IMPROVED AREAWIDE WHITEFLY MANAGEMENT THROUGH INDUSTRY AND EXTENSION PARTNERSHIP

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Abstract

Whitefly adult and nymph populations were monitored using the leaf turn method on nearly 18,000 acres. Each field was sampled weekly and field results provided to growers and Pest Control Advisors. Weekly meetings with discussions were held to provide ongoing analysis of whitefly populations and other cotton agronomy issues. This enhanced cooperation and communication with growers and PCAs. Planting date, insecticide applications, location within the area along with transgenic and nontransgenic cotton were studied and effects on whitefly populations recorded. Daily reports to growers and PCAs allowed them to corroborate observations. Planting dates affected population peak occurrence for adult and nymph populations. Nontransgenic cotton had lower whitefly populations. Fields on the Paloma Ranch had lower overall whitefly populations.

Introduction

Areawide pest monitoring and management is desirable for the control of mobile insect pests. It offers a broader understanding of the population dynamic of the pest and the possibility of implementing suppression of pests through cooperation. Within the last 2 years transgenic cotton and insect growth regulators, new tools for insect suppression, have been introduced. Transgenic cotton allowed reduction of applications of insecticides for control of early season pink bollworm, *Pectinophora gossypiella*. Insect growth regulators (IGRs) have been introduced for control of whitefly, *Bemesia sp*. Together, these tools have made it possible to continue growing cotton in the low deserts of Arizona. Due to previous experience with whitefly and its ability to develop insecticide resistance, a program to report population development, based on infield sampling was implemented by growers in cooperation with the University of Arizona Cooperative Extension personnel.

Area-wide management of whitefly is possible using the leaf turn method
for population assessment of adults and nymphs (Ellsworth, et al. 1995, 1996, Naranjo and Flint, 1994). When their density reached a threshold, growers and Pest Control Advisors (PCAs) were alerted and where indicated, insecticidal control was applied for whitefly. This cooperative effort attempted to bring these technologies together, assess their effectiveness and gather the results in an effort to understand how some of the basic activities associated with cotton production interact with the whitefly population development.

Some of the production factors easily isolated were the planting (water dates) dates, variety and pesticide use patterns associated with insect control in cotton. We examined whitefly adult and nymph populations differences associated with these parameters within the area. Field sampling was carried out daily. Individual producers and Pest Control Advisors (PCAs) were informed of the sampling results for their fields. Weekly meetings were held to provide sessions for information exchange.

Program goals and objectives are the following:

1. Weekly assessment of all cotton fields for whitefly adults and nymphs using two, fifteen leaf samples per forty acres or per field.
2. Relay the data to the producer and PCA the day the sample was taken.
3. Meet with Producers and PCAs to promote cooperation and communication.
4. Hold the information in a database to serve as a reference point.

In a companion paper, the result of the previous years, 1995 and 1996 were described (Jech and Husman, 1998). The following report gives some results of these goals for 1997.

Materials and Methods

Extension Component

To become an effective tool for analysis all the collected data was referenced to the field in which it was taken by a system of maps and field numbers. These were then combined to form a unique identification for each field visited on a given date. Planting dates (water dates) and variety planted were entered into a database along with grower's field identification. Data were entered into a file that was then checked against the list of growers and results were faxed to the grower and PCA. The data were then appended to a larger file.

We were available to meet with growers and PCAs to insure that the whitefly field sampling method was understood. We held weekly meetings to share the larger perspective over the area being scouted and encouraged discussion of tactics. We were able to direct samplers to fields of interest and make them aware of treated fields.

Grower and PCA Component

Growers supported the program with monies for scouting activities and provided direction to the program. PCAs provided timely notice of the application of insecticides and the reentry period. They offered valuable suggestions and

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criticism of reporting and problems with interpretation of the data.

