

**COMPETITIVE IN EVERY QUARTER
CROP PROTECTION: II. INSECTS**

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Abstract

Insect populations were considered generally light across the Cotton Belt, and as such, probably would not be ranked very high as a limiting factor in cotton production. Whitefly problems in the west were lighter than in the past five years and consequently more easily managed. Tobacco budworm infestations from Texas eastward were much lighter than had been experienced in many years and pyrethroid resistance did not play a major role in managing this pest. For the last eight years, beet armyworms had plagued one region or another, however, in 1996, no serious outbreaks were reported to have occurred. Aphid and plant bug populations did require control in some regions, yet their populations were considered to be less of a problem than normal. The boll weevil eradication program continued to make slow progress in the quest to eliminate this serious pest from U.S. cotton. A couple of new areas of eradication were initiated in Texas and a voluntary program in much of the eastern portion of Mississippi allowed for the continuation of the program there. There were no reports of serious secondary pest outbreaks associated with these new programs. Perhaps the most notable event of 1996 was the registration and commercialization of transgenic Bt cotton for the control of many caterpillar pests. As much as 1.8 million acres of the NuCotn varieties with Bollgard were planted in 1996. This technology did not go through the season without its own problems. Heavy infestations of bollworms challenged the toxin and some treatments were necessary to keep the bollworms under control.

Introduction

The 1996 production year might be considered a normal year, yes normal because it was so different from all of the other years, at least as far as the insect pest situation is concerned. It seems that no two years are alike and that challenges continue to confront us for managing pest populations.

Fortunately, 1996 may be considered a light insect year with heavy infestations of uncontrollable pests not being the hottest topic for discussion. Estimates of losses and costs of control, which are put together each year by research and extension specialists in each state and reported through the Cotton Insect Research and Control Conference, show a

much lower loss due to insects than in the previous five or more years.

1996 Insect Highlights

Bt Cotton - Perhaps the most notable event for the 1996 crop year was the registration and commercialization of transgenic Bt cotton. Approximately 1.8 million acres of NuCotn varieties containing Bollgard were planted in the U.S. in 1996. This was probably the most successful launch of a new product in the history of the cotton industry. Bollgard cotton was seen as an exciting tool for the management of many caterpillar pests in cotton and potentially a tool that could allow growers to more effectively manage other non-target pests and reduce the threat of creating secondary pest problems when applications were made for "non-target" pests. Despite the \$32 per acre "technology fee" as an up-front cost, many growers decided to plant some of the "insect resistant" cotton. Some growers were not completely satisfied with the variety selection that was available containing Bollgard thinking that those varieties were not adequately suited for their region or production system. Other producers, in areas of historically low insect control inputs, were unsure of the return on the up-front investment.

This product was unique also in that, written into the registration package to the Environmental Protection Agency and as a part of the agreement between the grower and Monsanto, a resistance management plan was put into effect. Not unlike any other crop protection tool, it was known (and had been documented in the laboratory) that resistance to Bt in tobacco budworm and pink bollworm is a likely consequence of the use of this technology. Without some attempt to manage resistance, this tool would soon be lost. The main concept in the resistance management plan was for each grower to plant a part of his crop in non-Bt varieties in an effort to prevent exposure of all individuals from each generation to the Bt toxin. Although received with some consternation by growers, this plan provides hope that this technology will maintain its viability for many years to come.

Silverleaf whitefly - The silverleaf whitefly problem in the west was much lighter than had been experienced during the last five years. Some of this may be attributed to a better understanding of its management by growers. The other factor which occurred may have been a real coup for the cotton industry. That was the Section 18 Emergency Exemption from Registration for two insecticides for whitefly control. Those products, Knack produced by Valent USA Corp. and Applaud produced by AgrEvo USA Corp., are extremely effective insect growth regulators that may be used without upsetting the natural enemy balance. Their use was allowed in an effort not only to control silverleaf whitefly, but also to manage resistance in this extremely adaptable insect pest. The Exemption was granted with the stipulation that only one application of

each product be used during the season. This unprecedented regulation was designed to limit exposure of successive generations of the pest to either product and thus minimize the potential for resistance build-up. By all accounts the strategy worked extremely well and management of the whitefly was quite successful compared to previous years.

