PERFORMANCE OF ACEPHATE AGAINST TOBACCO THRIPS AND EVIDENCE OF POSSIBLE RESISTANCE

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Abstract

Historically, acephate has been considered the "go-to" insecticide for foliar applications due to its effectiveness and relatively low cost. However, the efficacy of acephate on thrips has seemingly declined in Tennessee during recent years. Therefore, research was done to assess the efficacy of acephate against multiple populations of tobacco thrips collected from Tennessee and different locations in the Mid-South and Southeast. Data from bioassays of field-collected thrips as well as historical data of the field performance of acephate applications were presented. Results of the leaf-dip bioassays of tobacco thrips showed a considerable range of mortality for Orthene 97 (acephate) at 0.25 lb ai/acre. Radiant SC (spinetoram) at one-half the normal field use rate (0.012 lb ai.acre) provided consistent and higher mortality. Dose-response curves for three populations collected in Tennessee, including an F1 population where the F0 population was selected with acephate, indicated acephate at 1 lb ai/acre caused approximately 44-78% mortality. In contrast, acephate at 0.25 lb ai/acre caused an average mortality of about 96% for a laboratory colony of tobacco thrips maintained at Mississippi State University. Regression analysis of the field performance data for acephate showed a significant decline of thrips control with acephate in field trials done in Tennessee since 2005. Thrips control for Radiant or Intrepid Edge (spinetoram) at an equivalent rate of spinetoram has remained unchanged over time.

Introduction

Thrips are the most pervasive pest of seedling cotton in the mid-southern and southeastern U.S. Due to the ubiquitous nature of this pest, virtually all cotton grown in the Mid-South and Southeast receive at-planting treatments, typically a neonicotinoid seed treatment. Many acres are also treated post-emergence with foliar-applied insecticides including, most commonly, acephate, dimethoate, and dicrotophos. Spinetoram (Radiant SC or Intrepid Edge) is also recommended for thrips control but is seldom used because of the relatively higher cost.

Recently tobacco thrips' resistance to neonicotinoid insecticides has been documented in much of the Cotton Belt (e.g., Huseth et al. 2016, Darnell-Crumpton et al. 2018). This has led to an increased number of foliar applications targeting thrips. Historically, acephate has been considered the "go-to" insecticide for foliar applications due to its effectiveness and relatively low cost. However, the efficacy of acephate on thrips has seemingly declined in Tennessee during recent years. Therefore, research was done to assess the efficacy of acephate against multiple populations of tobacco thrips collected from Tennessee and different locations in the Mid-South and Southeast.

Methods and Materials

Bioassays - Thrips collections were done in 2019 at multiple locations in Tennessee, the Mid-South, and Southeast to evaluate the efficacy of acephate on tobacco thrips using bioassays. Field-collected thrips populations were tested. Leaf discs were dipped into solution for one second and allowed to air dry for one hour. Twenty-four hour leaf-dip bioassays were done using fresh cotton leaf tissue. The lids of 1.5 ml microcentrifuge tubes were used to make the leaf discs for each tube. Eight adult, female tobacco thrips were aspirated into each tube; 10 reps (tubes) were used per treatment. Tubes with thrips and leaf tissue were placed into an incubator set at 27-29C. Mortality was assessed at 24 hours. Data were analyzed in SAS using Proc PROBIT (α=0.05) (SAS Institute, Cary, NC).

Field Performance - For individual efficacy trials done in Tennessee, mean treatment responses were converted in each trial to percent control. Data used were thrips numbers at 3-6 days after treatment. Linear regressions were done weighted by the average number of thrips in the non-treated plots of each trial. Data were analyzed in SAS using Proc REG (SAS Institute, Cary, NC).

Results and Discussion

Results of the leaf-dip bioassays of tobacco thrips showed a considerable range of mortality for Orthene 97 (acephate) at 0.25 lb ai/acre. Radiant SC (spinetoram) at one-half the normal field use rate (0.012 lb ai/acre) provided consistently higher mortality (Figure 1). Dose-response curves for three populations collected in Tennessee, including an F1 population where the F0 population was selected with acephate, indicated acephate at 1 lb ai/acre caused approximately 44-78% mortality. In contrast, acephate at 0.25 lb ai/acre caused an average mortality of about 96% for a laboratory colony of tobacco thrips maintained at Mississippi State University (Figure 2). Regression analysis of the field performance data for acephate showed a significant decline of thrips control with acephate in field trials done in Tennessee since 2005. Thrips control for Radiant or Intrepid Edge at an equivalent rate of spinetoram has remained unchanged over time (Figures 3, 4 and 5).

