Effects of Various Nitrogen Treatments on Late Planted Soybeans

Principal Investigators:

Griffin Mobley, University of Kentucky, College of Agriculture, Food, and Environment, Department of Plant and Soil Sciences, e-mail: gtmo225@uky.edu

Chad Lee PhD, University of Kentucky, College of Agriculture, Food, and Environment, Department of Plant and Soil Sciences, e-mail: Chad.Lee@uky.edu

Summary

Nitrogen has become adopted by most producers for an effective fertilizer. While soybeans are legumes, and have the ability to fix nitrogen through a relationship with rhizobia bacteria, some varieties now cannot solely rely on this independent process for sufficient nitrogen. This raises many questions, the first being how much nitrogen is the most effective for growth/yield? This is important because you do not want to pay for the costs of applying nitrogen without reaping the benefits of an application. To discover the effects of nitrogen application various forms of nitrogen was applied to soybeans to find the most effective treatment plan. We hypothesize that the most nitrogen will promote the best growth and in turn producing the best yields. While yields have not been recorded and statistically assessed, this report presents the data collected from stand counts, a SPAD meter, and nodule counts to demonstrate differences in growth, nitrogen within the plant, and nitrogen fixation potential as measured by number of root nodules.

Rationale

The objective of this study is to develop the most effective nitrogen treatment plan based on measurements taken during different growth stages, as well as yield. The objectives are to find which nitrogen application results in the best yield. With this info, the most cost effective management practices to produce the most yield can be implemented by producers.

Methodology

This study was planted on June 20, 2018 with Xtend low maturity soybeans (AG38X6) in no-till soil on Spindletop Farm: Lexington, KY. The cover crop for the plot was volunteer rye that had been destroyed by a storm. The rotation from the previous season was corn. Each plot was planted with a Wintersteiger no-till planter with 15 inch row spacing. Eight total treatments were applied in 4 replications and are as follows:

1. Check: no nitrogen applications
2. In-furrow UAN (32%N), No post emergence application
3. In-Furrow UAN(32%N), 100 lbs. ai/a Urea (46% N)
4. In-furrow UAN(32%N), 21 lbs. ai/a AMS (21% N), 79 lbs. ai/a Urea (46% N)
5. In-furrow UAN (32%N), 21 lbs. ai/a AMS (21% N), 79 lbs. ai/a Urea (46% N), 100 lbs. ai/a Urea (46% N)
6. No In-furrow, 21 lbs. ai/a AMS (21% N), 79 lbs. ai/a Urea (46% N)
7. No In-furrow, 100 lbs. ai/a Urea (46% N)

8.No-In furrow, 21 lbs. ai/a AMS (21% N), 79 lbs. ai/a Urea (46% N), 100 lbs. ai/a Urea (46% N)

*ai/a- active ingredient per acre

* UAN- Urea Ammonium Nitrate

*AMS- Ammonium sulphate

The AMS was always applied with Urea to regulate Sulfur levels and to reach total 100 lbs ai/a of nitrogen. Urea was applied itself, solely making up 100 lbs. ai/a of nitrogen. Both post-emergence treatments were granular, and spread by hand immediately following emergence, while the in-furrow treatment was applied during planting. In order to test these differences in nitrogen application, several tests were done to measure the growth and overall effect of the nitrogen. The first test conducted was a stand count. **Stand counts** were taken using a 10 ft. pole placed randomly in the 3rd row of every plot at V2 growth stage. The number of plants within this 10 ft. line of a row was recorded. These numbers are used to predict yield potential and give an idea of if the AMS had any effect on early growth. Another test done was using a **Soil-Plant Analyses Development (SPAD)** which measures the leaf chlorophyll concentration, and can detect differences in nitrogen levels otherwise unseen. This meter is used by clamping down onto a leaf and it gives the reading. This was done to 10 plants in each plot at V2, and the average was recorded. **Nodule counts** were taken at V7. These were done by digging up 5 plants per plot and counting the nodules and taking a plot average. The nodules form on soybean roots and are where the soybean fixes nitrogen gas into a form able to be utilized by the plant. Nodules actively fixing nitrogen have a pink color inside, while inactive nodules are brown or white. This is based on the need for the beans to fix their own nitrogen due to the amount of residual nitrogen in the soil. From these results we can see which treatment was the most effective in getting nitrogen into the soil thus smaller and/or less nodules should be the result.

