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STATUS OF CHEMICAL CONTROL STRATEGIES

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Abstract

Chemical control of the tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), has become considerably more difficult in recent years due to changes in cotton production, IPM, and farm landscape. The result of these changes has been higher populations that persist late in the season that are more difficult to control with recommended insecticides. The efficacy of several products, including acephate and dicrotophos, is decreasing while tarnished plant bug populations in some areas are demonstrating significant decreases in their susceptibility to insecticides. The expense of controlling tarnished plant bugs has increased in recent years due to an increase in the frequency of applications and higher costs of products. Although the agrochemical industries are aggressively pursuing research and development of novel insecticidal molecules, there are limited alternatives to currently recommended products.

Introduction

The tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), is a common pest of cotton throughout the southern and southeastern areas of the Cotton Belt. Yield losses in cotton due to this pest vary over time and location. The primary factors for these variations include: (1) environmental conditions favorable to tarnished plant bug population growth and development, (2) weather that results in preferred wild hosts becoming less attractive, (3) environmental conditions that stress cotton, which results in greater sensitivity to tarnished plant bug injury, and (4) efficacy of insecticides registered and labeled for tarnished plant bug control. The purpose of this report is to briefly describe the current pest status of tarnished plant bug and evolving chemical control strategies.

Current Pest Status

Historically, the tarnished plant bug has been considered an early season pest of cotton and has been of little concern after the initiation of flowering (Tugwell et al. 1976). The cotton plant is most susceptible to yield losses from tarnished plant bug injury between the four to six true leaf stages through early squaring. Tarnished plant bug injury generally results from feeding on small squares, which abscise from the cotton plant (Layton 1995). However, this insect has become a primary pest of flowering cotton in the United States. Recent research has shown that tarnished plant bug feeding on bolls can cause significant yield loss (Russell et al. 1999). During the flowering period, tarnished plant bugs were inadvertently controlled by organochlorine, organophosphate, carbamate, and pyrethroid insecticides targeting boll weevils, *Anthonomus grandis grandis* (Boheman) and heliothines. The success of the boll weevil eradication program and wide scale adoption of *Bacillus thuringiensis* Berliner *var. kurstaki* cotton cultivars eliminated many of those applications (Roberts 1999). In addition, the use of more selective insecticides that target Lepidopteran pests (i.e. spinosad, indoxacarb, and emamectin benzoate) have increased survival of tarnished plant bugs. Consequently, the increased numbers of insecticide applications for tarnished plant bugs in cotton have primarily been during the flowering period. In addition, tarnished plant bug resistance to a variety of insecticides (organophosphates, carbamates, pyrethroids) in the mid-south states has contributed to the elevated status of this insect pest.

Across the mid-south states during the previous 15 years (1990-2004), tarnished plant bug has infested 77 to 99% of the cotton acreage. During those years, 44 to 93% of the infested acres were treated with one or more insecticide applications. For the past four years, chemical control strategies against tarnished plant bug were applied to over 65% of the mid-south cotton acres. Cotton yield loss estimates from this pest during 2001-2004 (Figure 1) were generally higher than those observed since 1990 (Head 1991-1993, Williams 1994-2005).

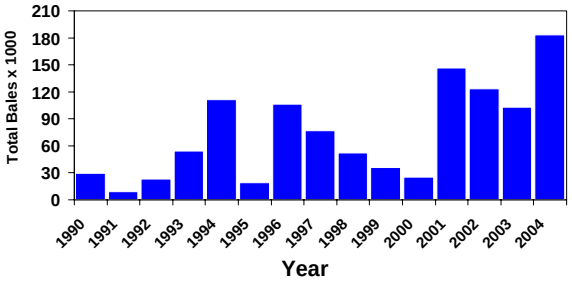

Figure 1. Cotton yield losses (bales x 1000) from tarnished plant bug in the Mid-South Region (Arkansas, Louisiana, Mississippi); adapted from cotton insect losses reports, 1991-2005 Proceedings Beltwide Cotton Conferences.

Insecticide Use Trends

Tarnished plant bug management relies almost exclusively on chemical control. Insecticides recommended for tarnished plant bug control in Louisiana, as well other mid-south states, include acephate, dimethoate, dicrotophos, thiamethoxam, imidacloprid, novaluron, and oxamyl (Bagwell et al. 2005). Of those listed, acephate and dicrotophos are the most frequent compounds selected by producers due to their concurrent efficacy against other Heteropteran pests of cotton.

Across the mid-south states, the frequency of insecticide applications per year has varied during the past 15 years (Figure 2), but an increase has occurred across the entire period (Head 1991-1993, Williams 1994-2005). During 1990-1993, the number of insecticide applications per year targeting tarnished plant bugs was less than one. During 2003 and 2004, producers applied 2.3 and 4.4 insecticide treatments per year, respectively, for this pest.

