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ECONOMICS OF COTMAN INSECTICIDE TERMINATION IN BT AND BOLL WEEVIL ERADICATION SYSTEMS

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Abstract

The COTMAN insecticide termination rule for fruit-feeding insects was developed and validated in the years preceding the availability of Bt cotton varieties and in production systems with boll weevils. The objective of this study was to compile results from insecticide termination trials in Arkansas conducted on Bt varieties and in Boll Weevil Eradication systems.

COTMAN Insecticide Termination Rule for Fruit-Feeding Insects

Monitor crop to identify the last effective boll population (cutout). Physiological cutout is signaled when field average Nodes-Above-White-Flower equals five.

Accumulate daily heat units (DD60's) starting at cutout.

Stop insecticide applications for bollworm, tobacco budworm and boll weevil infestations that occur after bolls have accumulated 350 heat units.

Review of Previous Research

Physiological Evidence for Insecticide Termination at 350 Heat Units

Caged boll studies examined susceptibility to damage by adult boll weevils, *Anthonomus grandis* (Boheman) and third instar cotton bollworm, *Helicoverpa zea* (Boddie). In each year, 1990 through 1992, after accumulation of 350 heat units the percentage of bolls damaged by each insect became static (Bagwell, 1994).

Kim and Oosterhuis (1998) investigated physical, anatomical and biochemical changes in the capsule wall in relation to boll age and insect feeding. Results showed that resistance to penetration of the boll wall increased sharply at about 350 heat units after flower.

Small Plot Research Trials

Validation research for the 350 heat unit termination rule was conducted in Arkansas, Louisiana, Mississippi and Texas, 1995-1997. Yields were compared with insecticide termination at 0, 200, 350, 500 and 650 heat units beyond NAWF=5. In the three years of research that involved 20 small plot trials, a yield penalty was never observed for insecticide termination at 350 heat units beyond NAWF=5 (Cochran et al., 1999).

Grower Validation Trials

On-farm trials in Arkansas, Mississippi and Texas, 1995-1998, compared yields using the COTMAN insecticide termination rule to yields using the growers' normal action thresholds for insecticide applications. In each of the 33 trials, the grower thresholds resulted in additional insecticide applications beyond 350 heat units at an average cost of $19.62 per acre with no return to yield. Average yield difference was 2 lb of lint per acre (Cochran et al., 1999).

Arkansas Termination Research with Bt and Boll Weevil Eradication

Bt Variety Tests

Five Bt varieties and one standard variety were used to compare yields when insecticides were terminated at 350 and 650 heat units past NAWF=5, Rohwer, AR, 1996. No significant yield differences were observed in any of the varieties, leading the researchers to conclude, "higher yields were not obtained by continued late-season sprays on Bt or non-Bt cotton" (Allen et al., 1999).

Grower Validation Trials

Insecticide termination at NAWF=5 plus 350 heat units was compared to grower standard termination for a Bt variety in Lincoln Co., AR, 1998. While the grower made two additional insecticide applications totaling over $27/acre, no yield differences were observed (Benson et al., 1999).

A similar result was observed in 2000 for a standard variety under heavy late-season worm pressure in Desha Co., AR, an area that was undergoing boll weevil eradication (Kharboutli and Allen, 2001). The grower spent about $25/acre for additional insecticide treatments, but no yield differences were realized by extending the period of crop protection. Research was repeated at the same location in 2001 with similar results (Capps et al., 2002). Again, standard varieties were tested under boll weevil eradication. In two tests, no yield differences were noted for the $27/acre spent in extra protection. In this study, the authors concluded that "no economic benefits were found by prolonging crop protection after NAWF=5 + 250 heat units". An additional test in 2002 again found no yield increase with continued protection (Greene and Capps, 2003). In 2003 the grower's normal thresholds did not call for additional sprays beyond NAWF=5 + 350 heat units.

In 2002 a test in Northeast Arkansas by Greg Smith compared insecticide termination at NAWF=5 + 350 heat units to continued protection for treatment level worms. Yields were not different (863 for COTMAN termination, 871 with continued sprays), but the grower spent $24/acre for additional sprays.

Tarnished Plant Bug

Studies examined insect control termination for tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), on a Bt variety at a Northeast Arkansas location in 2001 and 2002. Natural infestations of tarnished plant bug were augmented by release of 3 to 5 nymphs (3rd instar) per plant starting at about 1 week after NAWF=5 and continuing weekly for a total of either 1, 2 or 3 times per plot. Visual inspection indicated significant feeding injury to upper canopy bolls, but researchers found no yield penalty compared to untreated or protected controls in either year. Results of the 2001 study are summarized by Teague et al (2002). In 2002, yield was 1074 lb lint/acre for the treatment with three bug releases after cutout compared to the untreated check yields of 1089. Yields did not differ significantly from sprayed plots despite a late season boll weevil infestation. COTMAN termination rules for heliothine caterpillars and boll weevils appear to be more than sufficient for late season plant bug management.

Conclusions

Arkansas research on COTMAN insecticide rules in production systems following boll weevil eradication or in systems using Bt varieties gives no evidence to support crop protection for bollworm, budworm or tarnished plant bug infestations that occur beyond NAWF=5 plus 350 heat units. An average expenditure of $24/acre for late-season protection was not exceeded by the value of the 17 lb of increased yield found in the grower validation studies in Bt and boll weevil eradication systems.

Acknowledgements

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