A.)

B.)

Figure 1*. A.) Urea and AMS application at V1. B.) Urea application at V1.*

Results and Discussion

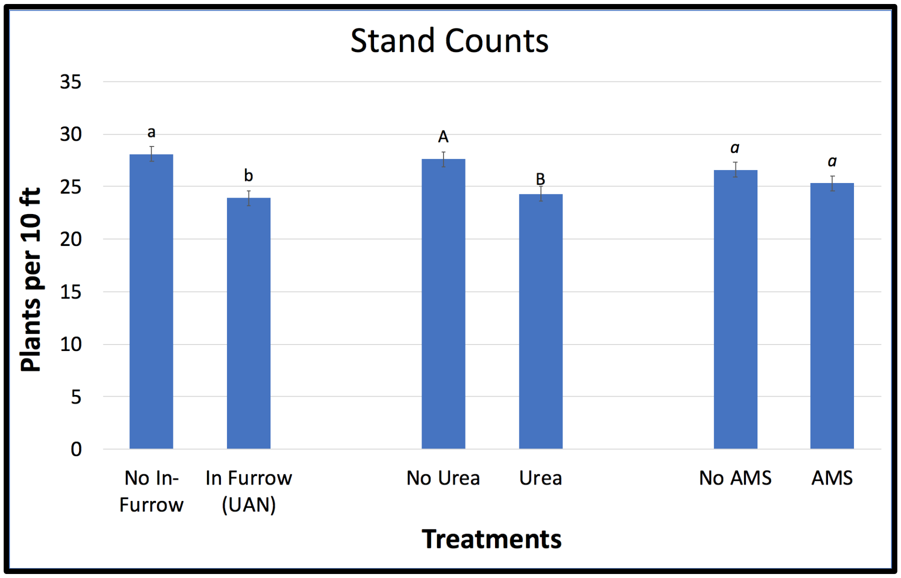

Figure 2. *In-furrow (UAN), urea and AMS effects on soybean stand counts. Means overtopped by different letters are significantly different (LSD = 0.05).*

In figure two, the bars representing the plots with the UAN in-furrow treatment compared the ones without the treatment shows the in-furrow treatment significantly decreased the stand count. Hedges explains why this may be, "Placing fertilizer in-furrow increases salt concentration around the seed, if salt concentration is excessive the seed is unable to germinate" (Hedges 2012). Urea also significantly decreased the stand, while AMS had no significant effect.

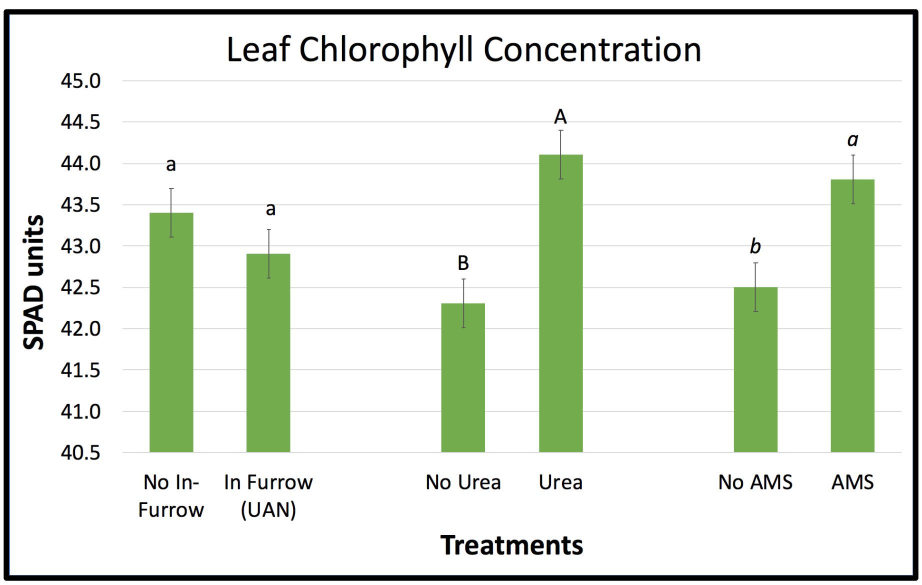

Figure 3. *In-furrow (UAN), urea and AMS effects on leaf chlorophyll concentration. Means overtopped by different letters are significantly different (LSD = 0.05).*