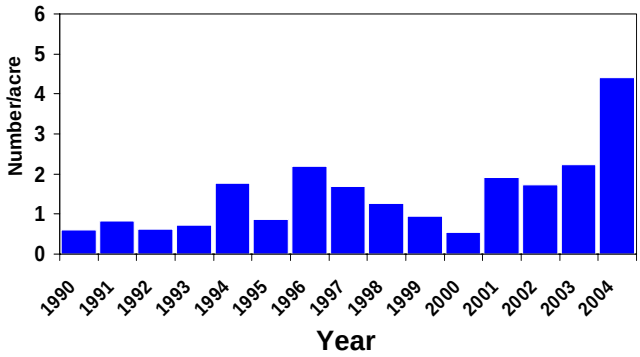

Figure 2. Frequency of insecticide applications against tarnished plant bug in the Mid-South Region (Arkansas, Louisiana, Mississippi); adapted from cotton insect losses reports, 1991-2005 Proceedings Beltwide Cotton Conferences.

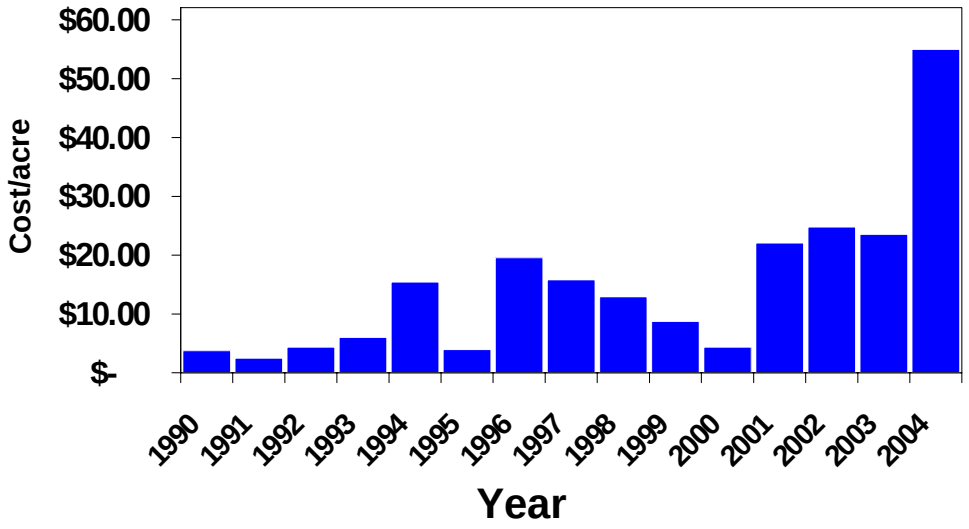

Figure 3. Cost of insecticide applications against tarnished plant bug in the Mid-South Region (Arkansas, Louisiana, Mississippi); adapted from cotton insect losses reports, 1991-2005 Proceedings Beltwide Cotton Conferences.

Insecticides Recently Registered or In Development

Novaluron. Chemtura Corporation (formerly Crompton Corporation) registered the benzolphenyl urea compound, Diamond 0.83EC during 2004 (Weiland 2005). The mode of action is defined as an insect growth regulator interfering with the process of chitin formation. The primary target pest in cotton is tarnished plant bug, but suppression of some Lepidopteran pests has also been observed. Actual use rates range from 0.039-0.091 lb AI/acre or 6-14 oz product/acre. Diamond is selectively active against immature stages, expresses relatively long residual properties, and demonstrates ovicidal activity.

Flonicamid. FMC Corporation registered the pyridine carboxamide compound, Carbine 50WG, during 2005 (Long et al. 2004, Treacy and Mize 2005). Although the structure is similar to that of the neonicotinoids (imidacloprid and thiamethoxam), the proposed mode of action is defined as different and unique. Current research suggests that it disrupts the insect nervous system by influencing Ca^{+} concentrations at target sites. The primary target pests in cotton are cotton aphid, *Aphis gossyppi* (Glover), and tarnished plant bug. Actual use rates range from 0.036-0.089 lb AI/acre. Efficacy of this compound is related to rapid cessation of feeding after intoxication without producing immediate mortality of the insect.

Metaflumizone. BASF Corporation is currently developing a novel compound (BAS 320I) in the phenyl semicarbazone class (Anderson et al. 2005). This compound is scheduled for registration during 2006 or 2007. The proposed mode of action is thought to block the Na^{+} channel in the insect nervous system and cause a state of paralysis. Target pests in cotton that are likely to be listed on the label will include tarnished plant bug and selected Lepidoptera. The rates tested in cotton have ranged from 0.08-0.25 lb AI/acre. The mode of action for metaflumizone is considered to be unique in that no evidence of cross-resistance with other compounds has been detected in target pests.

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