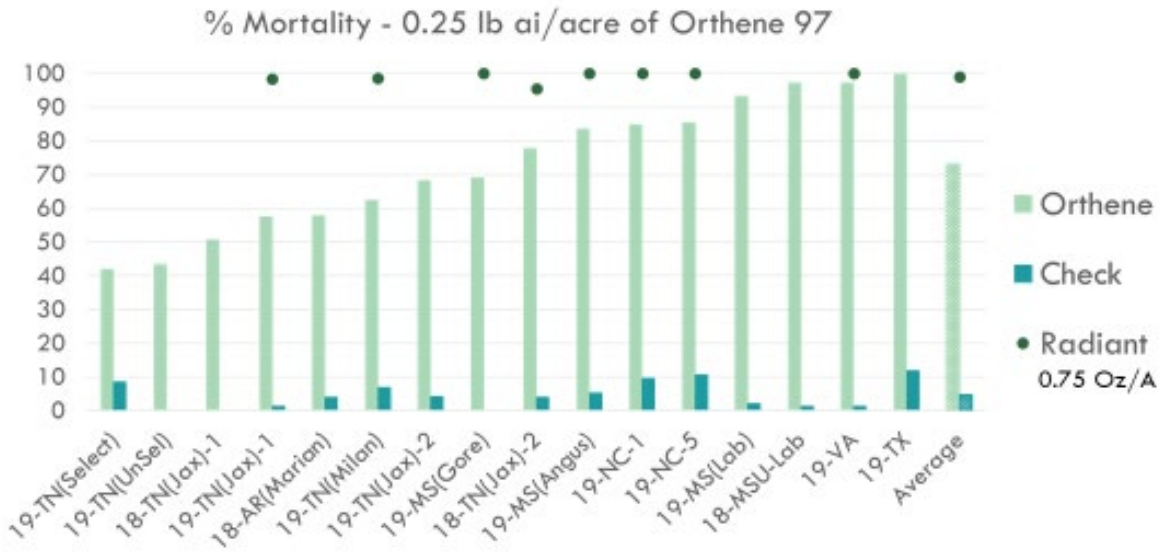

Figure 1. Results of 24-hour leaf-dip bioassays to assess the efficacy of acephate (0.25 lb ai/acre of Orthene 97) against tobacco thrips populations from multiple locations in the Mid-South and Southeast (2018, 2019).

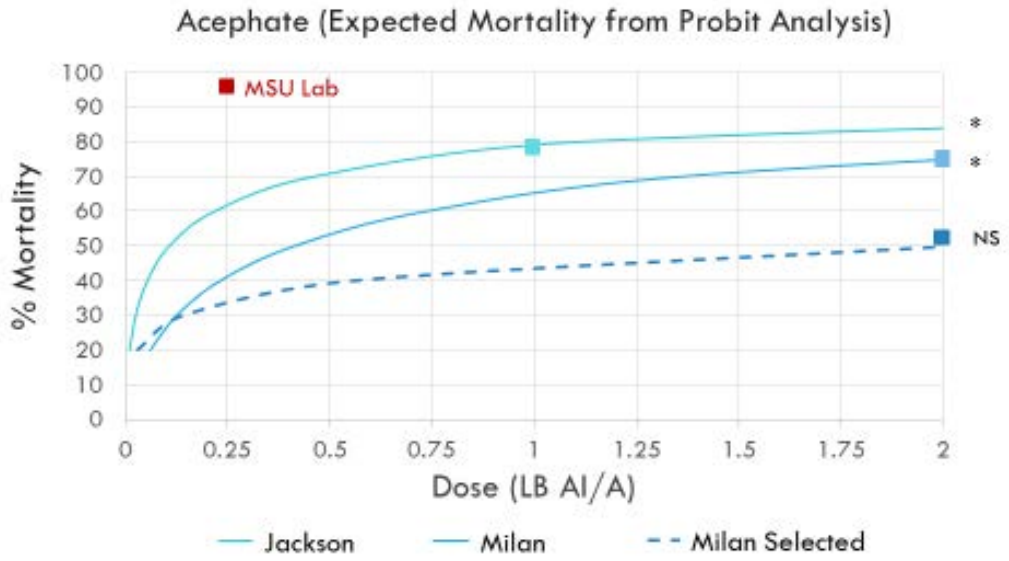

Figure. 2. Dose response to acephate using bioassays of three field collected populations of tobacco thrips from Tennessee compared with a lab colony from Mississippi State University (2019). *, Indicates a significant probit fit ($P < 0.05$); squares show actual mortality at highest rate tested.