Tobacco Budworm - The tobacco budworm, a pest that has over the last 10 years provided serious challenges for control for some producers, did not pose near as much of a threat in 1996. Extremely low populations occurred throughout most of the Cotton Belt. Pyrethroid resistance in this pest posed little difficulty. Of particular note here may be in the state of Alabama. During 1994 and 1995, resistant tobacco budworms were virtually uncontrollable and caused severe devastation to the state's crop. In 1996, populations were so low that little or no insecticide was used for tobacco budworm control. There is no clear understanding as to why the populations were so low, however, they are a very cyclic pest and this appeared to be one of the years that was the low ebb of the cycle.

Bollworm - Bollworms were noted to be a much more severe problem than in recent years. Their abundance may have been caused, in part, by the dramatic increase in acreage of corn in many production areas. However, early season monitoring of these pests on wild hosts in several areas indicated that this might be a year for heavy infestations. These results were obtained prior to the time when corn would have had any influence on the population. To make the bollworm problem even more difficult, moths laid their eggs low in the plant canopy. This made them more difficult to detect and lack of penetration of insecticides into the canopy where they were located provided inadequate control in some cases.

Bollworm populations presented the greatest challenge to Bt cotton of any of the potential pests. First there were reports of bollworm problems occurring in seedling cotton in Louisiana. These turned out to be problems brought about because of the lack of early burn-down of host weeds in stale seedbed plantings. Bollworm larvae moved from the weed hosts to the cotton and caused some stand loss. Some of the Bt cotton had to be sprayed for bollworms in these cases, however, these applications could not be blamed on lack of performance of the Bollgard technology. Later in the season, because of the high populations of bollworm and its reduced susceptibility to the Bt toxin (compared to the tobacco budworm) and their location lower in the plant canopy, there were a higher than expected number of escapes. The first reports of problems came from the Brazos Bottoms of Texas. Those same situations occurred eastward from there as the season progressed. In areas where applications of insecticide were necessary, generally one to two sprays were all that were necessary for bollworm control in Bt cotton. The 1996 experience pointed out the

continued need for careful and systematic monitoring of pest problems in all cotton.

To make the future threat of bollworm problems even greater is the documented resistance of this pest to pyrethroid insecticides near Estell, South Carolina. Failure to control bollworm infestations with pyrethroids in this vicinity as well as another site in the panhandle of Florida may be an early warning of control problems for the future. Tom Brown at Clemson University showed a five-fold decrease in susceptibility in those South Carolina populations.

Plant Bugs - Plant bug problems were less severe in many parts of the Cotton Belt than in the past several years. Some applications of insecticide were made for these pests but at less than normal levels. Indications of resistance to pyrethroids in tarnished plant bug continue. In the mid-south, infestations persisted in fields following multiple applications of pyrethroid insecticides. This resistance has also been documented in laboratory bioassays at the Southern Insect Management Laboratory in Mississippi.

Populations of cotton fleahopper were higher in the southeast than in the past 25 years. The high numbers did not occur until mid-season and in untreated fields, no discernable losses occurred from their presence. These pests will bear watching in this region in the future.

Aphids - Aphid infestations during 1996 were lighter over much of the Cotton Belt than had been experienced over the last several years. Economic problems still did occur in several areas to warrant control, however, generally fewer problems were encountered.

Boll Weevil - Despite extremely cold conditions during the winter of 1995/96, boll weevil populations continued to be abundant in most non-eradicated areas. Control was not a significant problem, however, control in Bt cotton was necessary to prevent economic damage.

Boll Weevil eradication programs were initiated in the Coastal Bend and Rolling Plains regions of Texas. The eastern section of Mississippi continued their eradication program on a voluntary basis and found that secondary pest infestations were not a problem. There were extremely low numbers of boll weevils found in this area during 1996. Isolated pockets of boll weevil infestations in South Carolina and southern Georgia were cleaned up again ensuring the continued success of the program in these states.

Beet and Fall Armyworms - Unlike the last eight years, the beet armyworm posed no serious regional problem anywhere in the Cotton Belt. Pheromone trap captures indicated that potential infestations could have posed problems. Some areas had enough of a potential for damage, had the infestations continued to develop, that a

Section 18 Emergency Exemption from Registration for Confirm and Pirate was granted to several states for control of beet armyworm. However, the serious infestations did not materialize, even in active eradication zones.

Fall armyworms did cause problems in some areas of the southeast. Control considerations were costly and only marginally effective. Early detection and rapid response is

critical in successful suppression of these pests. Once established, control of fall armyworms will likely be unsatisfactory.

Miscellaneous Pests - Few other pest infestations warrant mention as their infestations were light and were not much of an economic consideration to cotton production in the U.S.