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EVALUATION OF NITROGEN MANAGEMENT WITH PENTIA GROWTH REGULATOR FOR COTTON FOLLOWING CORN IN ROTATION

M. Wayne Ebelhar, Steve P. Nichols and Davis R. Clark
Mississippi State University
Stoneville, MS

Abstract

Interest in higher nitrogen (N) rates in combination with plant growth regulators continues with a renewed interest also in crop rotations involving corn or grain sorghum and cotton. High N rates required for corn production, relative to cotton production, could lead to a buildup of residual N in the soil profile. This residual N carryover could be exhibited as excess growth in subsequent cotton crops. In order to assess the interaction of N management with plant growth regulation of cotton following corn, 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 a new chemistry plant growth regulator (Pentia™, mepiquat pentaborate) was evaluated in 2003 and 2004 at the Delta Research and Extension Center near Stoneville, MS. Pentia™ product literature indicated that the product resulted in improved boll retention, faster uptake, earlier maturing cotton, superior height control, and superior rain-fastness. The objectives of this study were to determine the interaction effects of N management and mepiquat pentaborate (PGR) on cotton yields in a cotton/corn rotation and evaluate end-of-season plant characteristics with respect to N management and PGR use. A total of 28 oz/acre Pentia was applied as a split application with the first application during early bloom and the remainder about two weeks later during peak bloom.

Total lint yield in 2003 ranged from 1205 to 1683 lb/A with the highest yield observed where 120 lb N/A was applied with no PGR. When averaged across over factors, total lint yields increased with increasing N rates up to 120 lb N/acre with no significant response to an additional 30 lb N/acre. Split application of N (PP+SD) decreased lint yields compared to all N (PP) being applied prior to planting, especially at the lower N rates. There was no significant response to application of PGR when averaged across N rates and application systems. However, at the lower N rate (60 lb N/acre) the use of the PGR reduced lint yields by 110 lb/acre (8.3%) when averaged across the two application systems. In 2004, lint yields averaged 1111, 1212, 1326, and 1372 lb/acre with no significant difference between the top two N rates. For both 2003 and 2004, optimum lint yield was achieved with 120 lb N/acre and that supports the current recommendations for the soils in the study. In 2004, there was no significant difference between N application systems even though June was an unusually wet month. The PGR applications in 2004, initiated at early bloom, significantly reduced lint yields at all N levels. The reduction ranged from 6.7 to 10.0% with the greatest reduction at the lower N rate. In other studies in 2004, where the PGR application was initiated during squaring, the significant yield reductions were not observed.

Plant height and total nodes increased with increasing N rates in both 2003 and 2004 although the two years were different. Plants were slightly shorter in 2004 but did have an average of three more nodes per plant. Mepiquat pentaborate did significantly reduce plant height and the total number of nodes on the plant in both 2003 and 2004. Height:node ratio was also significantly lower each year where PGR was applied. At the time of mapping, nodes above cracked boll (NACB) was used to determine overall effects on maturity. The NACB was not significantly different where the PGR was applied when evaluated at the 5% level of significance. However, the differences were significant at the 10% level in favor of earlier maturity where the PGR was used. Increasing N rates generally tends to delay maturity, and this was evident in both 2003 and 2004 when using NACB data.

Under the conditions of this research, it was concluded that applications of mepiquat pentaborate were not successful in increasing lint yields. The reduction in yields in 2004, when coupled with the cost of application and cost of the product, resulted in significant financial loss based on yields alone. However, additional studies where PGR applications were initiated earlier than early bloom, the use of mepiquat pentaborate did not show any yield loss.

