VOLUNTARY AREA-WIDE WHITEFLY MONITORING PROJECT IMPLEMENTATION 1995-1997 GILA BEND, ARIZONA

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Abstract

Growers, Pest Control Advisors (PCA), and University of Arizona Cooperative Extension personnel formulated and coordinated area-wide cotton pest management strategies in the production area near Gila Bend, AZ from 1995-97. The primary target pest was whitefly with secondary control strategy implementation for pink bollworm. In 1995-1996, the coordinated effort encompassed approximately 10,000 and 6000 acres which included 10 and 8 cotton producers respectively and 6 PCA. Due to producer interest and initiative in an adjoining production area, project acreage increased to more than 18,000 acres and included 14 producers and 9 PCA in 1997. The project cost of $3.00/acre was supported by participating producers with the monies used to hire students for field scouting. An economic development grant from the Electrical District #8 supported the project coordinator's salary who is a University of Arizona employee. The area was divided into quadrants with every field within the project sampled a minimum of once weekly for whitefly populations using recommended University of Arizona sampling procedure. As whitefly populations approached treatment thresholds, more frequent sampling was initiated. The population data was then faxed to the responsible producer and PCA on the date of sample. Treatment thresholds and chemistry class suggestions were made by Cooperative Extension with final control decisions and material choice at the producer and PCA discretion. Weekly community wide meetings were conducted and used to discuss general area-wide and field specific population dynamics, treatment suggestions, crop condition, and agronomic and entomological area-wide production strategy recommendations.

Introduction

Due to increasing cotton production costs and relatively flat commodity price returns, profitable cotton production is becoming increasingly challenging in the low deserts of Arizona. Whiteflies are a major pest in the Arizona cotton production system with control costs comprising a significant proportion of the insecticide budget. Arizona cotton producers are keenly aware that production input efficiency will be the key to future individual and possibly industry survival. As a result, producers are extremely interested in accurately identifying components within the production budget that may offer opportunity for increased efficiency, expenditure reduction, while maintaining yield and fiber quality.

Insecticide costs have increased at a rapid rate in the last several years. As a result, all producers are interested in making cost-effective control decisions based on individual field pest populations and technically sound threshold recommendations. In addition, it is recognized that due to the mobile nature of common cotton pests such as the whitefly and pink bollworm, communications relative to area-wide population distribution and dynamics data offers opportunity for increased understanding and pro-active versus reactive pest control approaches. In essence, producers are experiencing the fact that the more information they have regarding pest populations within their communities which have been developed through standard sampling techniques, the better the opportunity to make well informed and cost-effective control decisions.

Program goals and objectives are the following:

1. Implement coordinated area-wide whitefly and pink bollworm management strategies.
2. Develop and document area-wide population distribution dynamics of whitefly and pink bollworm.
3. Reduce insecticide applications through implementation of scientifically sound scouting and treatment threshold utilization.
4. Promote cooperation and communication.

Area-Wide Project Description

The voluntary area-wide community-based program was initiated in 1995 in an area near Gila Bend, AZ and has continued through 1997. Due to programmatic modifications which have occurred over time, the most logical description is annual. An extremely important component of this effort which has contributed significantly to its success has been the voluntary and producer driven orientation. University of Arizona Cooperative Extension provides leadership, coordination, and technical information dissemination relative to area-wide practice of sound entomological Integrated Pest Management (IPM) principles. In many ways, the program can be simply described as implementation of sound and recommended IPM practices on an area-wide commercial scale. In order to offer a comprehensive program description, this section will essentially describe the fluid evolution of deployment.

1995 Pink Bollworm

In 1995, Maricopa County Cooperative Extension provided coordination for an area-wide whitefly and pink bollworm monitoring program. The program was initiated upon request from several cotton producers in the Gila Basin area near Gila Bend, AZ The project was initiated as a

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component of an economic development grant provided by the Electrical District #8 (ED8). In 1995, the program included 10 cotton producers and 6 pest control advisors (PCA) encompassing approximately 10,000 cotton acres. The University of Arizona Maricopa County Cooperative Extension provided project coordination. A project coordinator was supported from funding provided by ED8 and was employed by the University of Arizona (UA). The producers contributed an additional $3.00/acre which was used to support temporary labor, travel, and operational needs.

