QUANTIFYING TARNISHED PLANT BUG RESISTANCE TO ACEPHATE IN LOUISIANA

Josh T. Copes
Winnsboro, LA
Gordon Snodgrass
USDA
USDA-ARS, SIMRU
Stoneville, MS
R. D. Bagwell
Jonathan W. Sharp
LSU Agcenter
Winnsboro, LA

Introduction

The tarnished plant bug (TPB), Lygus lineolaris is a key pest of cotton production. Prior to the boll weevil eradication and the introduction of Bt-cotton cultivars, the TBP historically was considered a secondary pest of cotton in many areas of the mid-south. The TPB has become the primary pest of cotton in many areas of the mid-south after the elimination of the once primary pests: the boll weevil and tobacco budworm. There has been an associated increase in reliance on acephate and dicrotophos as control tools because of the increase in importance of the TPB. The concern is obviously that with the increased reliance on acephate and dicrotophos that resistance could possibly develop to either of these two compounds. Circumstantial evidence would suggest that resistance to acephate could already be impacting cotton production. For example in 1996 the recommend use rates for acephate to control TPB were 0.33 to 0.5 lbs of (AI)/acre. Eleven yrs later the LSU AgCenter now recommends use rates that are ~ 2X higher with use rates of 0.5 to 1.0 lbs of (AI)/acre. Even at the higher use rates, there have been a number of reports of difficulties of control recently, even at multiple applications of 1.0 lbs (AI)/acre. Dr. Snodgrass has been documenting changes in the tolerance levels of TPB to acephate in MS for a number of years. The first TPB populations with significant tolerance to acephate were found in MS in 2005, and further increases in tolerance levels were seen the following year in these TPB populations. Thus the objectives of our research were to determine if TPB control complaints are due to resistance or some other factor, and evaluate acephate use rates for farm performance.

Materials and Methods

The assays performed were: field efficacy, a discriminating dose and a dosage mortality line test, the later two being glass vial bioassays. Field efficacy tests were performed at 8 locations. The populations of TPB for the glass vial bioassays were collected from alternate hosts near the field efficacy test site. Site selection was limited due to certain aspects that must be met. 300-500 adult TPB were needed for vial tests and locations with alternative hosts adjacent to in field tests where this amount of plant bugs could be collected were chosen. The field efficacy study was 4 rows by 50 ft. Efficacy was evaluated 5-7 DAT by using a 2.5 ft. black drop cloth and checking 2 areas within each plot. The TPB populations used in the vial test were collected near the field efficacy evaluation site. Methamidophos was evaluated in the discriminating dose assay and mortality was assessed at 2hrs. The dosage mortality assay 2 sets of dosage rates were used. The first dosage rates were: 0ug, 5ug, 10ug, and 15ug per vial, and these were traded out for higher dosages of acephate per vial because even at the highest dosage of 15ug per vial low mortality in most of the TPB populations were observed. The second dosage rates were: 0ug, 10ug, 25ug and 50ug per vial. Mortality was assessed 24hrs after treatment.

