EVALUATION OF STARTER NITROGEN FERTILIZER RATES FOR GRAIN SORGHUM PRODUCTION IN THE SOUTHERN GREAT PLAINS

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ABSTRACT

With the continuous increase in fertilizer prices, it's become more evident that management practices need improved to ensure nutrient use efficiency (NUE). This study was conducted to observe the effects of placement and rate of starter nitrogen (N) on sorghum plant growth, and final grain yield. Two sources of N were utilized, liquid UAN (28-0-0), and granular urea (46-0-0) in combination with three rates of N 8, 16, 24 lbs N ac^{-1}, and four-application methods in-furrow, surface dribble, surface, and 2x2 side-dress. It has been documented that at lower rates of N placement could negatively affect crop emergence, while results from this study suggest no correlation.

INTRODUCTION

The unpredictability of Oklahoma's climate Grain sorghum is one of the few crops adapted to such harsh environments, making it the fifth most planted crop in that state covering approximately 305,000 acres planted in 2020. Majority sorghum acres are used for grain production producing approximately 10.35 million bushels, while 195,000 tons of silage are produced (NASS, 2020). Non-uniform stands and uneven early season growth have been shown to significantly reduce grain sorghum yields (Conley et al., 2005).To overcome these issues, the use of starter fertilizer in conjunction with grain sorghum has increased. Starter fertilizer application involve the placement of fertilizer in close proximity to the seed at or near planting (Lofton et al., 2019). Here is where you could briefly discuss the negative effects of starter N placement

MATTERIALS AND METHODS

This experiment was conducted across two locations, Lake Carl Blackwell (LCB) and EFAW (in Stillwater, OK) during the 2020 and 2021 growing season. . The LCB location is irrigated using a T&L linear irrigation system and EFAW is a dry land environment. This study utilizes a Randomized Complete Block Design (RCBD) with 13 treatments replicated 3 times. The planter used is a John Deere Max Emerge 2 vacuum 4-row planter with 30 inch row spacing. The planter has Yetter row cleaners; the seed firmer is a Keeton 2 tube universal seed firmer and Schefert 2x2 and dribble band attachment. The nitrogen source used is UAN-28. The UAN application is driven by CO_2 and controlled by electronic solenoids. Insect boxes were converted to handle dry fertilizer via a 1 inch hose that placed the urea behind the seed firmer and in front of the closing wheels, which exposed some urea to the seed furrow. The Dribble Surface methods were done by planting the plot then picking the planter up off the ground. While the planter is picked up reverse to the start of the plot, keep the planter raised about 6-10 inches off the ground engage the UAN dribble surface option and drive forward at the specified rate to get the correct amount of nitrogen placed. All other fertilization methods are done as planting while planting the plot. Stand counts were done by counting every emerged sorghum plant in the middle two rows in every treatment plot. Treatments are in table 1 also included is nitrogen rate, source and method of application. All statistical analysis was preformed using SAS 9.4.

Treatment	N Rate (lbs N^{-1})	Source	Method
1	0	----	----
2	8	UAN	With Seed
3	16	UAN	With Seed
4	24	UAN	With Seed
5	8	UAN	Dribble Surface
6	16	UAN	Dribble Surface
7	24	UAN	Dribble Surface
8	8	UREA	Dry Surface
9	16	UREA	Dry Surface
10	24	UREA	Dry Surface
11	8	UAN	2x2
12	16	UAN	2x2
13	24	UAN	2x2

Table 1*. List of treatments from* evaluation of *starter nitrogen rates and placement study in grain sorghum in central Oklahoma*

RESULTS AND DISCUSSION

For the growing season of 2020 there was no stand count data was collected. In 2021, stand counts were collected at both locations, the EFAW location averaged one plant $foot^{-1}$ and the LCB location averaged two plants ft^{-1}. At the designated planting population of 35,284 plants ac^{-1}, there is an expected four plants ft^{-1}. The check plots for EFAW averaged one plant $foot^{-1}$ and the checks from LCB averaged two plants $foot^{-1}$. In 2021 at both locations, stand count had no significant impact on grain sorghum yield. There was also no significant impact of application method, nitrogen rate, or an interaction of method and nitrogen rate at any site year. There was also no significant impact of method, rate and site year on the yield of grain sorghum. There are a few potential reasons on why there was nothing reported statistically. One reason is that the nitrogen rates were not at a level to cause significant salt damage that would limit emergence. The nitrogen application rates were not high enough to produce a significant difference in yield. There is the possibility that the closing wheels on the planter did not close the furrow for good soil seed contact for proper germination, which resulted in universal stand counts below expectation.

