

Title: Bollworm Issues in Transgenic Cotton

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Growers and consultants have recently expressed concerns for the number of bollworms found in Bt cotton, especially Bollgard II cottons. Control of bollworm with Cry1Ac cottons like Bollgard is good but less than perfect. Bollworm populations were found in commercial fields of Bollgard the first year it was commercially deployed and damaging populations have been found most years since commercialization. These problem fields are typically scrutinized by Monsanto and university or USDA scientists. Control problems are often associated with factors governing protein expression in the plants, especially cutout and maturity of the plant late in the growing season. Oviposition of bollworm on blooms and boll tags is considered a window of reduced plant defense where small larvae are allowed to survive and subsequently survive to later instars capable of fruit damage. Bollgard cotton is routinely sprayed with pyrethroid insecticide, and Bt cotton sprayed with pyrethroid is considered to be a superior control strategy for bollworm. Unfortunately, bollworm populations are exhibiting reduced susceptibility to the pyrethroid insecticides.

Commercialization of Bollgard II and Widestrike cottons, both with two insecticidal proteins (Cry1Ac and Cry2AB2 in Bollgard II; Cry1Ac and Cry1F in Widestrike), provides improved plant protection and a broader spectrum of insect control. Growers have been interested in these cottons because of increased protection from bollworm and armyworm pests. Many growers perceive that these new cotton should eliminate the need for the pyrethroid sprays required on Bollgard cotton.

Over the past four years, we have measured significant variability in the response of bollworm to Cry1Ac and Cry2Ab in diet incorporation assays. These biological assays are influenced by several sources of biological variability. The overall results suggest that bollworm populations have meaningful genetic variability in response to these proteins and that some portion of problem situations may be associated with reduced susceptibility to the proteins. Bollworm appears to have significant fitness costs when Bt resistance is present creating a negative impact on resistance evolution.

Bollworm populations were higher than normal in some parts of the Midsouth during 2006. Increased frequencies of pyrethroid resistance, possible reduced susceptibility to Cry1Ac and Cry2AB proteins, and reduced or variable plant expression of the insecticidal proteins are often associated with control problems.

In this paper, we review the growing database on bollworm susceptibility to Cry proteins, published accounts of sprayed and unsprayed comparisons, and possible combined influences of decreased susceptibility and reduced protein expression on bollworm survival on Bt cottons.