Sampling

Fields 40 acres and smaller were sampled in two locations. Fifteen leaves from each location were examined for whitefly adults and large nymphs (instars 3-4). A hand lens was used to aid in the identification and counting of the nymphs. A leaf was considered infested if it had three or more adults and or 1 or more nymphs per leaf.. Data were converted to binomial counts and the percent leaves infested was calculated. Forty percent adults and 40 percent nymphs were considered to be at the action threshold for insecticide control. Larger fields were sampled proportionally. Treated fields were reentered as per EPA reentry interval. Fields skipped were resampled as soon as possible. Data were collected in the morning and counts were entered into the database. In practice, growers and PCAs were warned when fields began to show population increases.

The percent infestation for adults and nymphs was relayed to the grower and PCA. PCAs then confirmed our observations and recommended control action. Although data were collected daily, it is reported here by summing the data for an entire week. This reflects the weekly summary that was prepared for the growers and PCAs. Data presented is the mean of the population for either adults or nymphs.

Planting dates were defined for purposes of investigation as: Very Early (1-15 March), Early (16-31 March), Mid (1-15 April), Late (16-31 April) and Very Late (1 May and later).

Results and Discussion

Overall Whitefly Populations

1997 whitefly populations began to show up sporadically by the second week in July (Fig. 1). Initially, adult populations appeared to be slow to develop. The nymph build up was very rapid. Some fields had received early season control for other pests, notably pink bollworm. In these fields, the adults were not initially numerous enough to forewarn of the build up of nymphs. Fields that exhibited this pattern also appeared to be under some stress. Applications of both IGR and conventional chemistry were used to bring these populations under control (Table 1). Application of control measures brought the whitefly population below action thresholds.

We observed that in many fields the percent of leaves infested by adults did not exceed the action threshold. When nymph populations exceeded the threshold (>40%) and adults had begun to be numerous (>25%), the growers and PCAs were recommended to watch the fields closely and avoid high nymph to adult ratios.

Whitefly Control with Insecticides

Applications of insecticides for whitefly control began the first week in July and continued for 10 weeks (Table 1.). Early applications were for fields that were designated as hot spots. Treatments for whitefly peaked in week 9 and again at the end of the season. Forty-nine percent of acres were treated during week 9. The late season treatments were in response to both adults and nymphs.

Planting Date and Bt Cotton

Comparing whitefly populations on transgenic cotton (Bt) and non-transgenic cotton (NBt) by planting date (Fig. 2), revealed some consistent differences across the area. For cotton planted during the middle-planting interval, from April 1 to April 15, populations of adults and nymphs peaked simultaneously. The difference at this middle interval between the whitefly adult and nymph populations was perhaps the greatest for all planting dates, but points out that the adult populations were lower than the nymph populations.

When comparing planting dates and adult whitefly populations (Fig. 3), the earliest planting dates appear to peak first, followed by the early, mid and late planting dates. The peaks follow, separated by about a week from the previous planting interval. There appears to be a second peak late in the season near mid-August. Figure 4 shows the adult whitefly populations on NBt cotton. Peaks for the very early and early nymphs occur nearly simultaneously and at the same density. Whitefly population peaks on mid and late-planted cotton are separated by one week each. There is some indication that the curve may be bimodal as seen in the adults. The NBt adult whitefly population on the mid-season planted cotton was low and probably reduced the overall population mean.

Nymphal peak populations on Bt cotton (Fig. 5) are above the action threshold when they peak for all planting dates except the middle planting date. Peaks cluster around weeks 9, 10 and 11. A second wave of nymphs was seen in early September. Figure 6 presents the whitefly nymph populations on NBt cotton. Population peaks are lower than those of nymphs from Bt fields. Separation of population peaks appears to be one week for each interval from very early to late.

Gila Basin and Paloma Ranch Whitefly Populations

We compared the Gila Basin with the Paloma Ranch to see if different locations had different whitefly populations (Fig. 7). The Paloma peak population was 2 weeks ahead of the Gila Basin peak population for both Bt or NBt cottons. The NBt cotton also had a second peak population that was very apparent in Gila Basin. Nymphal populations in Gila Basin were present at higher densities and occurred later than on the Paloma Ranch (Fig. 8). Again there appeared to be a second population peak at the end of the season.