Results

Results for field efficacy and resistance monitoring for acephate were inconclusive. Figure one shows the total average of percent control of TPB for all locations. There was not a significant difference in percent control (~79-81%) from 0.75 to 1.0 lbs AI/Acre and only slightly higher control (~87%) observed at 1.25 lbs AI/Acre. At the Angola location approximately 80% control was observed in the field efficacy tests, but our discriminating dose glass vial bioassays suggest that approximately 96% of this plant bug population could possible be resistant to acephate. In the dose mortality line glass vial bioassay only 50% mortality was observed at the highest dosage of acephate of 15ug/vial. The glass vial bioassays in this population contradict the results of the field efficacy test. The Mound location field efficacy test show approximately 60 and 80 percent control at 0.75 and 1.0 (the highest label rate of acephate) respectively. The discriminating dose assay suggests that the entire population is possible resistant to acephate, and the dose mortality line assay revealed no change in mortality over the entire dosage range (Figure 3). No trends can be established between the field efficacy assay and the glass vial bioassay. The field efficacy test results at the Wisner1 location showed the lowest percent control when compared to the other locations. At 0.75 lbs of AI/Acre approximately 60% control was observed, and at the highest label rate of acephate (1.0 lbs of AI/Acre) a lower percent control of approximately 50% was shown. The discriminating dose assay results for this population revealed the lowest survival percentage for a population thus far of 54.8%, the other percentages being over 95%. The dose mortality line results show excellent control (80.9%) of this population even at the lowest dosage rate of 5ug/vial. Again no clear trends between field efficacy results and glass vial bioassay results can be observed (Figure 4). The Wisner2 location was within the same field as the last location but at another site within that field, and the test was conducted a week later. The field efficacy results show excellent control (~80%) at the lowest rate of acephate of 0.50 lbs of AI/Acre and not a significant difference from this control percentage when compared to the remaining rates of acephate. The results of the discriminating dose assay revealed only 36.1 percent of this population could possible be resistant. In the dose mortality line assay this test was the first to use the second dosage rates (0, 10, 25, 50ug/vial) of acephate for this glass vial assay. Excellent control (91.7%) was observed at the lowest dosage of 10ug/vial, and the mortality of the remaining dosages not being significantly different (Figure 5). This population and results of the three assays establish somewhat of a clear trend between them.

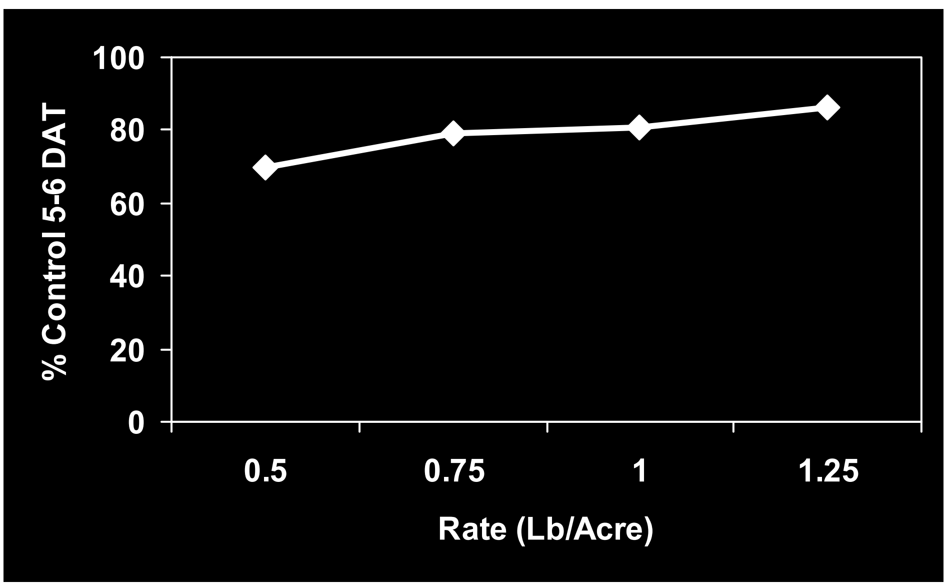
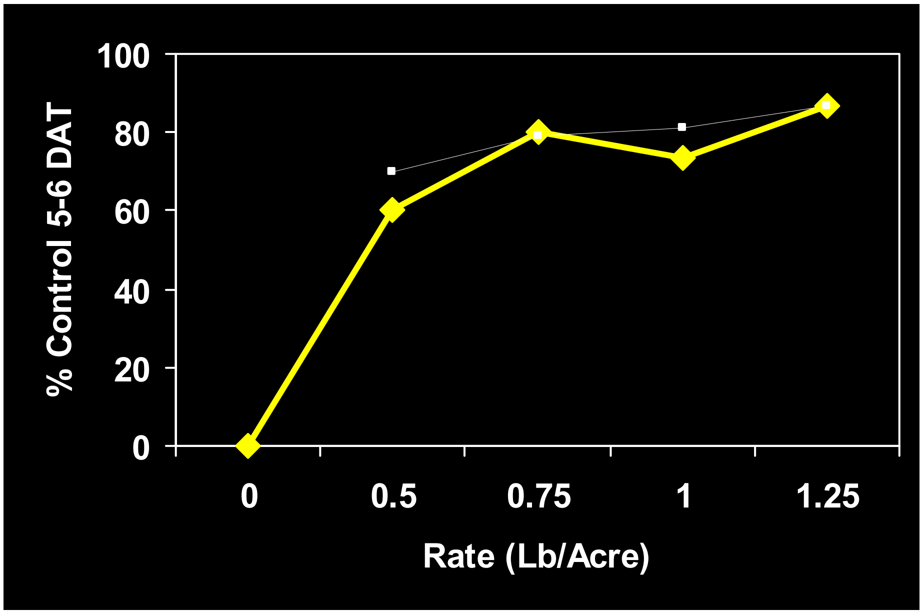


