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PLANT GROWTH AND YIELD RESPONSE TO TRIMAX (IMIDACLOPRID) INSECTICIDE IN THE WEST MISSISSIPPI DELTA

Alan Hopkins
Bayer CropScience
Greenbrier, AR
Ross Bell
Bayer CropScience
Monroe, LA
Roger Bowman
Bayer CropScience
Leachville, AR

Abstract

Imidacloprid was discovered by Bayer in 1985 and was the first commercially introduced insecticide of the class chloronicotinyl insecticides (CNI, *syn. neonicotinoid*). TRIMAX™ Cotton Insecticide is a new imidacloprid product from Bayer CropScience registered specifically for use on cotton. TRIMAX contains 4.0 lb of imidacloprid per gallon in a soluble concentrate formulation. The product was introduced to cotton growers in most of the cotton-growing region of the United States in 2002. More than 10 years of testing and experience prior to market introduction confirmed that TRIMAX provides benefits over and above traditional insect control with unique technology that delivers *Pest Management, Plant Health, and Enhanced Yield*. Results from 2002 corroborate findings from previous years with emphasis on improved plant health and enhanced yield.

Private and public researchers have conducted small-plot and large-plot testing since the early 1990's. Observations for insect control, plant growth and development and yield have been made. Data were summarized over 22 trials where multiple applications were used and yield data were reported between 1995 and 2001. Demonstrations and experiments with 30 cotton consultants and 14 university cooperators were conducted in 2002 to confirm the pest management, plant health and yield benefits of TRIMAX in the western Mississippi Delta. Special emphasis was placed on obtaining data to support plant health and yield observations. Data developed by Dr. Derrick Oosterhuis of the University of Arkansas were particularly interesting since they represent some of the first attempts to elucidate the plant physiological and biochemical effects of TRIMAX on cotton.

The unique chemistry of TRIMAX has a mode of action that incorporates insect mortality, ovicidal activity and behavioral changes. These properties work together for the ultimate goal of the cotton producer – maximum yield. The insecticidal properties of TRIMAX (imidacloprid) are well documented. Therefore, the emphasis of this paper is to document plant health and yield effects from demonstrations and experiments conducted in the western Mississippi Delta.

About 20 of the 30 consultant demonstrations were designed to collect plant growth and yield data. Of these, yield data were available for 13 demonstrations. A positive yield response was observed for all locations except one in Arkansas, where a yield was 1.3% lower than the untreated. Yield results from all 13 locations indicated a range of –1.3% to 11.5% yield response with TRIMAX compared to the untreated or standard-treated plots (median: +4.4%, mean: +4.8%).

Yield benefits can be expected to result from effective pest management and improved plant health. Research has shown a positive yield response following TRIMAX applications on cotton. In research conducted at the University of Arkansas, Dr. Charles Allen, observed significantly higher square retention and yield when imidacloprid was applied three times starting at pin-head square. Dr. Allen also observed increased yield in this trial for imidacloprid treatment (1304 lb. lint/A) compared to the untreated (1067 lb. lint/A). In 2002, Dr. Jeremy Greene, at the University of Arkansas, conducted a similar study with TRIMAX applied three times under severe plant bug infestation. He observed significant increase in cotton yield following TRIMAX at 1 or 1.5 oz/A compared to the untreated or standard-treated plots (884, 810, 492 and 445 lb lint/A for the four treatments, respectively).

Dr. Sandy Stewart, LSU Cotton Specialist observed improved fruit development and significantly higher yield with three applications of TRIMAX (1.5 oz. formulated product/A) compared to the untreated control. Dr. Derrick Oosterhuis observed effects on plant growth and development and reported an increase in cotton yield where TRIMAX was evaluated at two locations in Arkansas (Fayetteville and Clarkedale). Dr. Oosterhuis also reported significant differences in specific leaf weight, chlorophyll, and canopy temperature. He did not observe significant effects on photosynthesis or carbohydrate production. Perhaps the most intriguing observation from Dr. Oosterhuis' experiments was a significant reduction in the antioxidant enzyme glutithione reductase. This enzyme is related to plant stress. Dr. Oosterhuis hypothesized that "*the apparent growth advantage imposed by TRIMAX is in part due to the activation of these antioxidant enzymes to detoxify the plant of free radi-*

cals which are always present due to the numerous environmental stresses that crops face daily. Glutathione is involved in a wide range of metabolic processes (Meister and Anderson, 1983) and its content increases considerable under stressful conditions (Smith et al., 1990). A major function of glutathione is thought to be that of protection against oxidative biotic and abiotic stress, i.e. SO_2 , O_3, UV irradiation, drought, extreme temperatures, and attack by other organisms. Our results showing a significant increase in glutathione reductase would support this hypothesis". Data from 2002 support previous results and offer clues for future research. Studies will be continued in 2003 to further elucidate mechanisms for improved plant health with TRIMAX Insecticide.