Program 5C-2

▸ Irrigation, Nitrogen Fertility, And Seeding Rate Effects On Cotton Yield And Fiber Quality

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Not only has the price for cotton remained stagnant relative to the price increases received for other commodities, but the cost for cotton productions inputs has also steadily increased over the past few years. Rising costs have been particularly problematic with petroleum based inputs, such as nitrogen fertilizers and diesel fuel needed to run irrigation pumps. Technology fees for inclusion of desired transgenic traits and costs associated with more elaborate seed treatments bring additional expenses to the planting operation and stand establishment process. Because of these increasing input costs, it is important for producers to understand how to make the most efficient use of any input they incorporate into their production strategies. This research investigated the effectiveness of three rates of nitrogen fertilization under both irrigated and dryland conditions for 4 different seeding rates.

'DPL 1321B2RF' was the cotton variety grown at Stoneville, MS in 2013 and 2014. The experiment was planted on April 16 in 2013 and on April 17 in 2014. Half the plots were furrow-irrigated and half the plots were grown under non-irrigated dryland conditions. All plots received one of three nitrogen fertility treatments (0 lb N acre-1, 50 lb N acre-1, or 100 lb N acre-1). The plots were 15.2 m long and consisted of 4 rows spaced 1-m apart. The four seeding rates utilized in this research were 1 plant ft-1 of row (13,000 plants acre-1), 2 plants ft-1 (26,000 plants acre-1), 3 plants ft-1 (39,000 plants acre-1), and 4 plants ft-1 (52,000 acre-1). The experimental design was a randomized complete block design with a modified split plot treatment arrangement and 6 replicates. The irrigation regimes were the main plots and the split plots were the seeding rates by nitrogen treatments arranged factorially. Dry matter partitioning, canopy light interception, lint yield, yield components, and fiber quality data were collected.

Both the 2013 and 2014 growing seasons started off with cool and damp conditions during planting and stand establishment. The 2013 season then progressed through mild temperatures with only moderate insect pressures throughout the rest of the growing season. Although all the designed treatment factors effected growth and development of the crop, no interactions were observed among any of these factors. The added soil moisture and soil nitrogen level brought about from the irrigation and N fertilization treatments, respectively, produced greater plant stature and biomass. This aspect was reflected in taller plant heights and greater leaf area indexes for plants receiving irrigation or N fertilization. Plants grown at the 4 plants ft-1 seeding rating were taller than the lower seeding rates early in the growing season. However, as the season progressed, this trend reversed itself and the plants grown at the 1 plant ft-1 seeding rate were tallest while plants in the 4 plants ft-1 seeding rate were the shortest.

The 2014 season produced a pattern of regularly occurring precipitation events throughout the growing season, negating any positive effect from the irrigation events for most measured traits. Similar to the 2013 results, the added nitrogen fertilization produced taller plants with more plant biomass than the unfertilized plots in 2014. The growth response to the varying seeding rates was consistent across both growing seasons. No interactions between N and irrigation regimes were observed for any of the growth and development parameters in 2014.

Although nitrogen fertilization produced a yield increase in 2013, the extent of that yield response was dependent upon whether the plots were irrigated or not. The yield differential between the highest nitrogen treatment and the non-fertilized plots under irrigated conditions was almost double that observed under dryland conditions (731 lb acre-1 vs. 475 lb acre-1 difference). Nitrogen also needed to be applied to get an irrigation response. Although irrigation did not produce a yield response when nitrogen was not applied, irrigation increased lint yield production by 23% at the highest nitrogen fertility rate (100 lb N acre-1) compared to that produced under the dryland conditions.

In 2014, irrigation didn't produce a positive yield response due to the abundant precipitation that occurred during the growing season. However, each increment of nitrogen fertilization did produce a yield increase. The interaction between levels of nitrogen fertilization and irrigation regimes observed in 2013 for lint production, was not present during the 2014 growing season.

As the future costs and input availability becomes more challenging for cotton production, producers will have to make difficult decisions as to how best to allocate their input dollars. This research indicates that when water is limited during the growing season (through the lack of precipitation, insufficient irrigation capabilities, or restrictions on the ground or surface water supply or availability for irrigation), then the applied nitrogen fertilizer may not be used as efficiently by the plant to produce yield.