DO NITROGEN AND CALCIUM PLAY NICE IN COTTON

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Abstract

Nitrogen (N) is required in the largest amount by most all plants (Marschner, 2012). Plant available N in the soil is limited and can be lost easily due to environmental conditions (IPNI, n.d.). Subsurface drip irrigation (SDI) can be used to improve management and use efficiency of fertilizers. When fertilizers are applied with SDI, they are placed in the seed furrow potentially increasing plant uptake and use efficiency. Fertigation is beneficial for N application due to it being needed at different points in the growing season (Haynes 1985). Calcium (Ca) affects pH, nitrate (NO_3) uptake, and interacts with other nutrients. Millikan et al. (1969) observed that the growth of NO_3^- fertilized plants was less under low Ca, most likely due to a decrease of Ca uptake by the plant. Leidi et al. (1991) determined that the type of N affected the levels of Ca in plant parts. Calcium in the leaves, stems and roots was lower in the ammonium (NH_4^+) fertilized plants than in the NO_3^- fertilized plants (Leidi et al., 1991). In this experiment agronomic nitrogen use efficiency (ANUE) and lint yields were determined in Lubbock, TX at the Texas A&M AgriLife Research Center in 2019 and 2020. The main objective of this research was to evaluate the interaction between N and Ca fertilizer sources and rates applied using fertigation on cotton lint yield and ANUE. Urea-ammonium nitrate (UAN32), calcium ammonium nitrate (CAN17) and 6-0-6-3.1 Ca-4 S were applied pre-plant in 2019 at different rates which included 0, 45, 90, and 180 lb. N ac^{-1}. Urea ammonium nitrate, calcium nitrate (CN9) and CANMIX were applied pre-plant in 2020 at different rates which included:

1) 0 lb N ac^{-1} (Check);
2) 135 lb N ac^{-1} (UAN32);
3) 50 + 85 lb N ac^{-1} (CN9 + UAN32);
4) 75 + 60 lb N ac^{-1} (CN9 + UAN32);
5) 50 + 85 lb N ac^{-1} (CN9 + UAN32 + CANMIX); and,
6) 75 + 60 lb N ac^{-1} (CN9 + UAN32 + CANMIX).

Soil pH was approximately 8.0 in both years. Soil nitrate-N (NO_3^--N) in 2019 ranged from 22.5 ppm at the shallowest depth (0-6") to 27.0 ppm at the deepest depth (12-24"), and in 2020 soil NO_3^--N ranged from 19.2 ppm at the shallowest depth (0-6") to 65.6 ppm at the deepest depth (12-24"). Soil Ca in 2019 ranged from 2544 ppm at the shallowest depth (0-6") to 2662 ppm at the deepest depth (12-24"), and in 2020 soil Ca ranged from 1869 ppm from the shallowest depth (0-6") to 5625 ppm at the deepest depth (12-24"). The greater amounts of NO_3^--N and Ca at the deepest depth (12-24") in 2020 was most likely due to the new subsurface drip system that was installed during the off-season. In 2019, N rate affected N and Ca concentrations in the leaves. Leaf tissue N content increased as the fertilizer rate increased. The 45 and 180 lb. N ac^{-1} fertilizer rates increased the Ca content in the leaf tissue compared to the check. Pearson's correlation was used to determine a relationship between lint yield and leaf tissue nutrients. Nitrogen and yield had a positive relationship. Calcium had a positive relationship with N and magnesium (Mg) and a negative relationship with phosphorus (P) and potassium (K). The fertilizers 6-0-6 and UAN32 exhibited a parabola pattern with the 90 lb. N ac^{-1} having the max yield and CAN17 the max yield was 180 lb. N ac^{-1}. Nitrogen use efficiency was affected by source and rate, but not the interaction between them. The N source UAN32 had the greatest ANUE, while the 45 lb. N ac^{-1} rate had the greatest ANUE. Fiber strength had a source by rate interaction. The 6-0-6 fertilizer source, strength decreased as N rate decreased. Fiber strength has been reported to decrease with a decrease in leaf N (Lokhande and Reddy, 2015). The 6-0-6 source increased fiber strength over the other fertilizer sources. The 6-0-6 source has K, which is known to increase fiber strength. In 2020, no other treatment yielded greater than the UAN32 only treatment. The N source UAN had the greatest ANUE compared to the CN9 + UAN (50 + 85 lb. N ac^{-1}) and the CN9 + UAN + CANMIX (75 + 60 lb N ac^{-1}). In 2020, there was an October freeze that caused bolls on the top one-

third of the plant not to open, which negatively effects lint yield. Urea-ammonium nitrate had the greatest lint yield and ANUE during both years. However, we observed that there was a limited interaction between N and Ca, due to high residual soil Ca levels.

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