TRANSGENIC BT COTTON - PROBLEMS FROM CONSULTANTS' PERSPECTIVE

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Abstract

The production of transgenic Bt cotton (NuCotn® 33B) in 1996 in southeast central Louisiana was observed to have been affected by several insect pests, including unusually heavy cotton bollworm (*Helicoverpa zea*) (CBW) populations. Survival of CBW larvae age 1-4 days feeding on NuCotn®33B bolls 1½ inches or younger far exceeded presumed economic injury thresholds for boll damage. Therefore, synthetic pyrethroid applications were required in order to prevent damage to NuCotn®33B. Conventional varieties sustained less injury initially since ordinary treatment thresholds triggered pyrethroid application prior to larval injury to bolls. Plant agronomic characteristics and weather conditions also contributed to varying yield outcomes, which trended much lower than expectations, in spite of intense cultural and pest management inputs.

Introduction

In Pointe Coupee and Avoyelles Parishes, LA, corn and soybean acreage historically far exceeds that of cotton; and 1996 was no exception. Corn acreage along with an unusually dry winter contributed to CBW infestations in cotton estimated to have been 5-8 times normal. It is common for corn acreage to be 2-6 times that of cotton in this area, but the January through May 1996 period was the fifth driest weather period on record (La. Office of State Climatology). The latter may have been more of a contributing factor to high CBW populations than originally thought. Populations of CBW in the whorls of corn plants in May 1996 were estimated to be at 5-10 times that normally observed.

Observations

Unusually heavy plantbug populations in early and mid season frequently exceeded treatment thresholds and were controlled adequately to allow 85-95% square retention in early and mid season. Plant mapping and physiological milestones and benchmarks (Kirby 1996; Cotton Physiology Program) were excellent for NuCotn ®33B and conventional varieties. However, normal July and August rainfall caused more additional stalk growth and hard lock in NuCotn®33B than in conventional varieties. Very few fields of NuCotn achieved a normal, readily observable cut out. All varieties experienced very heavy infestations of boll weevil in mid and late season. Early season sprays for plantbugs and boll weevils noticeably reduced the numbers of beneficial insects in cotton fields. Numerous fields of NuCotn®33B exhibited varying levels of boll shed in mid and late season giving rise to speculation that observed cloudiness, high humidity, and warm overnight low temperatures may have contributed to this. Unusual boll shed was not evident in conventional varieties. Table 1 reflects actual applications necessary during the 1996 season. Plantbugs seemed to be both more attracted to and to more easily cause a drop in square retention in NuCotn®33B than conventional varieties.

As shown in Table 2, NuCotn®33B sustained more average boll injury during initial CBW infestations due to control applications to conventional cotton having been triggered by egg and brown egg counts. Evidence of the lack of adequate control of CBW in NuCotn®33B became apparent only after egg hatch and several days allowance for early stage larvae to consume a lethal dosage of Bt toxin. Larval survival was sufficiently high to cause an average of 6.8% and 3.1% small boll damage in the second and third weeks of July, respectively. However, boll damage levels in individual fields ranged as high as 38% in several fields and 13-16% in many others. Subsequent pyrethroid applications directed at brown eggs in NuCotn®33B controlled ongoing CBW infestations and prevented what would have been devastating injury by large larvae.

Harvest aid practices traditionally include a boll opening rate of ethephon to help insure once over harvest. In 1996, approximately 8% (only slightly more than recent years) of conventional cotton required second pick harvest. However, over 80% of NuCotn®33B cotton required second picking in spite of high rate ethephon usage.

Yields of conventional varieties averaged approximately 812 lb. lint/ac (range: 640-1260 lb. lint/ac) versus NuCotn®33B average of 758 lb. lint/ac (range: 581-1210). Farms planted to a high percentage of NuCotn®33B were more likely to yield well below their 5 year average, while farms with none or a low percentage of acreage in NuCotn®33B yielded near their 5 year average.

Future use of NuCotn®33B will be curtailed because of its relatively high costs (Carter et. al., 1997), and until more public sector research data concerning its production becomes available.

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Table 1: Average no. applications (PGR: avg. no. oz.) per acre.

	NuCotn®33B	Conventional
Plantbugs	4.1	3.6
Boll Weevils	9.8	8.9
pyrethroid	2.2	3.7
PGR (oz.)	34.0	28.4

Table 2: Average % small bolls with live larvae and/or injury.

Week of:	NuCotn®33B	Conventional
1 July	2.8	(?)
8 July	6.8	<1.0
15 July	3.1	1.1
22 July	<1.0	0.0
29 July	<1.0	<1.0
5 Aug	<1.0	1.1