CONTINUED EVALUATION OF NITROGEN MANAGEMENT IN COTTON WITH MEPIQUAT PENTABORATE FOLLOWING CORN PRODUCTION

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Abstract

Several nitrogen management systems have been evaluated with different plant growth regulator (mepiquat pentaborate) systems for the past several years at the Delta Research and Extension Center (DREC) near Stoneville, Mississippi. The research area has been established on very productive Bosket very fine sandy loam (Mollic Hapludalfs) and Dundee silt loam (Typic Endoaqualfs) soil with irrigation. The cotton crop followed corn in a 1:1 cotton/corn rotation with both crops receiving the supplemental irrigation. Pentia™ plant growth regulator (PGR) has been applied during each growing season based on an experimental design that also includes an untreated control. Higher N rates needed for optimum corn production could lead to a buildup of residual N in the soil profile if biological processes do not decrease the pool or plant uptake and removal does not deplete the reserve. Generally, denitrification leads to a decline in the N pool, thus little residual remains after the fall, winter, and spring rains. However, the potential residual N pool along with above recommended levels of fertilizer N could lead to excessive growth in the cotton crop following corn in the rotation. Excess growth can be regulated with PGR applications, reduced fertilizer N rates, or combinations of both. The objectives of these studies were to determine the interaction effects of N management and PGR application in cotton following corn and to evaluate the main effects of N management and PGR where interactions were not significant. Multiple studies have been used in the last eight years to look at N rate, N application timing and, various PGR systems, all of which utilize mepiquat pentaborate (MP) as the plant growth regulator.

The first study used a 4x2x2 factorial combination of N rates (60, 90, 120, and 150 lb/A), N application systems (preplant [PP] and preplant+sidedress [PP+SD]), and MP in the evaluation from 2003 through 2008. Product literature suggested that the PGR resulted in improved boll retention, faster uptake, earlier maturing cotton, and superior height control. In the first study (2003 and 2004), a total of 28 oz/acre MP was applied as a split application with the first application made during early bloom and the remainder applied about two weeks later during peak bloom. For both 2003 and 2004, optimum lint yields were achieved with 120 lb N/acre when yields were averaged across the MP levels (0 or 28 oz/acre). In 2003, MP application had no significant effect on lint yield when N rates were at least 90 lb N/acre. At the lowest N rate (60 lb N/acre), MP application resulted in an 8.1% reduction in lint yield. In 2004, with MP applications initiated at first bloom (FB), lint yields were reduced at all N levels by 6.7 to 10.0% with the greatest reduction occurring at the lowest N level (60 lb N/acre). Additional studies at DREC in 2004 showed similar significant reduction in lint yields with the higher MP rates applied at first bloom. The MP treatments from these studies, initiated at pin-head square (PHS) and at lower application rates, showed positive response compared to the untreated controls. With these results in mind, the MP applications were modified for 2005 and 2006. The initial application (6 to 8 oz/acre) was applied at PHS and a second application (8 oz/acre) applied two to three weeks later, near first bloom. Most of the MP applications occurred before the initial applications were made in the two previous years.

In 2005, harvest was delayed until after the adverse effects of both hurricanes Katrina and Rita and lint yields were reduced compared to 2003. Lint yields ranged from 1082 to 1228 lb /acre with the highest yields achieved at the 150 lb N/acre level. This was the only year of the study where 150 lb N/acre produced significantly higher yields than 120 lb N/acre. With the damage to the crop from the weather, later maturity associated with the higher N level was actually an advantage since less of the crop was mature during the storms. Lint yields increased significantly with respect to MP applications. The increase ranged from 6.1 to 9.2% and was positive at each N level. The greatest responses were observed at the 90 and 120 lb N/acre rates. Lint yields in 2006 were similar to those measured in 2005. However, there was no response to increasing N rates. When averaged across the N management systems, there was a significant increase in lint yields with the application of MP initiated at PHS. The increases ranged from 5.2% to 8.5% with the largest increase at the 120 lb/acre N rate. Defoliation in 2006 occurred prior to the cotton reaching full maturity. This tended to mask the yield potential of later maturing bolls since these bolls were not allowed to mature on their own.

There was no significant difference between N application systems during the first four years of the study. Yields from the 100% PP N treatments were just as effective as sidedress N applications for producing optimum yields. With this in

mind the application systems were modified in 2007 to include a uniform preplant N rate (60 lb N/acre) with the various N rates determined as sidedress applications of 0, 30, 60, and 90 lb N/acre. In subsequent years (2007-2009) there was still no significant difference between this system and the 100% PP system. Cotton yields in 2007 ranged from 1128 to 1416 lb lint/acre with no significant increase above 120 lb N/acre. In 2008, yields ranged from 1214 to 1371 lb lint/acre with the highest significant yield at 120 lb N/acre. These yields represent averages across N application systems and MP levels with no significant interaction. The lint yield response to MP application in 2007 ranged from -1.0% to +9.1% with the greatest response at the highest N rates. The same effect was observed in 2008 with the lint response to MP ranging from -0.1% to +7.2%. In both 2007 and 2008 the response to PGR was greater at the higher N levels (120 and 150 lb N/acre). The 2009 lint yields were much lower than observed in previous years, largely related to extreme insect pressure that was evident all around the area. Lint yields, even at the higher N rates, were less than 750 lb/acre with no advantage to rates above 120 lb N/acre. In 2009, MP applications again resulted in yield declines ranging from -1.6 to -10.1% with the greatest loss at the 60 lb N/acre rate.

In 2010, the research was again shifted to evaluate MP applications across at even higher N rates. The treatments included five N rates (60, 90, 120, 150, and 180 lb N/acre) and three MP systems. The MP system compared 16 oz MP/acre applied in two 8 oz/acre applications or four 4 oz/acre applications beginning with the initial application at PHS. These MP applications were compared to an untreated control. As with previous years, there was no significant yield response above 120 lb N/acre (1515 lb lint/acre). The growing season was extremely hot and dry thus supplemental irrigation was needed to optimize yield. Insect pressure was lower than in previous years and yields much higher. The MP applications produced slightly lower yields (not significant) when two 8 oz/acre applications were made. However, splitting the 8 oz/acre rate into two 4-oz/acre rates reduced yields significantly (4.0%, 60 lb lint/acre) compared to the untreated control

After the first two years of research, it was concluded that application of MP was not successful in increasing lint yields when the initial application was delayed until first bloom or early bloom. However, in 2005 and 2006, where the PGR applications were initiated at PHS, the use of MP at lower application rates did show significant lint yield increases (88 lb lint/acre, 7.9% in 2005; 74 lb lint/acre, 6.6% in 2006; 64 lb lint/acre, 5.0% in 2007; and 41 lb lint/acre, 3.2% in 2008) compared to the untreated control. Throughout the studies, 120 lb N/acre remains the optimum fertilizer recommendation for these soils with split application offering no yield advantage. However, split applications have not resulted in any yield decline and offer the opportunities for more efficient N use. While data has shown significant responses to MP applications, economic considerations should be included in the decision making process. Application and material costs may not be covered by the additional yield. Fruit load continues to be the best plant growth regulator for cotton production.