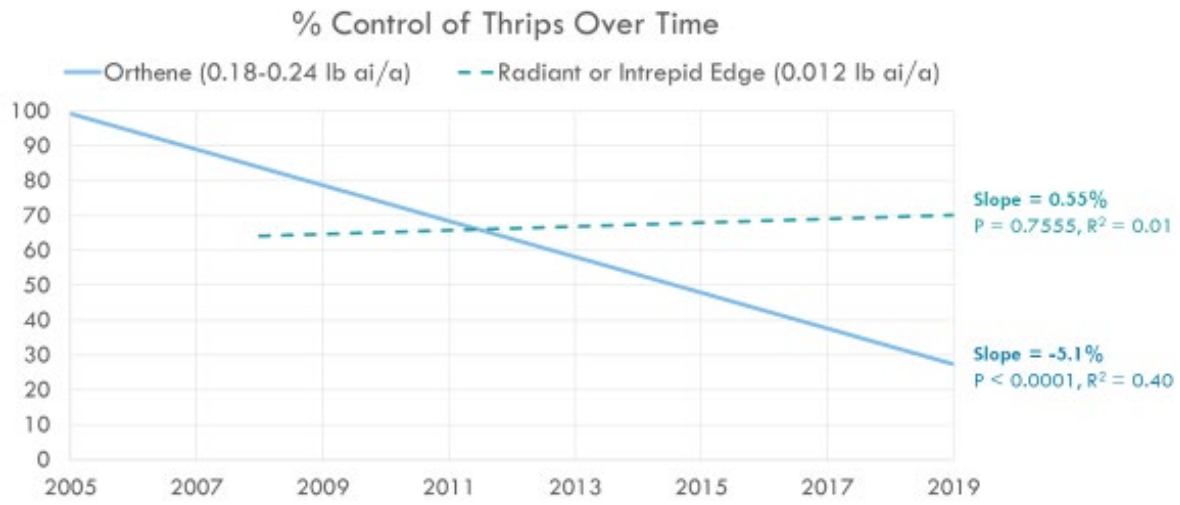

Figure 3. Linear regression lines of thrips control over time for acephate (Orthene) and spinetoram (Radiant or Intrepid Edge) in replicated field trials in Tennessee since 2005.

