Whole Season Rotational Pesticide System for Integrated Pest Management for Control of Sweetpotato Whitefly in Cotton

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Abstract

A season long pesticide rotational system for cotton management of Bemisia tabaci (Gennadius) (SPWF) was put in place. The system tried to minimize pesticide impact on midseason build-up of beneficials against SPWF. SPWF thresholds were used to begin use of "potent, efficient" insecticides to stop exponential increase of SPWF in late season. Insecticide class rotation was a key element of the system to prevent insecticide resistance. Comparisons between test blocks and best agricultural practices for rest of field showed that SPWF eggs and large immature of September populations, yields (2.68 bales/Ac), and beneficials were about the same among the blocks. The cotton was free of stickiness in the entire field.

Introduction

Control strategies for sweetpotato whitefly (SPWF), *Bemisia tabaci* (Gennadius) (Aleyrodidae: Homoptera) must account for a pest that has many diverse hosts at any time during the year. SPWF populations that interact between melons, cotton, and vegetables are particularly difficult to control. Integrated crop management is a vital component of the system. A first step is to develop integrated pest management (IPM) for the specific crop involved, in this instance, cotton.

The objectives of our study were to use IPM principles, rotate chemical class usage to prevent development of insecticide resistance, and to minimize detrimental insecticidal impact on beneficial arthropods to promote biological control. An important challenge to the practical application of IPM is to utilize both biological and chemical control in a compatible manner in the field to achieve true IPM.

Materials and Methods

Sundance Farms of Coolidge, AZ, was chosen for the study site. The experimental fields were solid planted with DPL 5415 cotton under furrow irrigation. The field was divided into four 5-ac blocks. Each block was subdivided into 5 replicated strips with 5 subplots within each replicate for a total of 25 sampling points within each block. Leaf samples were taken to count SPWF eggs and large immatures. Sticky cards were used to sample adult SPWF. Standard sweep net samples were used to estimate beneficial arthropod populations. Applications were by ground with a John Deere HI Cycle 6000®. It was outfitted with a boom that had inverted "Y" drops with Tee Jet® nozzles by Spray Systems Inc. to penetrate the canopy at 70 psi. Each row was sprayed by 2 side and 1 overhead nozzle with 25 gal/ac delivered.

Results and Discussion

For early season control, the first two 5-ac blocks received aldicarb 5lb/ac (Temik®) at planting and a side-dress application of 15 lb/ac. On the first 5-ac block (Rotation I), pink bollworm (PBW) pheromone as NOMATE® was put out with chlorpyrifos (LOCK-ON®) 3 times (weekly) against PBW at pin-head square and NOMATE alone 2 times as determined by PBW pressure (via Delta traps). On the second 5-ac block (Rotation II) that received aldicarb, 3 applications were made with thiodicarb (Larvin®) at pin-head square against PBW. On the third 5-ac block (Rotation III), oxamyl (Vydate®) with methomyl (Lannate®) was applied for early season pest and PBW control. The fourth block was a best agricultural practices per the farm protocols and did receive aldicarb as a side dress treatment.

For mid-season control on the first 3 blocks (Rotations I,II, and III), biorational agents were used for pest arthropod control as needed, with a second goal of preserving beneficial arthropod populations. These agents, primarily targeted toward lepidopterous pests, were BT (Biobit®), and Diflubenzuron (Dimilin®). Also, Potassium salts of fatty acids (M-PEDE®), and petroleum oils (Saf-T-Side Oil® and JMS Stylet Oil®) were used as needed on SPWF during June and July. Adult SPWF numbers of 2-3 per plant or large immature numbers of 3-4 per leaf with highest immature count were considered action thresholds.

For late season control, when the SPWF action thresholds of 2-3 large immatures or adults per leaf was exceeded, amitraz (Ovasyn®) with endosulfan (Thiodan, 2C®) was applied twice at weekly intervals in Rotation blocks I- III. Block IV received the regular farm schedule/applications. The pyrethroid, esfenvalerate (Asana®) was applied twice. Though not necessary in this study if control had been still needed, a different class of insecticide would have been used.

In September, mean numbers of SPWF/cm^2 of leaf in all plots ranged as follows: eggs, 13.5 - 29.5 , and large immatures, 2.0 - 3.0, TABLE 1. Mean differences among rotational plots were not statistically significant for eggs nor large immatures. Analysis is still in progress for SPWF adults. Beneficials arthropods counted included: *Chrysopa* adults and nymphs, *Hippodamia*, *Geocoris*, *Orius*, *Nabis*, *Collops*, *Lygus* adults and nymphs, *Zelus/Sinea* (Assassin bugs), parasitic wasps, predacious flies, and spiders. At the end of the season, abundant beneficials were *Chrysopa* adults, parasitic wasps, and predacious flies; ranges of mean/sweep were 6.0 - 10.5, 3.0 -8.5, and 11.5 - 22.5, respectively. Differences among groups were not statistically significant.

Cotton was terminated expediently (about 4 nodes above 1st cracked boll) and harvest aids were used as needed, Ethephon (Prep®) and thidiazuron (Dropp®).

Yield was 2.68 bales/ac (means of 1388 lb/ac) and differences between blocks was not statistically significant. The cotton lint and leaves from all blocks and the remainder of the field were not sticky. The management programs tested in these studies tried to use true IPM and to present methods of insecticide usage to promote biological control by beneficial arthropods and prevent insecticide resistance from occurring. The use of different action thresholds for different parts of the season proved useful to achieve these objectives.

Table 1. Sweetpotato Whitefly September Populations, 3 Sampling Dates, Mean No./cm^2 of Leaf, N = 15.

	STAGE	
BLOCK	EGGS	LARGE IMMATURES
RI	29.5	3.0
RII	13.5	2.0
RIII	16.3	2.1
RIV	15.3	2.4

No statistically significant differences among rotational blocks for eggs or large immatures.