

INSECT CONTROL WITHOUT Bt**R. G. Luttrell****R. E. Jackson****K. C. Allen****USDA ARS Southern Insect Management Research Unit
Stoneville, Mississippi****Abstract**

Understanding potential to grow conventional cottons that do not express Bt insecticidal proteins requires an appreciation for the historical impact of Bt cotton on cotton insects. Insects have long been exposed to *Bacillus thuringiensis*, a common soil-borne bacterium. Commercial deployment of Bt cottons engineered to express *cry* toxins of *B. thuringiensis* provided outstanding control of insecticide-resistant tobacco budworm, a species causing serious economic damage to U.S. cotton prior to the use of Bt cotton. Over the 15+ years of commercial Bt cotton use, pest complexes have changed and cotton yields have steadily increased. These changes are associated with better control of caterpillar pests, but they also reflect benefits from boll weevil eradication and more efficient production practices. Adoption of Bt cotton is high, greater than 95% of the planted acreage in most production regions of the U.S. Adoption was rapid when Bt cotton was first introduced in 1996 in regions of the Midsouth and Southeast impacted by tobacco budworm. Populations of tobacco budworm have declined with increased adoption of Bt cotton. Bollworm is now the most important caterpillar pest of Bt cotton. Bollworm is less susceptible to the *cry* toxins, and Bt cotton requires supplement use of insecticide to control bollworm. Bt cotton in the Midsouth and Southeast averages about one application of insecticide for control of bollworm. Bt cotton in the Southwest averages about 0.5 or about one application on every other acre. In 2011, the USDA ARS Southern Insect Management Research Unit at Stoneville, Mississippi initiated research to compare insect management on commercial Bt cottons and new high-yielding non-Bt cottons from F. Bourland's breeding program at the University of Arkansas and B. Meredith's breeding program at Stoneville, Mississippi. The experimental comparisons were made in large field cages, in replicated field plot studies at Stoneville, and in large plot studies on farms at five locations in the Mississippi Delta. All cotton lines were managed as no insecticide use for bollworm or tobacco budworm, sprayed with Karate® (lambda-cyhalothrin) for bollworm or tobacco budworm, and treated with Coragen® (chlorantraniliprole) for bollworm or tobacco budworm. Karate is a long-standing and affordable pyrethroid insecticide. Coragen is a new diamide insecticide that provides long residual control of bollworm. A single Coragen spray costs more than three times that of a single Karate spray. Yield of non-Bt cottons treated with Coragen were as great as those of Bt cottons treated with Coragen and greater than those of some untreated Bt cottons. In some experiments, yields of Karate treated conventional cotton were comparable to those of Coragen treated conventional cottons. In other experiments, they were not. Unsprayed conventional cotton was economically damaged by insects. In an additional summary of cotton insect loss and control cost estimates published in the Beltwide Proceedings, 41 paired comparisons of insect losses and control costs for Bt and conventional cotton were examined. Bt cotton had lower % crop loss to insects, lower insecticide use for targeted caterpillar pests, and fewer dollars spent on insecticide than those of direct comparisons to conventional cotton. However, Bt cotton had an additional average technology fee of \$23.58 per acre. Estimated costs of insect scouting were about \$7 per acre for both Bt and conventional cotton comparisons. Results of these summaries and the experimental work initiated in 2011 indicated that conventional non-Bt cotton can be grown and economically protected from insect damage if affordable and effective insecticides are available. Management of the conventional non-Bt cotton may require additional investments in scouting and crop monitoring that should be cost-effective given the low investment in scouting under current management approaches.