OVERVIEW OF INSECTICIDE RESISTANCE IN COTTON

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Abstract

Insecticide resistance has been defined as the inherited ability of a pest to tolerate doses of an insecticide that would prove lethal to a majority of individuals in a normal population of that species. Throughout the last half century, insects have demonstrated their adaptability by developing resistance to a wide range of insecticides. Over 550 species of insects have been reported to be resistant to insecticides with resistance being reported to over 330 compounds. The impact of pesticide resistance has been estimated to impact crop production in the U.S. by over $4 billion annually, so insecticide resistance management has become an integral part of cotton production.

Over the last decade, tarnished plant bugs and bollworms have been the top two insect pests of cotton in the mid-South based on control costs for these pests. Based on adult vial tests and field trials, tarnished plant bugs have developed resistance to major classes of insecticides including pyrethroids, carbamates, and organophosphates. Since resistance to pyrethroids became widespread in tarnished plant bug populations, the most commonly used insecticide for tarnished plant bug control has been acephate, an organophosphate. However, recent studies have documented acephate-resistant populations and a drastic increase in the proportion of acephate-resistant populations in the mid-South. No resistance to the neonicotinoids has been documented at this time; however, the increased use of this insecticide class has created concerns dealing with resistance development to this chemistry. The number of insecticides that produce adequate field control of tarnished plant bug is limited to only a few insecticide classes.

Another insect pest that has created concerns with resistance development is the bollworm. The primary control strategy for bollworm has been synthetic insecticides, particularly pyrethroids. Pyrethroid resistance monitoring programs have been conducted with bollworm since the mid-1980's. From 1990 to 2006, bollworm resistance to pyrethroids increased 21-fold. A major problem with bollworms is caused by exposure to pyrethroids in many different crops, leading to very high resistance selection.

Insecticide resistance development can produce major hurdles to production agriculture. In cotton, resistance monitoring is critical for a number of pests, particularly those that have been targeted for eradication. Hundreds of millions of dollars have been spent in the boll weevil eradication program. The eradication of this pest enabled cotton production to rebound in certain areas of the country. Insecticide resistance development in this pest could prove costly to the cotton industry in the U.S. Similarly, the western portion of U.S. cotton production, which is involved in pink bollworm eradication, could be greatly impacted by insecticide resistance development in this pest.

Resistance development to insecticides is a concern for other species of insects because of over use of products in cotton production. For example, several species are exposed to the neonicotinoid class throughout the season. Aphids and tarnished plant bugs are exposed to these chemicals from insecticide seed treatments targeted at thrips, foliar sprays where they may be the primary target, and foliar sprays of premixes targeting other species later in the season. For tarnished plant bugs, acephate has long been the standard control option, but over use of this product has likely led to the resistance currently found in mid-South populations. At this point, cotton producers should combine insecticide resistance management strategies with other best management practices to reduce selection pressure on these pests.