In 1995, participants collectively decided to pursue an area-wide pinhead square treatment program for pink bollworm control. The criteria used for treatment decisions were based on a well documented heat unit based model of spring emergence of overwintering pink bollworm moths (Figure 1). Overwintering emergence of 95% occurs by the time 1875 heat units (HU) (86/55 F threshold) have accumulated since January 1. Pink bollworm susceptible cotton square production occurs between 800- 900 heat units accumulated since planting. Individual field planting dates and resultant heat unit accumulation measurements from January 1 to the planting date were recorded from a nearby UA Arizona Meteorological Weather Network (AzMet) station. Simple additive arithmetic enabled the implementation of a fundamentally sound heat unit driven pinhead square treatment program. For example, a field was planted on April 1 with a hypothetical 500 heat units accumulated since January 1. A susceptible square occurs at 900 heat units after planting. The first treatable susceptible square will be when 1400 heat units have accumulated since January 1 which was tracked from AzMet. After initial treatment, fields were retreated weekly until 1875 heat units had accumulated since January 1. accounting for protection through the 95% emerging pink bollworm population. Fields were treated until 1875 heat units had accumulated but no more than 3 applications maximum.

The criteria used for the area-wide pinhead square treatment were the following:

1. A minimum of 5-10 moths trapped nightly in the two-week period prior too susceptible square (900 HUAP).
2. Night minimum temperatures were greater than 60 ^{0}F, a temperature conducive to moth flight.
3. Treatment applications include fields within a range of 775 - 875 HUAP.
4. Treat fields weekly but no more than 3 times until 1875 heat unit accumulation since January 1.

The project coordinator tracked heat unit accumulation and informed by fax participants of pending treatable fields. Weekly meetings were also held where all fields were described relative to heat unit accumulation. Material selection and combining area-wide eligible fields were coordinated by producers and PCA.

1995 Whitefly Monitoring

Whitefly sampling was coordinated on a systematic basis. Two summer temporary employees were hired and trained by UA personnel to use the UA whitefly leaf turn sampling technique. The project acreage was divided into quadrants. Each field within each quadrant was sampled at least once weekly. As fields approached a treatable threshold, sampling frequency increased too twice weekly.

The sampled field was divided in half for sampling unit purposes. Adult counts were made from a 15-leaf sample. The UA recommended leaf turn technique for adult evaluation was used. The leaf turn method involves turning up the bottom side of an attached leaf from the fifth mainstem node when counted from the top or terminal down. A leaf is considered infested when 3 or more adult whiteflies are present. The treatment threshold used was 5 adults per leaf which was equivalent through modeling to be 57% of leaves infested.

Whitefly populations were faxed on the same day to the responsible producer and PCA. In addition, weekly meetings were held where area-wide comprehensive whitefly populations were distributed to all participants. Chemical material choices were discussed with recommendations disseminated as a result of UA efficacy studies. Chemistry rotation was encouraged for resistance management purposes. In addition, the meeting content subject matter was general with UA dissemination of research based crop production information as well as general participant information sharing.

1995 Results

1995 can be described as a failure relative to effective or improved area-wide pest control. Whitefly populations were low through the middle of May. Populations began to increase in late June and became very high in July. Populations rapidly increased beyond the treatment thresholds with high frequency treatment intervals occurring on most fields within the area (Figure 2). All fields received at least 3 whitefly control application treatments with 7-8 being normal (Table 1). Efficacy seemed to be very low which was documented at a later time to be the result of a resistance increase within the area. Treatment records were used in support of a Section 18 request for the use of Insect Growth Regulators in 1996.

In spite of the apparent project failure to meet goals, the participants felt a great deal was learned and expressed interest in continued effort in 1996.

1996 Project Description

Many project participants felt that the area-wide pinhead square treatment efforts may have contributed to rapid and severe whitefly pressures in 1995 due to removal of natural enemy complexes early in the season from non-selective area-wide chemical applications. Area-wide strategy implementation included the planting of Bt. cotton on approximately 70% of the acreage, effectively eliminating pink bollworm treatment necessity. The remaining 30% of the acreage was treated with pheromones in order to deploy a soft approach to early season pink bollworm management.

The Insect Growth Regulators (IGR), Applaud and Knack were made available in 1996 through a successful granting of a Section 18 for Az. This was an extremely important resistance management tool which enabled minimization or elimination of pyrethroid chemistry. The Section 18 allowed for the use of each IGR only once/season with the final application deadline of August 31. IGR treatment thresholds utilized for whitefly control purposes remained at 1-5 adults/leaf and 0.5 3rd and 4th instar nymphs. Sampling procedure and information transfer was the same as in 1995.