Figure 3 represents the changes in the leaf chlorophyll concentration, measured by the SPAD meter. Looking at the results, the in-furrow treatment had no significant effect on the leaf chlorophyll concentration. Both Urea and AMS significantly increased the reading, meaning that the plants that were treated with both Urea and AMS have more nitrogen inside their leaves.

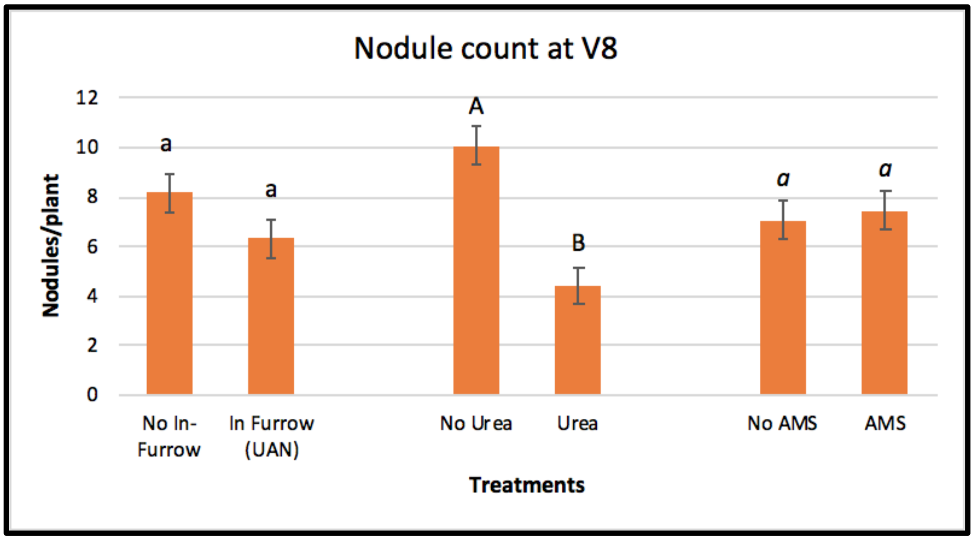

Figure 4. *In-furrow (UAN), urea and AMS effects on number of nodules at V7. Means overtopped by different letters are significantly different (LSD = 0.05).*

After the nodules were counted and averaged, the results were compared within each treatment. The only significant result was that Urea did decrease the avg. number of nodules compared to plots that had no Urea applied. The in-furrow and AMS did not significantly change the number of nodules. This can be seen below in *Figure 5,* showing the difference in nodules on a plant in a no-Urea plot and a Urea plot.

A.)

B.)

Figure 5. *Nodules on a plant treated with no Urea (A.) and a plant that was treated with Urea.(B)*

Significance of Findings

Many things other than these Nitrogen treatments have the capability to change the stand count, but consistently throughout all the reps the in-furrow decreased the stand which is not unusual and can likely be attributed to soil conditions around the time of planting. The SPAD readings suggest that the application of both Urea and AMS increased the nitrogen in the soil enough for the plants in those specific plots to take in the nitrogen. Similar can be said for the nodule counts, as the Urea treated plots had significantly less nodules due to the fact that the beans did not have a need to form them as the nitrogen that would normally be needed to be fixed, was taken up through soil. In turn, when yield is recorded, we expect to see an increase in yield due to the fact that the soybeans have devoted less energy to their own nitrogen fixation and more into production of the beans themselves. This would be good for producers, to have a nitrogen treatment plant that can actually increase yields, but to also know why and how it is doing so.

Implications for Future Work

This report being finished before yield will be able to be recorded and assessed, the most important thing for the future is harvest. It will be pivotal in understanding which nitrogen treatments can be used in the most effective way. This will not only help us to better understand what role nitrogen plays in soybean production, but more importantly give producers a better and more efficient nitrogen application plan.

Acknowledgements

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