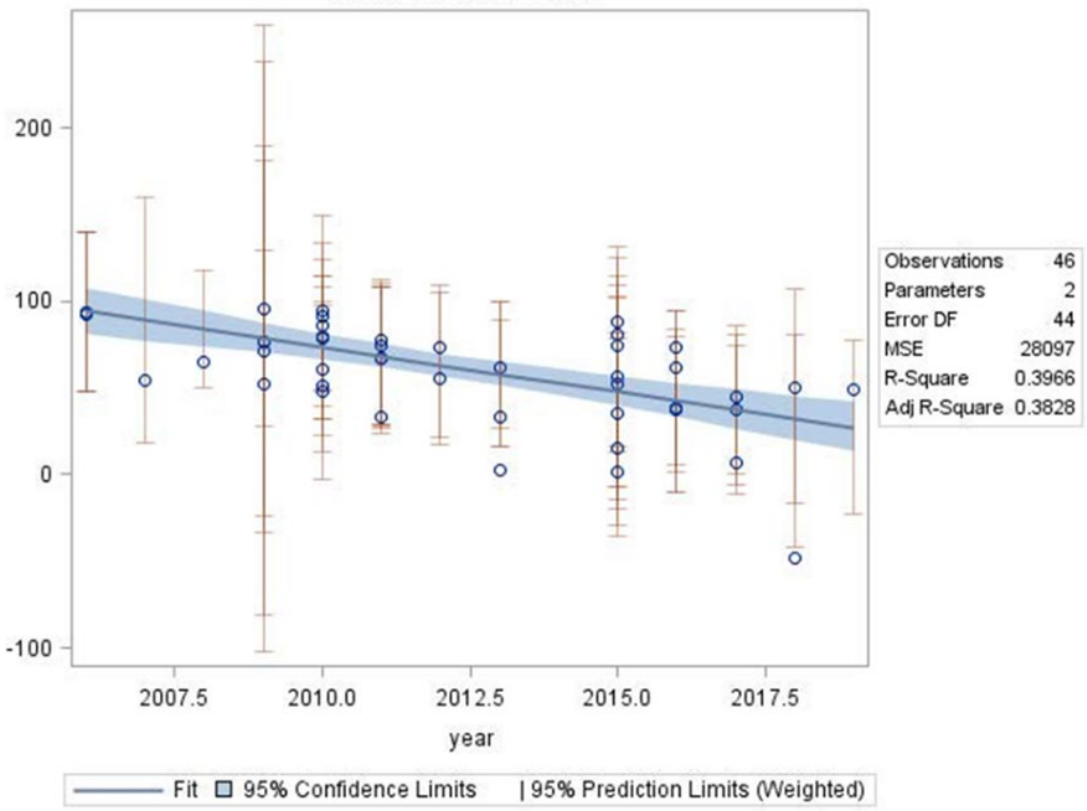

Figure 4. Detailed regression analysis of thrips control over time for acephate (Orthene) in replicated field trials in Tennessee since 2005.

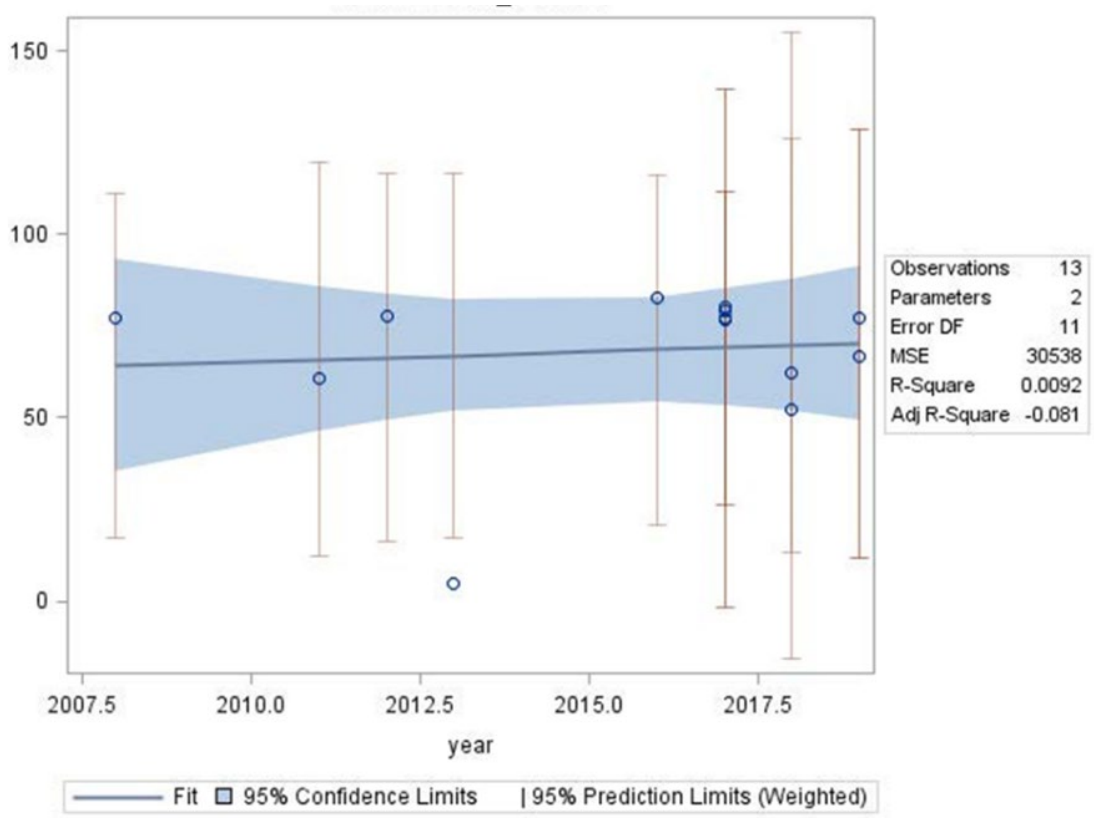

Figure 5. Detailed regression analysis of thrips control over time for spinetoram (Radiant or Intrepid Edge) in replicated field trials in Tennessee since 2008.

Acknowledgements

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