Conclusion

Observations presented are based on 285 fields in 1997. Comparisons of transgenic and nontransgenic cotton indicate there are no differences. Differences cited here are more likely due to their previous histories. That history is specific to the field and the populations are therefore diverse within an area. Factors identified here include planting date and decisions of when to initiate whitefly control. We noted the late season population build up of the whitefly population that may pose a threat to open bolls.

Literature Cited

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Table 1. Timing and percent of acres treated for whitefly, Gila Bend, Az. 1997.

Week	5	6	7	8	9	10	11	12	13	14	15
Percent of Acres Treated[a]	9	3	21	40	49	30	36	11	20	17	40

[a] Includes both Conventional and Insect Growth Regulators.

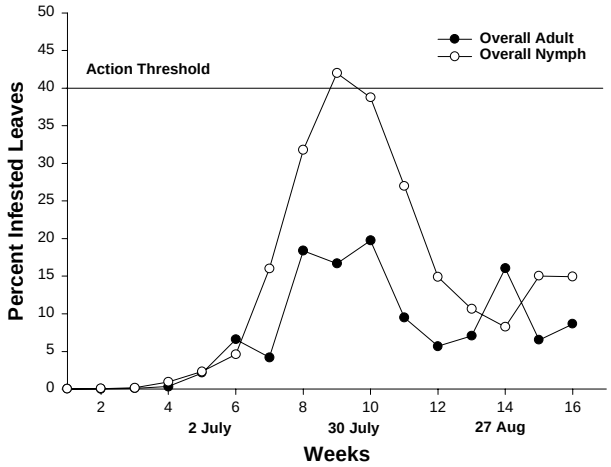

Figure 1. Overall whitefly adult and nymph population dynamics, Gila Bend, AZ, 1997.

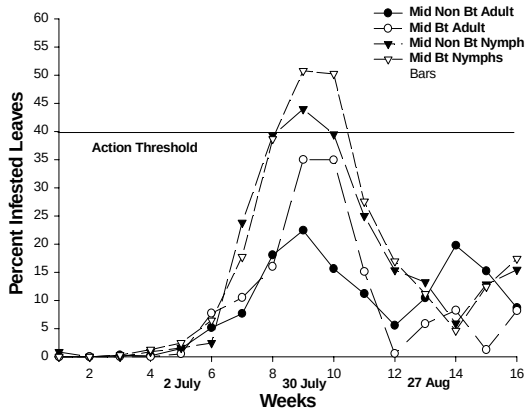

Figure 2. Whitefly adults and nymph populations from the middle planting interval (1 to 15 March) for both transgenic (Bt) and nontransgenic (Non Bt) cotton fields, Gila Bend, AZ, 1997.

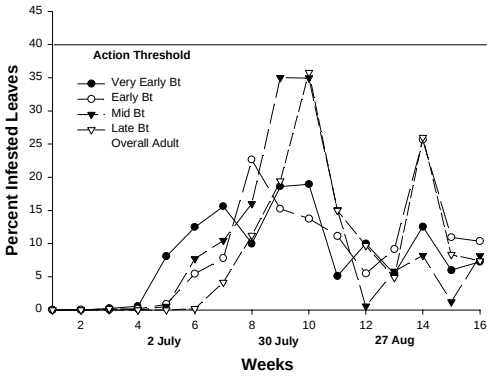

Figure 3. Whitefly adult populations on transgenic (Bt) cotton planted at different intervals (Very Early, 1-15 March; Early, 16-31 March; Mid, 1-15 April; Late, 16-31 April), Gila Bend, AZ, 1997.

