2005 Beltwide Cotton Conferences, New Orleans, Louisiana - January 4 - 7, 2005

EFFECT OF BT (CRY1AB) CORN ON BOLLWORM BIOLOGY: EMPHASIZING PROGENY RESPONSES TO BT (CRY1AC) COTTON

John J. Adamczyk Jr., Jeff Gore, Carlos Blanco and Craig Abel
USDA
Stoneville, MS

Abstract

Certain transgenic Bt (*Bacillus thuringiensis*) corn (YieldGard, Monsanto Co.) and cotton varieties (Bollgard, Monsanto Co.) have been genetically engineered to express the Cry1A (subclass b & c for corn and cotton, respectively) δ-endotoxin to control certain noctuid pests. In addition to the Cry1Ac protein, Bollgard II contains a second protein (Cry2Ab). These technologies provide superior control of the tobacco budworm, *Heliothis virescens* F., in cotton, and the European corn borer, *Ostrinia nubilalis* (Hübner), in corn and cotton. However, other pests such as the bollworm, *Helicoverpa zea* (Boddie), is less than adequately controlled in both Bollgard and Bt corn. Although there are numerous reports on the sublethal effects of the Cry proteins on the larval stage of the bollworm, few studies have examined the effects on the moth and subsequent progeny. The purpose of this study was to determine the effects of Bt corn has on bollworm development, especially during the adult stage, and the ability of progeny to survive and damage transgenic Bt cotton.

In one experiment, plots of either conventional corn (Terral 3130) or transgenic Bt corn (YieldGard: Terral 3160) were grown in a 0.125 acre field cages located in Stoneville, MS. Corn types were planted on May 22nd, 2004. A natural population of bollworms was observed on both corn types once plants began to silk. Once the vast majority of bollworms had pupated and corn was no longer attractive to the pest, netting was placed over the entire field cage. Light traps were placed inside the cages to catch emerging bollworm moths. Traps were checked at dawn for 17 consecutive days, and the number of emerged moths was recorded daily. All live moths were transported within 30 min. to the laboratory. The moths were chilled at 4°C for approximately 15 min. and then promptly weighed. Moths were captured in the Bt corn cage nearly one week after emergence ceased in the conventional corn cage. Furthermore, moths were smaller when completing development on Bt corn versus conventional corn. A 3-fold reduction in moths emerging from Bt corn (n=55) was observed when compared to moths emerging from conventional corn (n=170). Smaller than anticipated numbers of moths that were collected was probably due to an epizootic that occurred in late-instars in both conventional and Bt corn.

In another experiment, strip plots (6 rows) of either conventional corn (Terral 3130) or transgenic Bt corn (YieldGard: Terral 3160) were grown in a 0.125 acre field cage located in Stoneville, MS. In addition, transgenic Bt cotton containing the Cry1Ac protein (Bollgard: SG215BRR) and Bt cotton containing both Cry1Ac and Cry2Ab proteins (Bollgard II: DP 424BGIIRR) were planted simultaneously in a randomized complete block design within the cages. Cotton plots were 4 rows (40 inch centers) by 15 ft. Cotton and corn were planted on May 22nd, 2004. A natural population of bollworms was observed on both corn types once plants began to silk. Once the vast majority of bollworms had pupated and corn was no longer attractive to the pest, netting was placed over the entire field cage. For both corn types, emerging bollworm moths successfully mating and deposited eggs in both Bollgard and Bollgard II. Plants (5) per cotton plot were examined for the presence of bollworm larvae. Furthermore, all bolls present on the 5 plants/plot were examined for bollworm damage. Bollworm larvae completed development on both conventional corn and Bt corn (YieldGard). Moths successfully mated and deposited viable eggs that developed into larvae on all cotton types. As anticipated, the majority of larvae were found on conventional cotton followed by Bollgard and Bollgard II. As in the above experiment, fewer total larvae were found in the cage containing Bt corn, suggesting that the Cry1Ab had a negative impact on the previous bollworm population. However, bollworm larvae whose parents completed on Bt corn caused boll damage on all cotton types. These data suggest that fitness costs and selection pressure associated with larvae completing development on Bt corn (YieldGard) are small, although further experiments are needed to corroborate these conclusions.