Community-wide Insect Management Program in Pima County, 1991

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Abstract

The Marana-Avra Growers' Task Force and Arizona Cooperative Extension worked together to implement a comprehensive, community-wide insect management program. Growers worked in unison to implement a number of Integrated Pest Management techniques; including uniform optimal planting dates, trap cropping, pinhead square spray applications, in-season insect management, and late season management. This strategy focused on the area's primary pest, the pink bollworm (PBW). This program delayed the need to treat for PBW until late August and minimized secondary pest problems. However, research results on the effectiveness of trap crops were inconclusive.

Introduction

In anticipation of increased pest problems, stricter environmental regulations, greater public scrutiny, and economic pressures, Pima County cotton growers formed the Marana-Avra Growers' Task Force, Inc. (MAGTF). The MAGTF requested the assistance of the University of Arizona's Cooperative Extension System in developing a pilot IPM program centered around community action.

Most growers in the community had been using IPM on an individual basis. However, there were a variety of management strategies in use. In the community, this resulted in a wide variety of crop conditions at any point in time, which offered alternative habitats to insect pests as the season progressed. A key element of this program was to coordinate the management strategies of all growers to put additional pressure on insect pests.

Our strategy focused on the key pest in the area, the pink bollworm (PBW). Working with the MAGTF, a number of IPM techniques were applied to reduce PBW populations. These were trap crops, uniform optimal planting dates, pinhead square spray applications, in-season insect pest management, and late season management.

Trap Cropping

In the spring, emerging PBW moths seek out the most mature cotton for egg-laying. In a community with cotton planted at various dates, the earliest fields will tend to build PBW populations soonest. When those early fields are terminated in the summer, PBW populations then shift to younger fields. This problem was avoided with the uniform, optimal planting dates, but trap crops were planted earlier in order to take maximum advantage of this insect behavior.

Growers planted one acre blocks of TAMCOT 37 trap crops about three weeks earlier than the commercial cotton. There were 45 trap crops, all on set-aside acreage, strategically placed throughout the valley so that emerging PBW moths would have no more than one-half mile to fly into a trap crop.

The objective of this was to draw the emerging moths into a few small areas where they could be killed with intensive pinhead square spray applications. Thus, the trap crops were at the susceptible square stage during the peak PBW emergence. As soon as the trap crops reached susceptible square (Figure 1), the MAGTF had the trap crops sprayed by air on a 3-day schedule with Guthion at one quart per acre. Secondary pest problems were not a concern in the trap crops, because the trap crops were to be destroyed before first flower to ensure elimination of all sources of PBW infestation.

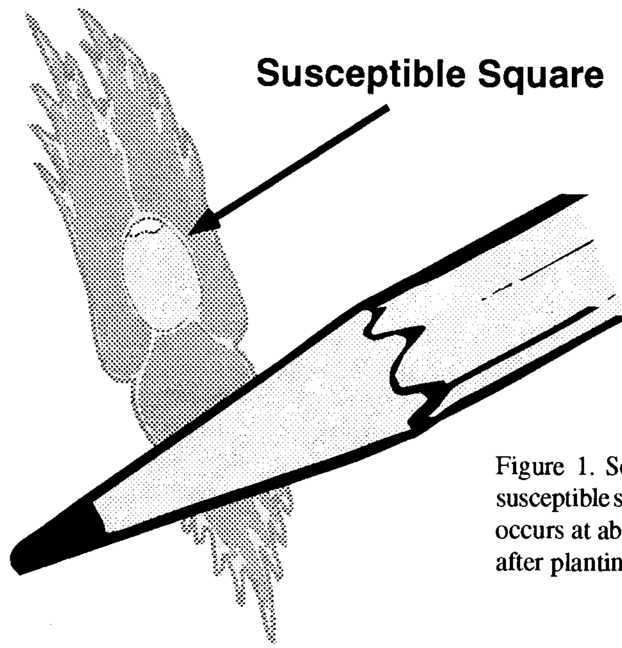

Figure 1. Schematic of susceptible square which occurs at about 900 HU after planting.