1996 Results

Whitefly populations were substantially reduced across the project area in 1996 (Figure 3). Populations were generally below treatment thresholds the majority of the season. Average whitefly treatments were reduced from 5.17 to 1.95 from 1995 to 1996 respectively (Table 2). Reasons for this are speculative and largely unknown. A possibility includes natural population reduction for unknown reasons. However, population increase trends in late July indicate the potential to experience pressures similar to 1995 existed. Project implementation strategy which included efforts to maximize natural enemy preservation and subsequent softer chemistry (IGR) for whitefly control to maintain natural enemy complexes while effectively controlling whitefly is proposed as a plausible population reduction.

1997 Project Description

Due to producer interest and initiative from an adjacent cotton production area, the project was expanded to include 14 producers, 9 PCA, and encompassed approximately 18,000 cotton acres. Due to the project expansion, 10 field scouts were hired. Again, both districts were divided into quadrants. Each field within the quadrant was sampled once weekly using the UA recommended leaf turn technique for both adult whiteflies and large nymphs.

Treatment threshold language was modified based on a statewide UA modification. In lieu of numeric evaluation, the binomial or presence/absence technique was reported as percent infestation. The IGR treatment threshold used was when both the nymph and adult components were attained. The two component thresholds were when 25-40% nymph and 40-57% adult infestation occurred. These thresholds were the equivalent of 0.5 nymphs and 3-5 adults per leaf based on a 30-leaf sample.

1997 Results

Whitefly populations were at a low level the majority of the season (Figure 4). In general, the project participants feel that implementation of a plan which encompasses thorough and repeatable whitefly population sampling coupled with an incorporated strategy to minimize broad spectrum insecticides when possible has contributed to successful area-wide whitefly management. Average treatments specifically targeted for whitefly control was 1.9 (Table 3). In addition, project participants have communicated the value of the project focus relative to whitefly density and consistent sampling utilization. Whitefly control costs are high, therefore additional information complimenting PCA reports are used to make the most cost effective control decision possible.

Summary

The area-wide voluntary pest management concept can work in Arizona. Reflecting on the previous three years, voluntary coordinated pest management can result in integration of sound scientific principles and research based information on a commercial scale. Communication between participating parties including producers, consultants, and the scientific community is a very powerful tool when used to address specific area-wide problems. Most participants have communicated very positive viewpoints relative to the coordinated project effort and wish to continue and refine strategies. The structure of this project is a true partnership with received input from all parties contributing toward implementation strategy and goal accomplishment.

Table 1. Number of Fields Receiving Treatments for Whitefly During 1995

Ranch	# of Fields	# of Treatments	Av. # of Treatments.
A	31	83	3
B	32	250	8
C	2	6	3
D	3	39	13
E	27	164	6
F	18	104	6
G	8	24	3
H	6	18	3
I	19	85	5
J	7	18	3
TOTAL	153	791	5.17

Table 2. Number of Fields Receiving Treatments for Whitefly During 1996

Ranch	# of Fields	# of Treatments	Av. # of Treatments.
A	27	63	2
B	21	63	3
C	2	0	0
D	0	0	0
E	12	6	0-1
F	11	7	0-1
G	3	0	0
H	6	0	0
I	15	65	4
J	6	0	0
TOTAL	103	201	1.95

Table 3.Number of Fields Receiving Treatments for Whitefly During 1997

Ranch	# of Fields	# of Treatments	Av. # of Treatments.
A	19	30	1.5
B	1	0	0
C	2	0	0
D	19	23	1.2
E	23	6	0.3
F	13	0	0
G	20	73	3.7
H	12	32	2.7
I	15	31	2.0
J	16	35	2.2
K	57	244	4.3
L	19	50	2.6
M	8	12	1.5
N	39	193	4.9
O	18	29	1.6
TOTAL	281	758	1.9

