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YIELD RESPONSE OF IRRIGATED COTTON TO RATE OF APPLICATION OF THE PLANT GROWTH REGULATOR ATONIK

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Abstract

This study evaluates the effects of different application rates of the plant growth regulator Atonik on yield, and fiber quality of cotton under irrigated, near optimal growing conditions. The study was conducted at the Texas A&M University Agricultural Research and Extension Center in Corpus Christi, TX, during 2001. Treatments included four rates of Atonik: 2.5, 5.0, 10, and 20 oz./ac applied at 9 nodes above white flower. Results from this study show that Atonik is also effective when used on high-yielding cotton. Atonik applied at 5.0 oz./acre at early bloom stage increased lint yield 256 lbs./acre (16.4%) over the untreated control (1557 lbs./acre). This yield increase resulted from a significant increase in individual boll weight. Fiber quality was not affected by Atonik applied at rates between 2.5 and 20 oz./ac. These results indicate that the use of Atonik may become an important tool to increase yields and profitability of irrigated cotton crops. More research in needed to confirm these results and further evaluate application rates and timing of application in both irrigated and dryland cotton.

Introduction

Atonik® (Asahi Chemical MFG. Co., Ltd.) is registered as a plant growth stimulator product for use to increase nutrient intake in cotton, rice, and soybeans. Its active ingredients are sodium-p-nitrophenolate (0.3%), sodium-o-nitrophenolate (0.2%), and sodium-5-nitroguaiacolate (0.1%). Earlier reports of physiological effects of this plant regulator include increased photosynthetic rate in cotton leaves (Oosterhuis and Guo, 1993), increased uptake of K, Ca, and Mg in hydroponically-grown cotton (Guo et al., 1994), decreased membrane leakage of solutes from cells (Oosterhuis and Guo, 1993), increased activity of nitrate reductase in chickpeas (Sharma et al., 1984, cited by Guo and Oosterhuis, 1995), increased assimilate translocation from upper leaves to ears in wheat (Kudrev, 1969, cited by Guo and Oosterhuis, 1995), and increased export of pinitol from leaves in soybean (Guo and Oosterhuis, 1993). Reports from USA, Egypt, Morocco, China, Philippines, and Guatemala indicated that Atonik increased cotton yield from 11% to 23% (Guo and Oosterhuis, 1995). In these reports, yields ranged approximately from 1.2 to 2.2 bales per acre, indicating sub-optimal growing conditions.

The objective of this study is to evaluate the effects of different application rates of the plant growth regulator Atonik on yield, and fiber quality of cotton under irrigated, near optimal growing conditions.

Materials and Methods

The study was conducted at the Texas A&M University Agricultural Research and Extension Center in Corpus Christi, TX, during the 2001 season. The soil at the experimental site is a Victoria clay-Orelia fine sandy clay loam complex. Broadcast fertilization of 60 lbs./acre of P_2O_5, 150 lbs./acre of N, 20 lbs./acre of S, and 4 lbs./acre of Zn, and yellow herbicide were applied before planting and incorporated by disking. Upland cotton cv. Tamcot Pyramid was planted to a target plant population of 41,267 plants/ac (3 plants/ft at 38'-inch row spacing) on 26 March with a vacuum precision Monosem NG Plus planter. Ground and aerial applications of insecticides as needed controlled insect pests. The experiment was conducted under full irrigation using a surface drip irrigation system. Irrigation was applied from early squaring through mid open-boll stage and amounted 6.1 in. (155 mm). Rainfall from emergence to defoliation amounted 5.5 in. (140 mm).

Treatments were foliar applications of Atonik at four rates: 2.5, 5.0, 10, and 20 oz./ac. Treatments were applied on June 6, when plants were 30 in. (76 cm) high, had 18 main-stem nodes, and 1st position bloom was at node 9. Treatments were applied with a four-row plot sprayer (Model 3220-GC 2wd Lee Spyder Spray-Trac, Lee Company, Inc., Idalou, TX). Plots were four rows wide and 75 ft long. Treatments were arranged in a randomized complete block design with four replications.

Upon defoliation, yield measurements were made by handpicking 1/1000 of an acre from one of the two central rows in each plot and ginning for lint turnout determination. Plant growth measurements and yield components were measured from sample of 10 contiguous plants. Plots were harvested on 16 August.

Results and Discussion

Plant Population
Final plant stands were not significantly different among treatments. Average population was 27,575 plants per acre as a result of 31% germination loss.

Plant Height
Atonik at 10 oz./ac and 20 oz./ac decreased plant height 12% (P=0.0120) and 8% (P=0.0743), respectively. Height of the untreated control (UTC) was 35.4 in. (89.9 cm).

Main-Stem Nodes
Atonik at 2.5 oz./ac and 20 oz./ac decreased the number of main-stem nodes 12% (P=0.1048) and 8% (P=0.0413), respectively. The number of main-stem nodes in the UTC was 20.7 per plant.

Sympodial Nodes
Atonik at 10 oz/ac decreased the number of sympodial nodes (35.1 nodes vs. 43.0 nodes in the UTC, P=0.0774).

Fruit Retention
Percent fruit retention followed an increasing tendency with increased rates of Atonik. However, only Atonik at 20 oz./ac showed a marginally significant increase with respect to the UTC (35.4 % vs. 28.2%, respectively, P=0.1303).

Bolls Per Plant
No significant differences in number of open bolls per plant were found between the UTC and Atonik treatments. The number of open bolls of the UTC was 12.75 per plant.