To monitor early PBW moth activity, three PBW pheromone traps were placed in each trap crop. Pheromone trap performance is not reliable enough to base treatment recommendations, but does indicate general moth activity and population trends. Mean moth activity peaked on May 25 at about 12 moths per trap per night (Figure 2).

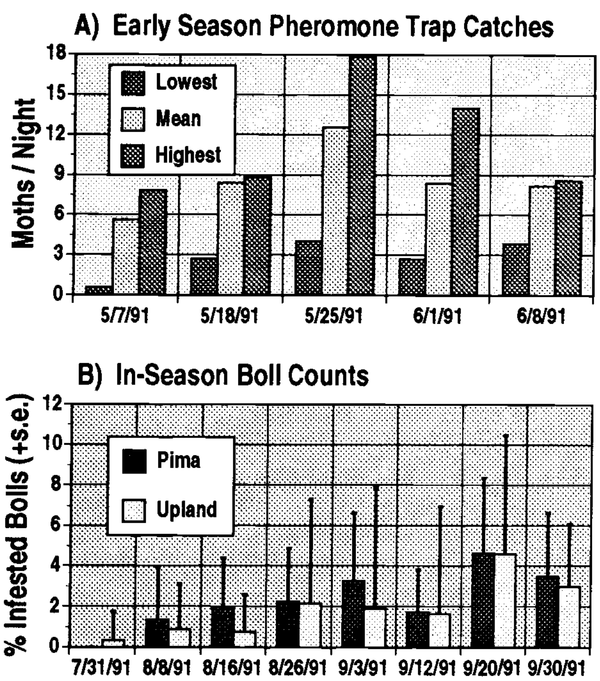

Figure 2. Pink bollworm population monitoring consisted of A) early season use of pheromone traps and, B) in-season boll counts. The error bars represent variation among fields in the entire valley.

As a part of this program, another technique of trap cropping was tested. If a moth lays an egg on a susceptible square, the egg can grow into a fully developed PBW larva. However, the larva cannot complete its development before the square flowers and becomes a boll. We hypothesized that if the trap crops were destroyed before first flower, the pinhead square spray applications would be unnecessary. In effect, emerging PBW moths would be drawn into the trap crop to lay eggs where they could not develop into the second generation PBW.

To test this hypothesis, three pairs of trap crops were configured so that one received pinhead square spray applications and the other did not. Each pair of trap crops was located in the same field, but with a substantial distance between them. Just before the trap crops were plowed under, 500 susceptible squares were sampled from each of the six trap crops in the study (treated and untreated, replicated three times). These squares were examined in the laboratory for PBW larvae. However, no PBW larvae were found in any of the 3000 squares sampled. Although trap crops have proven effective against the boll weevil (Moore & Watson 1990), these results were inconclusive. This research will be repeated next year with modifications in the time of destruction of the trap crops and in the sampling procedures.

Uniform Optimal Planting Dates

PBW larvae overwinter in the soil and cotton trash in the field. In the spring, larvae pupate and adult moths emerge according to temperature conditions regardless of the presence of a susceptible cotton crop. The pattern of spring PBW emergence is characterized by a bell-shaped curve (Figure 3), starting at about 200 heat units (86°/55°F) accumulated since January 1, peaking at about 1200 heat units (HU), and ending at about 2200 HU. The longer planting is delayed, the fewer moths will be able to lay eggs in susceptible squares. However, delaying planting long enough to avoid all emerging moths would seriously reduce cotton yield potentials and could lead to late season pest problems. Therefore, uniform plantings to avoid part of this emergence was a key part of the program.

Research by Silvertooth et al. (1991) showed that short staple cotton yield potentials in Marana were very good when planted within 600 to 900 HU of January 1. Pima yield potentials were good when planted at 600 HU, but began to drop steeply after 700 HU. If all growers began planting at 600 HU, it would be possible to avoid most of the emerging PBW moths. This would leave only the tail end of the emergence curve to control (cross-hatched area of Figure 3).