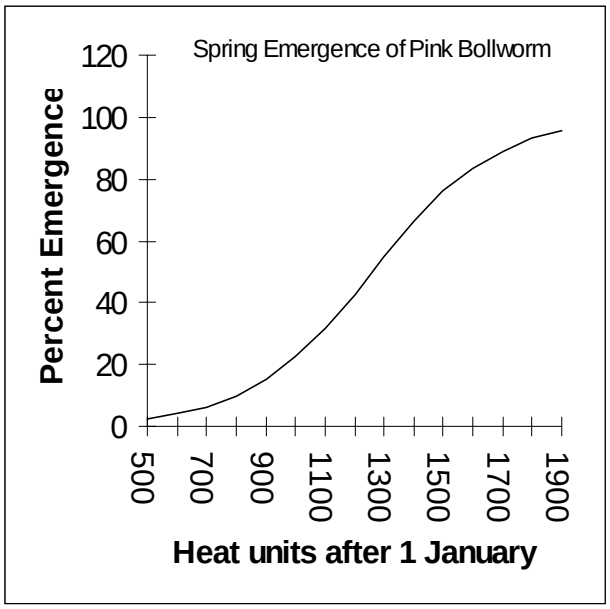

Figure 1. Pink Bollworm Emergence

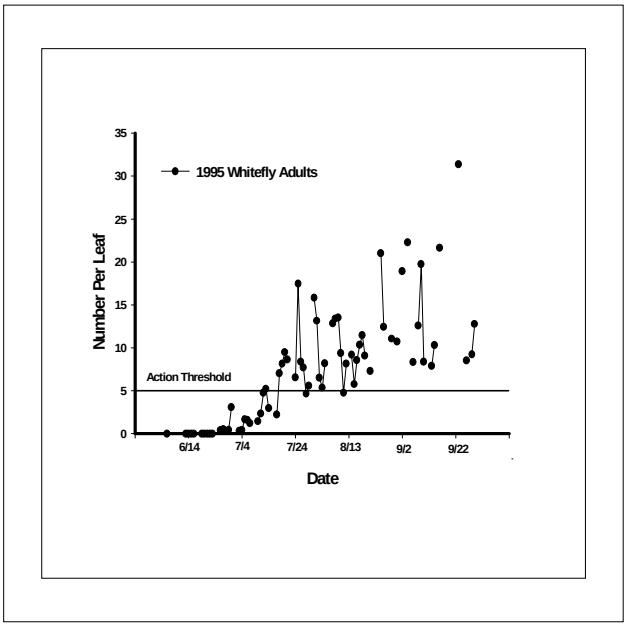

Figure 2. 1995 Whitefly Adults

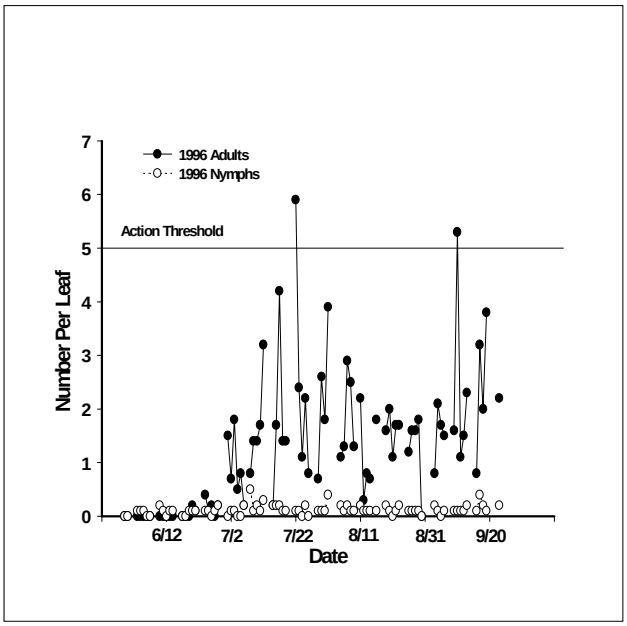

Figure 3. 1996 Whitefly Adults and Nymphs

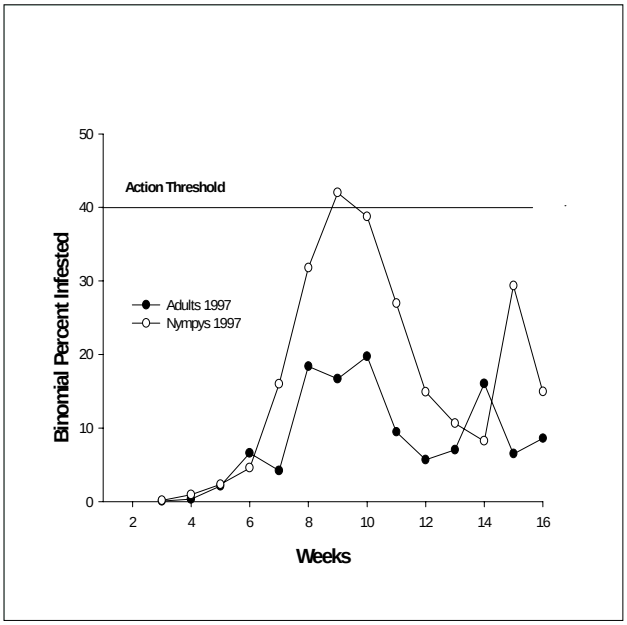

Figure 4. 1997 Whitefly Adults and Nymphs