Weight of Individual Bolls (Seedcotton)
The average weight of individual open bolls (seedcotton) was significantly higher only with Atonik at 5.0 oz./ac (5.85 g, P=0.0631). Weight of individual bolls of the UTC was 5.43 g.

Lint Turnout
Lint turnout was significantly higher only with Atonik at 10 oz./ac (41.3%, P=0.0917). Lint turnout of the UTC was 40.4%.

Weight of Individual Bolls (Lint)
Similar to seedcotton per boll, the average lint weight of individual open bolls was significantly higher only with Atonik at 5.0 oz./ac (2.35 g, P=0.0995) (Figure 1). Lint weight of individual bolls of the UTC was 2.175 g.

Lint Yield
Lint yield was significantly higher only with Atonik at 5.0 oz./ac (1813 lbs./ac, P=0.0266) (Figure 2). Atonik at 2.5 and 20 oz./ac showed only a non-significant numerical tendency of being higher than the UTC. Lint yield of the UTC was 1557 lbs./ac.

Micronaire
Micronaire, a measure of fiber fineness and maturity, was not significantly different among treatments and averaged 48.725±1.057, a value within the base range.

Length
Fiber length was not significantly different among treatments and averaged 1.043±0.016 inches.

Uniformity
Fiber length uniformity was not significantly different among treatments and averaged 82.8±0.801 %, an intermediate to high value of uniformity.

Strength
Fiber strength was not significantly different among treatments and averaged 27.770±0.718 grams per tex, an average value for fiber strength.

Conclusions

Results show that this plant growth regulator is also effective when used on high-yielding cotton. Atonik applied at 5.0 oz./acre at early bloom stage increased lint yield 256 lbs./acre (16.4%) over the untreated control (1557 lbs./acre). This yield

increase resulted from a significant increase in individual boll weight. Fiber quality was not affected by Atonik applied at rates between 2.5 and 20 oz./ac.

Results indicate that the use of Atonik may become an important tool to increase yields and profitability of irrigated cotton crops. More research in needed to confirm these results and further evaluate application rates and timing of application in both irrigated and dryland cotton.

Acknowledgements

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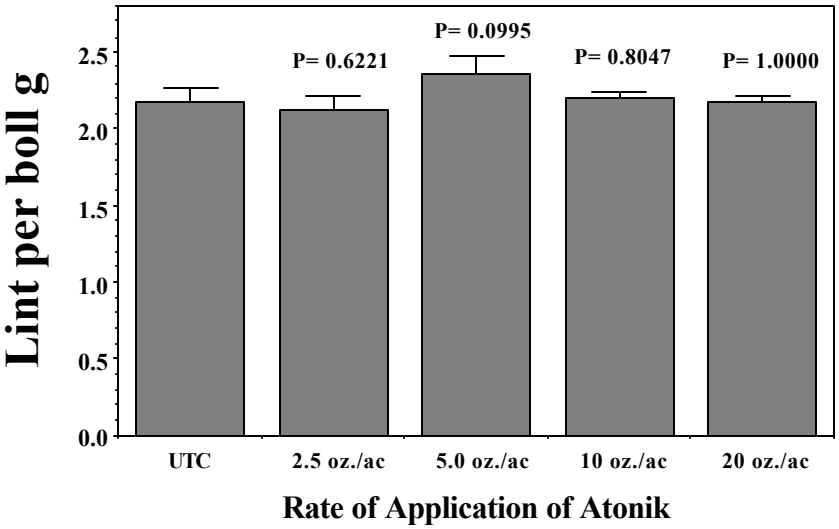

Figure 1. Average lint weight per boll in untreated plots (UTC) and plots treated with Atonik at rates of 2.5, 5.0, 10, and 20 oz./ac. Corpus Christi, TX, 2001. Statistical note: Probability of null hypothesis is shown on top of corresponding bars. T-line on top of bars indicates magnitude of standard error.

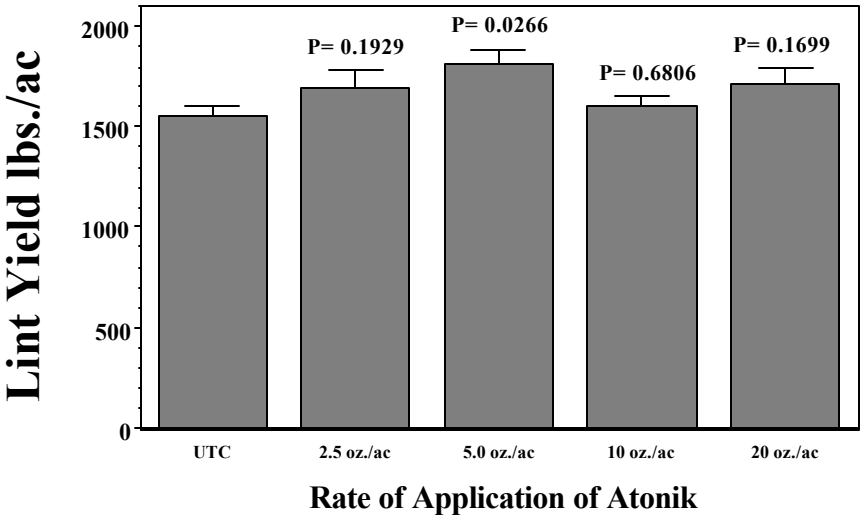

Figure 2. Lint yield of untreated plots (UTC) and plots treated with Atonik at rates of 2.5, 5.0, 10, and 20 oz./ac. Corpus Christi, TX, 2001. Statistical note: same as in Fig. 1.