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COTTON YIELD RESPONSE TO N AND K MANAGEMENT IN ROTATIONS WITH CORN IN THE MISSISSIPPI DELTA

M. Wayne Ebelhar, Davis R. Clark and H. C. Pringle III
Mississippi State University
Stoneville, MS

Abstract

Long-term rotation studies were established in 2000 at the Delta Research and Extension Center (DREC) and at the Tribbett Satellite Farm (TSF) to examine the rotational benefits and problems associated with corn/cotton rotations in the Mississippi Delta. The studies were designed to evaluate rotation effects on both poorly drained to somewhat-poorly drained silty clay loam soils (Forestdale/Dundee) as well as the better drained sandy loam soils (Bosket) that are more suited to optimum corn and cotton production. The most recent farm legislation has allowed producers the opportunity to look into alternative crops and cropping sequences to replace some of their cotton acres in certain years. These studies are intended to examine the impact of cotton/corn rotations on the whole farm enterprise. The objectives included: a) determining the effects of N and K nutrition on cotton lint yields and corn grain yields for different soil types; b) determining rotational effects of corn on cotton production and the implications of these rotations on whole farm economics; and c) supplementing the growing knowledge base for site-specific management utilizing GPS/GIS technology. Areas were defined at both locations that could be rotated over a 3-year period with two years planted to cotton and one year planted to corn. Within each area, each of the three sections would have a factorial arrangement of nitrogen (N) and potassium (K) treatments. The corn and cotton sections consisted of four-row (40-in spacing) plots, 90 to 100 feet in length, with either four (TSF) or five (DREC) replications. Nitrogen rates were 60, 90, 120, 150, and 180 lb N/acre for cotton and 120, 160, 200, 240, and 280 lb N/acre for corn with the fertilizer N applied as urea-ammonium nitrate solution (32% N). Potassium rates for all rotations were 0, 40, 80, and 120 lb K/acre. Nitrogen was applied at a uniform rate (60 lb N/acre for cotton, 120 lb N/acre for corn) prior to or near planting with the different N rates established as a sidedress application at early square formation. Potassium applications were made after planting utilizing a 0-0-16 solution (1.3 lb K/gal) applied with the same equipment used for N applications. The K solution (muriate of potash, KCl) was chosen for ease of application with available equipment and does not imply that granular muriate of potash could not be used with incorporation. High-yield potential corn and cotton cultivars were planted at each location and maintained throughout the growing season. Soil moisture sensors were installed to measure soil water tension and used to initiate and schedule irrigations for both corn and cotton. Both crops were harvested with commercial harvesters modified for plot harvest with grad samples taken for laboratory analyses and ginning. Stand counts were taken in the corn studies by counting the stalks in one of the two remaining border rows. The seedcotton grab samples taken at harvest were later ginned through a 10-saw micro-gin for calculation of lint percent. Data were summarized and statistically analyzed using SAS (Statistical Analysis Systems) with mean separations by Waller Duncan K-ratio t-tests and Fisher's Protected Least Significant Difference (LSD).

Corn yields have been increased by 8 to 24% at DREC and 27 to 38% at TSF in the last four years by increasing N rates above 120 lb/acre. On the sandy loam soil at DREC, corn yields have been optimized with 200 to 240 lb N/acre in most years. On the more poorly drained soils at TSF, at least 240 lb N/acre has been required to optimize corn yields. There has been no significant interaction between N rates and K rates at either location over the years. There has been no significant response to increasing K rates even though the lower K rate areas have had no fertilizer K applied in five years. Cotton lint yields have been affected by rainfall patterns in four of the last five years. In 2000, August became the driest month on record when no rainfall occurred, while August 2001 became the wettest on record with more than 9 inches of rainfall occurring during the month. Cotton yields were impacted by cloudy weather that led to increased boll rot and subsequent yield loss. The 2002 harvest season was also affected by adverse weather conditions during the harvest season that delayed the harvest for many producers and eliminated the possibility for any second harvest. The 2004 growing season found more than 20 days of cloudy weather and rainfall in the month of June that impacted vegetative growth. These weather variations aid in the interpretation of results for cotton following corn and cotton following cotton in rotations.

In 2001, cotton lint yield, when averaged across both N rates and K rates, was 10.3% higher where cotton followed corn (730 lb/acre) as compared to continuous cotton (662 lb/acre). In 2002, overall cotton yield was 4.3% higher for cotton