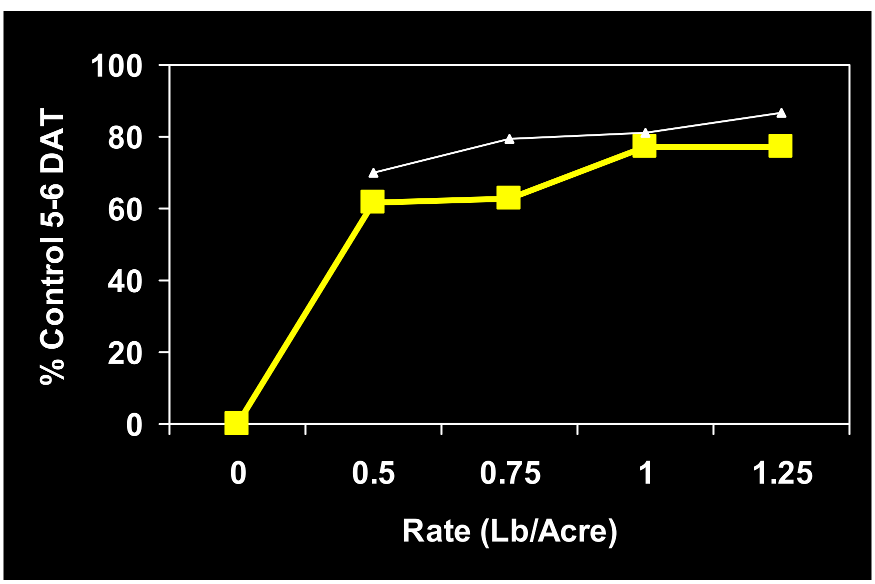
Figure 1 Total Avg. Percent Control for all Locations.



Discriminating dose survival = 96

% Mortality by acephate dose:
0ug/vial = 0%
5ug/vial = 15.4%
10ug/vial = 24.1%
15ug/vial = 50%

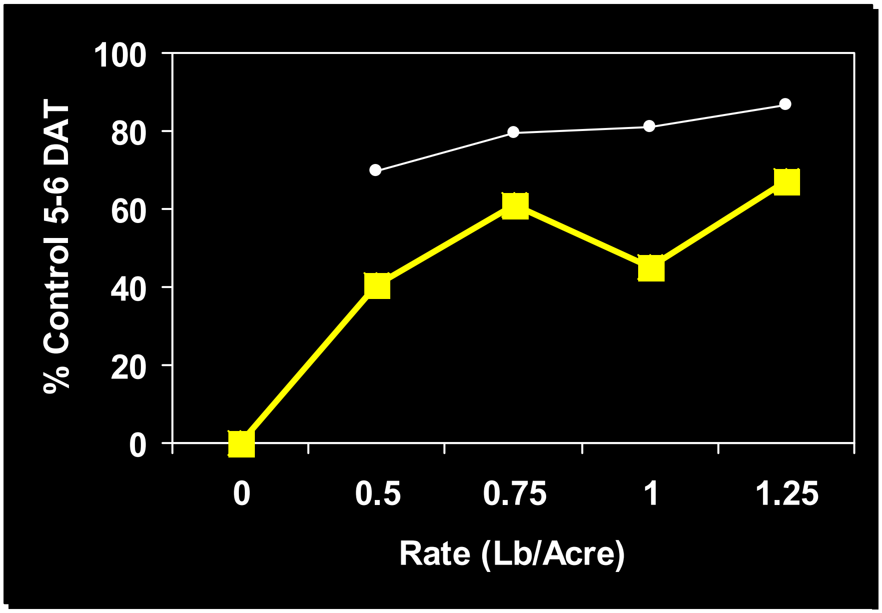
Figure 2 Percent Control of Angola Population When Compared to Total Avg. Percent Control and Glass Vial Bioassay Results.