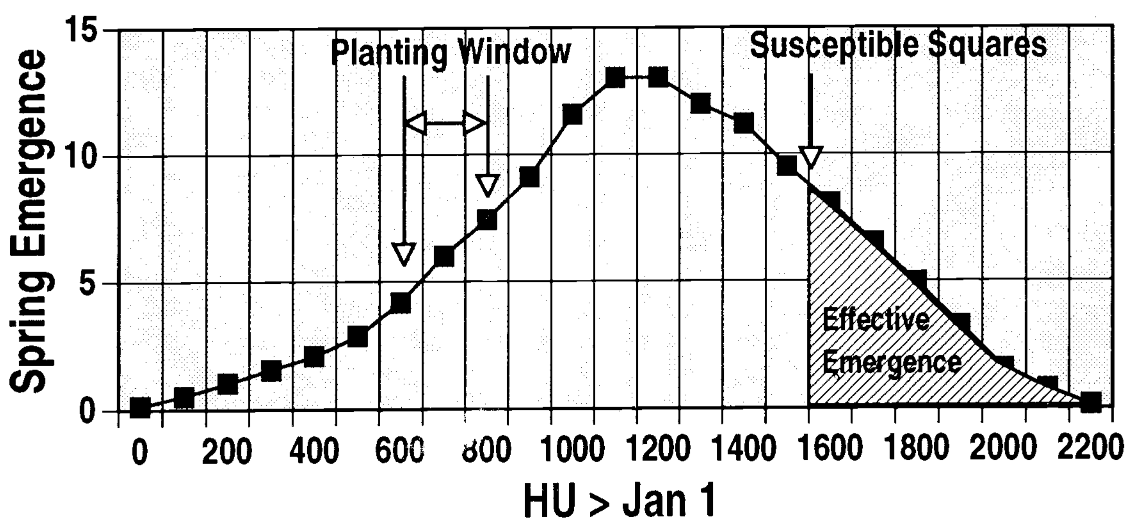

Figure 3. Typical pink bollworm emergence curve with the target planting window (600–900 HU > Jan 1) and initial occurrence of susceptible squares (900 HU > planting) in the valley. Cross-hatched area = PBW effective emergence.

Heat Units became a central tool for the success of this strategy. Cooperative Extension maintains a network of weather stations for delivery of real time weather information (AZMET). Agronomists, biometeorologists, and entomologists used this information to show growers how biological events such as crop and insect development can be reliably predicted by weather trends (Figure 4).

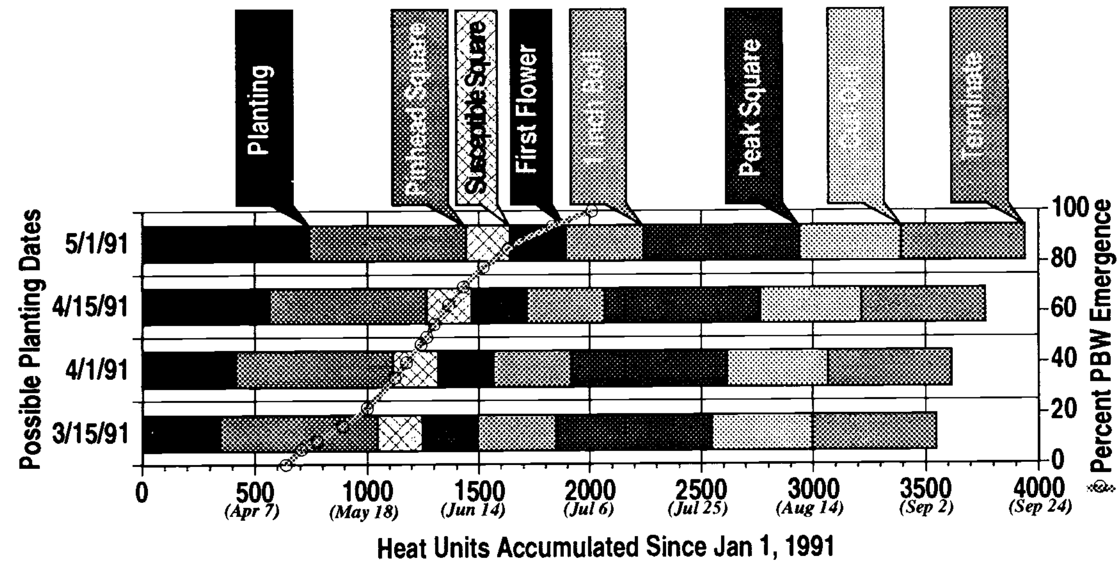

Figure 4. Proposed pink bollworm and cotton phenology in relation to four possible planting dates and heat unit accumulations for Marana in 1991. Actual pink bollworm emergence may have been even earlier.