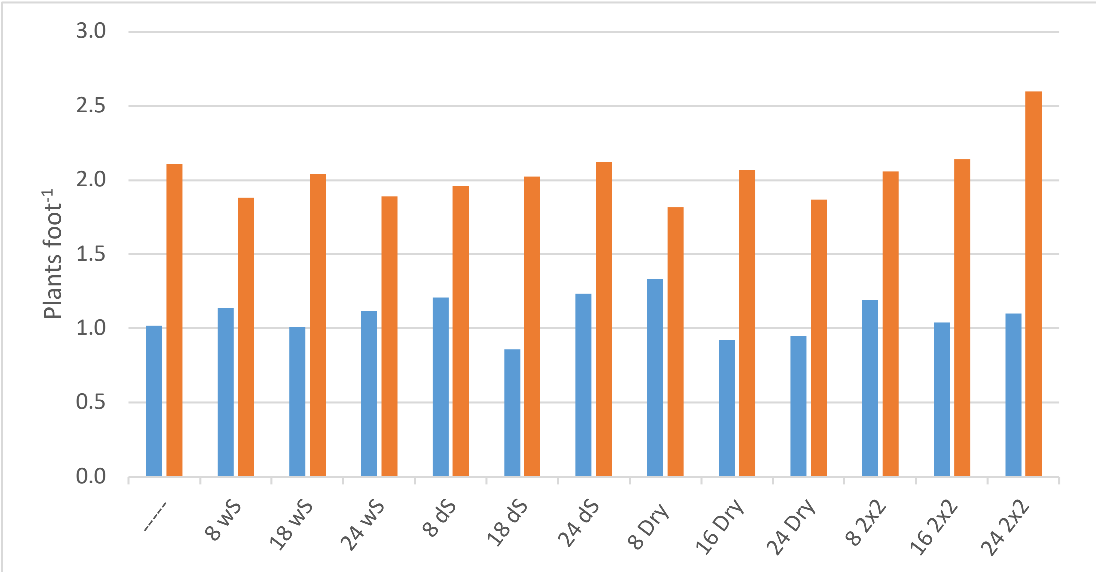

Figure 1. *2021 stand counts from evaluation of starter nitrogen rates and placement study EFAW (blue bar) and Lake Carl Blackwell (orange bar). Data only collected from only counting middle two rows of each plot.*

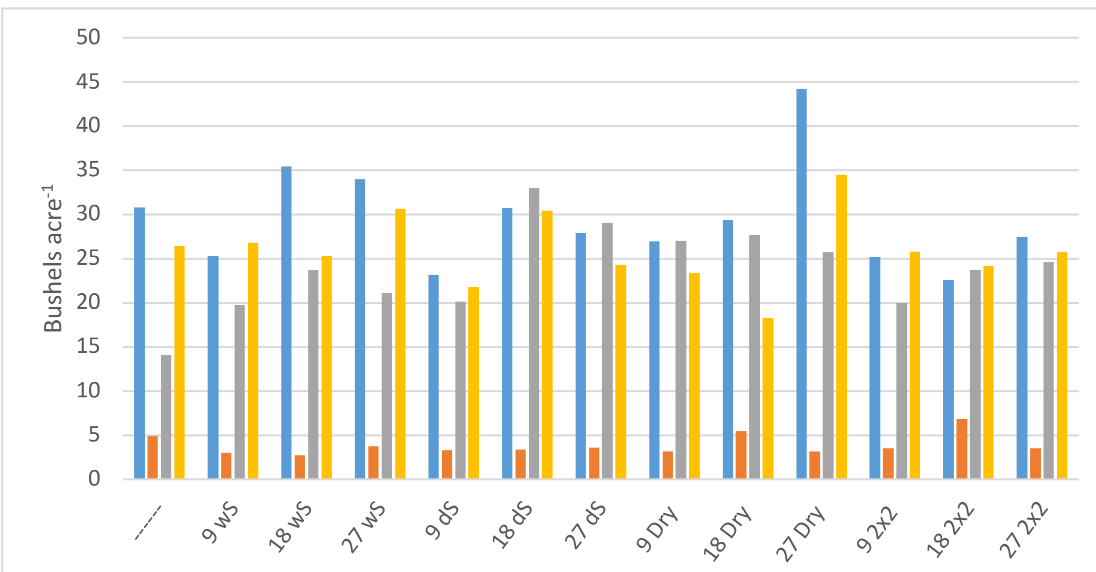

Figure 2. *2020 and 2021 grain sorghum yield from evaluation of starter nitrogen rates and placement study from Lake Carl Blackwell 20 (blue bar), EFAW 20 (orange bar), EFAW 21 (gray bar), and Lake Carl Blackwell 21 (yellow bar), wS (with seed), dS (dry surface), dry (dry surface)*

REFERENCES

Lofton, J., Arnall, D.B., Sharma, S. and Nisly, C. (2019), Evaluating Starter Fertilizer Applications in Grain Sorghum Production. Agrosystems, Geosciences & Environment, 2: 1-6 190004. https://doi.org/10.2134/age2019.01.0004

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