gal acre-1 and 10-34-0 applied at 1 gal acre^{-1} also produced 4.7 and 4.8 more soybeans per acre when compared to the check. The other interesting treatment was the use of ESN at R3 which resulted in 5.7 more soybeans per acre compared to the check. This was a significantly greater yield.

Summary

Nitrogen added at planting in the form of 30% NitroGain and ESN applied at R3 significantly increased soybean yield compared to the untreated check. This study indicates that adding some N at planting can improve soybean yield.

Table 3. Yield, moisture, and test weight averaged over four replications of three different fertility treatments and an untreated check.

Treatment	Moist	Test Weight	Yield
	-- % --	-- lb bu^{-1} -	-- bu acre^{-1} -
1. 30% NitroGain @ 5 gal acre^{-1} (IF)	16.2	58.8 ab	49.3 a
2. Check – No added nitrogen	15.7	59.1ab	41.0 c
3. 30% NitroGain @ 10 gal acre^{-1} (2 x 2)	15.5	59.3 a	45.7 abc
4. 10-34-0 @ 1 gal acre^{-1} (IF)	16.1	59.5 a	45.8 abc
5. ESN @ 100 lbs acre^{-1} (R3)	15.9	59.4 a	46.7 ab
6. AMS @ 200 lbs acre^{-1} (R3)	15.0	58.2 b	40.8 c
7. 30% NitroGain @ 15 gal acre^{-1} (R3)	15.1	58.3 b	42.4 bc
LSD ($p < 0.05$)	ns	0.98	5.35