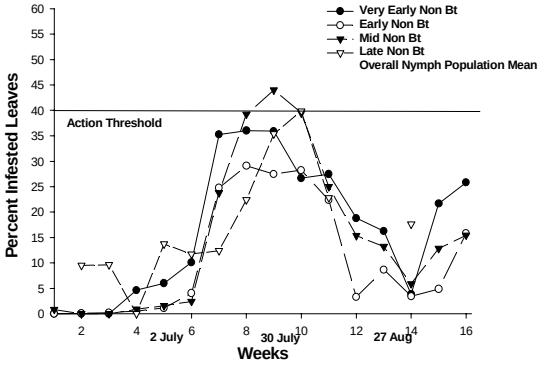

Figure 4. Whitefly nymph on transgenic (Bt) cotton planted at different time intervals (Very Early, 1-15 March; Early, 16-31 March; Mid, 1-15 April; Late, 16-31 April), Gila Bend, AZ, 1997.

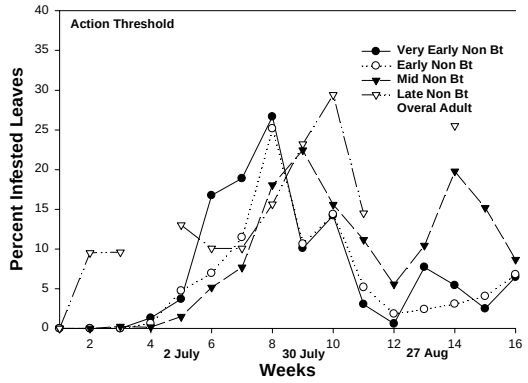

Figure 5. Whitefly adults on nontransgenic cotton (Non Bt) planted at different intervals (Very Early, 1-15 March; Early, 16-31 March; Mid, 1-15 April; Late, 16-31 April), Gila Bend, AZ 1997.

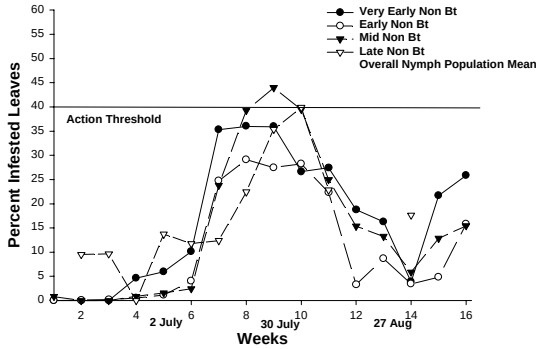

Figure 6. Whitefly nymphs on nontransgenic cotton (Non Bt) planted at different intervals (Very Early, 1-15 March; Early, 16-31 March; Mid, 1-15 April; Late, 16-31 April), Gila Bend, AZ, 1997.

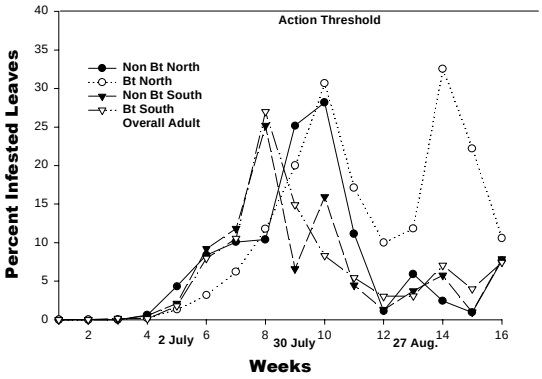

Figure 7. Whitefly adult populations in 2 areas, Gila Basin and Paloma Ranch, near Gila Bend, AZ, 1997.

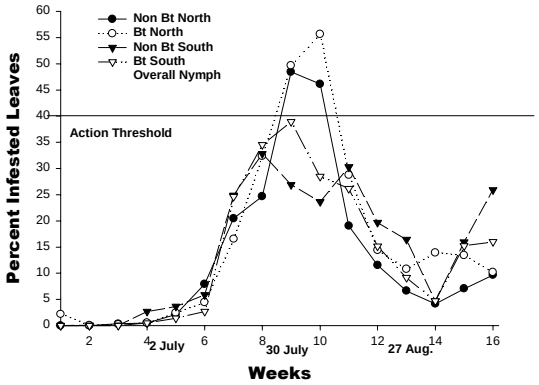

Figure 8. Whitefly nymph populations in Gila Basin and Paloma Ranch, near Gila Bend, AZ, 1997.