Discriminating dose survival = 100%

% Mortality by acephate dose
0ug/vial = 0%
5ug/vial = 15%
10ug/vial =15%

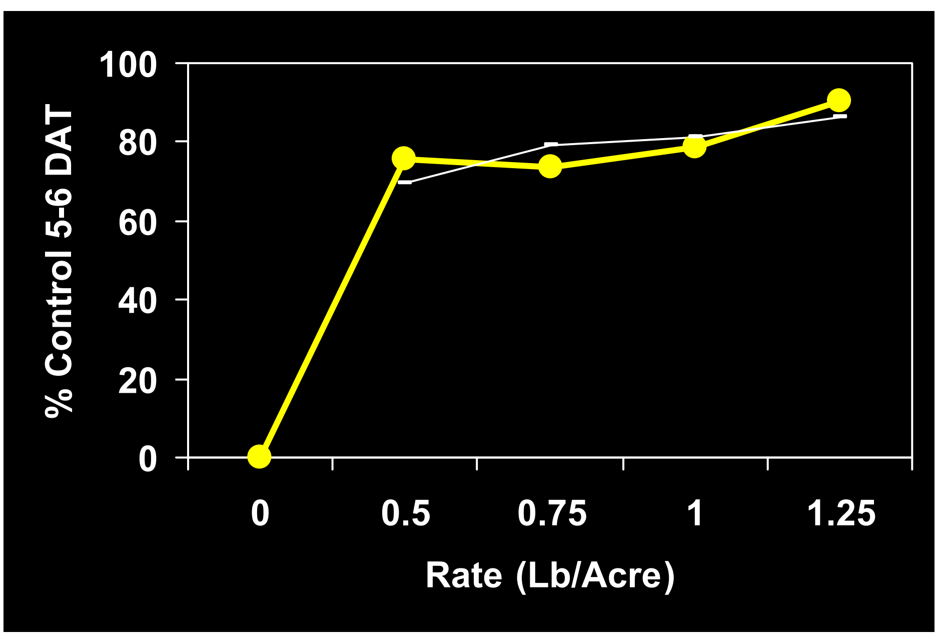
Figure 3 Percent Control of Mound1 Population When Compared to Total Avg. Percent Control and Glass Vial Bioassay Results.



Discriminating dose survival = 54.8

% Mortality by acephate dose:
0ug/vial = 21.4%
5ug/vial = 80.9%
10ug/vial = 97.6%
15ug/vial =92.9%

Figure 4 Percent Control of Wisner1 Population When Compared to Total Avg. Percent Control and Glass Vial Bioassay Results.



Discriminating dose survival = 36.1

% Mortality by acephate dose:
0ug/vial = 19.4%
10ug/vial = 91.7%
25ug/vial = 100%
50ug/vial = 97.2%

Figure 5 Percent Control of Wisner2 Population When Compared to Total Avg. Percent Control and Glass Vial Bioassay Results.

Discussion

In summary a clear establishment between vial and field efficacy data could not be established. Acephate field efficacy was similar between the rates of 0.75 and 1.0 lbs AI/Acre. These rates providing approximately 80 percent control. Resistance may play a role in control difficulties of acephate, but other factors are likely contributing to poor field activity of acephate.

Aknowledgements

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