Result Demonstration Report

Slow N (Dicyandiamide) – Nitrification Inhibitor Result Demonstration

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Summary:

Fertilizer is the largest single input cost on a per-acre basis for grain sorghum production in Fort Bend County. Ammonia (NH_4), found in many types of fertilizer, is converted to nitrate (NO_3) by bacteria in soil soon after application. Loss of NO_3-N from soil can occur due to denitrification (microbial conversion to nitrous oxide), leaching and surface runoff. Nitrogen losses from soil directly affect nitrogen use efficiency and could impact crop yield and profits. Dicyandiamide ($C_2H_4N_4$) is a chemical known to be a nitrification inhibitor. It limits uptake and utilization of ammonia by soil bacteria. The product can be mixed with liquid fertilizer with the goal of slowing conversion of ammonia to nitrate to reduce nitrogen loss from soil, increasing nitrogen availability to plants.

Objective:

The objective of this applied research plot was to evaluate the impact of Slow N (Dicyandiamide) as determined by levels of NO3-N in soil, grain sorghum leaf color, and grain yield.

Materials and Methods:

Grain sorghum (Dekalb 53-67) was planted on April 2, 2015. The plots were arranged as a paired t-test, with 12-row plots (40" spacing) and four replications. Treatments were urea ammonium nitrate (UAN 30-0-0-2S + zinc) applied at 130 lbs N/ acre (433 lb/acre) with and without Slow N (dicyandiamide) mixed at 12 lbs/ton. Although four replications were installed, only the three reps were used in the experiment. On May 5, 12-15 soil core samples (6" deep) were taken in each plot and analyzed for extractable NO_3-N. The middle six rows of each plot were sampled randomly to a distance of approximately 500' into the field from the south turn row. The cores were taken 4-6" to the furrow side of the applied fertilizer band. Leaf chlorophyll content was estimated using an atLeaf+ chlorophyll meter on May 7. The uppermost-expanded leaf was measured on 10 leaves, with one measurement each in rows 4 and 9, and two measurements each in rows 5, 6, 7, and 8. Grain yield was measured by hand harvesting 15 ft of row from 2 rows and mechanical threshing using a plot combine. A t-test was used to compare soil nitrate levels, leaf chlorophyll content and grain yield of dicyandiamide treated and non-treated plots.

Results and Discussion:

There was no difference in soil nitrate (p= 1), leaf chlorophyll (p= 0.9414), or yield (p= 0.4038) between samples taken in plots with or without dicyandiamide added to soil applied fertilizer. Mean

soil nitrate levels were 14 ppm for both treated and non-treated plots at time of treatment application. Leaf chlorophyll content was 49.7 and 49.6 for treated and non-treated plots. Yield data can be found in Table 1.

Table 1: Yield data for treated and non-treated plots

Treatment	Yield (lb/acre)	Leaf Chlorophyll	Soil NO_3 ppm
Slow N	4610	49.6	14
non-treated	4486	49.7	14
Sig. (Pr>t)	N.S.	N.S.	N.S.

Yield adjusted to 14 % moisture.
N.S. = not significantly different at Pr=0.05 level.

Conclusions:

Slow N (dicyandiamide) applied with liquid fertilizer at planting did not affect plant chlorophyll content at pre-boot stage or grain yield. Soil NO_3-N levels 33 days after application did not differ across treatments. Additionally, differences in form or concentration of soil N that may or may not have existed were not sufficient to affect grain yield.

Environmental conditions were present that could result in excessive nitrogen loss from soil due to leaching, denitrification and runoff. Rainfall measured at the site was 33.28 inches from January 1 through May 29, 15.52 inches above normal. Soil nitrogen concentrations and transformations were not measured throughout the growing season but conditions were ideal for such transformations and losses to occur. Yet, no yield differences were observed. It is uncertain to what degree Slow N affected nitrogen processes in soil but without significant yield increases, the potential for economic return is limited.

References

Kim, D.G., D. Giltrap, S. Saggar , T. Palmada , P. Berben, D. Drysdale. 2012. Fate of the nitrification inhibitor dicyandiamide (DCD) sprayed on a grazed pasture: effect of rate and time of application. *Soil Research*, 50:4, p. 337-347.

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