SEASONAL CONTROL OF SWEET POTATO WHITEFLIES IN COTTON USING AERIAL ELECTROSTATIC CHARGED SPRAYS

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Abstract

Aerial electrostatic charged sprays of Thiodan + Ovasyn, Danitol + Orthene, Capture + Orthene, and Asana XL + Curacron were compared with electrostatic uncharged sprays (applied with the electrostatic system) and with conventional spray applications at 0.75 + 0.25, 0.20 + 0.50, 0.08 + 0.50 and 0.05 + 0.50 lb active ingredients (a.i.) per acre, respectively, for seasonal control of sweetpotato whiteflies (SWF) on cotton during the 1995 season at Maricopa, AZ. Electrostatic charged sprays of Thiodan, Danitol, Capture and Asana applied at one-half label rates using the same chemical combinations were also included in the study. The volumetric spray application rates for electrostatic spray charging and conventional protocols were 0.5 and 5.0 gallons per acre, respectively. Seasonal mean numbers of viable eggs and live large nymphs in the electrostatic spray charging protocol at the full label rate were comparable to those in conventional applications. Seasonal means of SWFs were significantly higher in the one-half label rate than in the full label rate electrostatic charged and conventional spray applications. The data suggest that the potential for electrostatic spray charging technology as a practical application method is substantial and that with additional research this technology could be moved towards commercialization.

Introduction

Electrostatic spray charging technology is purported to increase deposition of pest control materials on living plants. Carlton et al. (1995) reported that aerial electrostatic charged sprays increased deposition of spray materials on cotton significantly compared to uncharged and conventional spray applications. Since the emergence of sweetpotato whitefly as a major pest on many cropping systems in Arizona, California, and in the Rio Grande Valley of Texas, interest in increasing spray deposition on the bottom leaf surfaces of plants where whiteflies locate has received the attention of many researchers in the United States. On cotton, whiteflies are persistent pests as they remain on cotton until the crop is harvested with the risk of causing "sticky" cotton. Furthermore, the presence of alternative hosts or other crop fields during the growing season near cotton fields facilitates movement of the insect from one host crop field to another. This requires more frequent control operations in cotton. Whether or not electrostatic spray charging technology can be used to control SWFs on cotton should be determined in order to provide guidance in research and development of this technology.

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The objective of this study was to determine the efficacy of electrostatic spray charging protocol against sweetpotato whiteflies on cotton. The intent was to determine whether or not insecticides of diverse chemistries will control SWFs on a seasonal basis using the electrostatic spray charging protocol which required a volumetric application rate of 0.5 gallon per acre compared to conventional protocol applied at 5.0 gallons per acre.

Materials and Methods

Field Description. This study was conducted in a 60 acre field located at Maricopa Agricultural Center, Maricopa, AZ., during the 1995 growing season. There were four application treatments which were comprised of electrostatic spray charging at full label active ingredient rate (a.i.) (T_1), electrostatic spray without charging at the full label a.i. rate (T_2), electrostatic charging at one-half label a.i. rate (T_3) and a conventional application at full label a.i. rate (T_4). All treatments with electrostatic spray charging nozzles mounted on a Cessna AgHusky were applied at 0.5 gallon per acre. The conventional sprays were applied at 5 gallons per acre using CP nozzles (The CP Products Company Inc., Mesa, AZ). Carlton (1995) provided detailed descriptions of the electrostatic spray system used in this study. The number of sprays, application dates, description of pest control materials and the a.i. rates used in this study are shown in Table 1. Spray treatments were arranged in a split-plot design with four replications.

Determination of Treatment Effects. Treatment effects were assessed by sampling SWF eggs and nymphs from upper and mid-canopy positions 3 days after sprays were applied. Three locations for sampling SWFs were established at the center of the swath trajectories in each plot. Six main stem leaves were collected from each canopy at each sample location in each treatment plot within each replication. Viable eggs and live large nymphs from each 0.13 sq in leaf plugs taken from each leaf were counted according to the methods described earlier (Latheef et al. 1994). Statistical analyses of the data were conducted using SAS (1988). Means were separated using the Least-squares means technique at the 5% level of probability.

Results and Discussion

The seasonal mean of SWF eggs in the upper canopy in T_1 did not differ significantly from that in T_4 (Table 2). The seasonal mean of eggs in T_2 was significantly greater than those in T_1 and T_4. Among all treatments, T_3 had significantly the highest number of eggs and live large nymphs in the upper canopy. The seasonal means of live large nymphs in T_1 and T_4 in the upper canopy were comparable.

The seasonal means of SWF eggs in T_1 and T_4 in the mid-canopy were comparable. T_1 and T_2 also had similar number of eggs in the mid-canopy, but T_2 had significantly higher number of eggs than T_4. The seasonal mean of eggs in T_3 was significantly the highest among all treatments. The seasonal mean of live large nymphs in the mid-canopy followed a pattern similar to that in the upper canopy.

The data suggest that electrostatic charged sprays at the full label rate reduced SWFs on a seasonal basis to a level comparable to that in conventional spray applications. The one-half label rate treatment did not reduce SWFs significantly compared to full label rate treatment. Carlton (1995) reported that T_3 was operative at less than the marginal level because of nozzle leakage and hence wetting of electrodes which decreased deposition of pest control materials. Whether or not poor performance of T_3 was due to an a.i. response or to diminished activity of electrostatic spray charging system or due to a combination of both factors is not known. Additional research will be required to address the issues involved vis-a-vis reduction in the efficacy of electrostatic spray system in T_3.

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Table 1. Spray number, spray dates, description of insecticides and active ingredient rates.

Spray # and dates	Insecticides[a]	Rate lb (a. i.)/acre[b]
1. July 17	Thiodan 3EC + Ovasyn ® 1.5EC	0.75 + 0.25
2. July 28 & 29	Thiodan 3EC + Ovasyn ® 1.5EC	0.75 + 0.25; 0.75 + 0.125
3. Aug. 4 & 5	Danitol ® 2.4EC + Orthene ® 90S	0.20 + 0.50; 0.10 + 0.50
4. Aug. 16 & 17	Danitol ® 2.4EC + Orthene ® 90S	0.20 + 0.50; 0.10 + 0.50
5. Aug. 25	Danitol ® 2.4 EC + Orthene ® 90S	0.20 + 0.50; 0.10 + 0.50
6. Aug. 31 & Sept. 1	Danitol ®2.4EC + Orthene ® 90S	0.20 + 0.50; 0.10 + 50
7. Sept. 7 & 8	Capture ® 2EC + Orthene ® 90S	0.08 + 0.50; 0.04 + 0.50
8. Sept. 13	Asana ® XL 0.66EC + Curacron ® 8E	0.05 + 0.50; 0.025 + 0.50

[a] Volumetric spray application rates for electrostatic and conventional system sprays were 0.5 and 5 gallons per acre, respectively.
[b]Beginning July 28, an electrostatic spray charging treatment at one-half label a.i. rate was added.

Table 2. Seasonal means of SWF eggs in upper and mid-canopy leaves in cotton treated aerially with electrostatic and conventional system sprays.

Treatment	upper canopy		mid-canopy	
	eggs	nymphs	eggs	nymphs
	Means per 5.1 cm^2 leaf area[a]			
T_1	5.0c	1.6b	2.9bc	1.4b
T_2	8.0b	1.4b	3.7b	1.4b
T_3	11.1a	2.2a	6.0a	2.6a
T_4	4.5c	1.1b	2.4c	0.9b

[a]Means within each column followed by the same letter were not significantly different at the 5% level (Least-squares means)