Beginning in February, weekly newsletters were mailed to growers. These included the AZMET updates, which showed a site-specific, graphic representation of the growing season in relation to HU accumulations. The newsletter also included an insect update, weather summary and 5-day forecast, and an agronomy update. Thacker and Moore added more site-specific information and updates on the MAGTF activities.

Following this strategy, growers began planting cotton at 600 HU after January 1, with an emphasis on getting the Pima planted first. To avoid late season pest problems, most growers finished planting by 900 HU. This "Planting Window" opened late enough to avoid most of the emerging moths and closed soon enough to maintain cotton uniformity, thus preventing a wide variety of crop conditions (and pest habitats) from occurring during the season and facilitating earlier termination.

Pinhead Square Treatments

The pinhead square is a readily identifiable growth stage of cotton that occurs around 700 HU after planting. These squares become susceptible to PBW egg-laying at about 900 HU after planting. Growers began applying pinhead square treatments just before the first susceptible squares appeared and continued treating at weekly intervals to kill any invading moths. This effectively lengthens the period of suicidal emergence. Depending on the time of planting (and hence, the stage of the crop), crops received three, two, or one treatment. The last pinhead square treatments were applied on June 24, about 1700 HU after January 1. This provided protection for the entire valley through July 1, at about 1800 HU and 94% PBW moth emergence.

To avoid creating secondary pest problems, we recommended that the material used for the last pinhead square treatment be effective against both PBW and beet armyworms.

In-season Insect Management

In-season control measures depended on twice-weekly scouting for *Lygus* bugs / fleahoppers, budworms / bollworms, beet armyworms, stink bugs, aphids, whiteflies, and counts of PBW-infested bolls. Control measures were used when warranted by the UA guidelines for cotton insect control (Moore & Watson 1991). Figure 5 shows the 1991 insecticide usage for the Marana Valley. Pima acreage was minor and required significantly more applications for PBW. Upland acreages received only about one in-season application for PBW (exclusive of pinhead treatments). Overall, upland cotton required less than three in-season insecticide applications for all pests.

A) Mean number of applications for all pests

	Pink Bollworm	Lygus Bugs	Budworm/ Bollworm	Total
Upland	1.13	1.14	0.61	2.88
Pima	4.56	0.75	0.75	6.06
Total	1.88	1.05	0.64	3.58

B) Total in-season applications

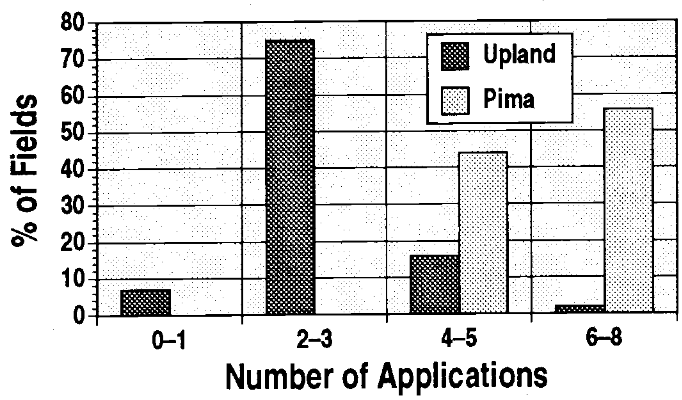

Figure 5. Valley-wide 1991 insecticide usage summary for upland and Pima cotton (exclusive of pinhead square treatments). A) Pima acreage was small, and part of it was out of compliance, B) Percentage of fields receiving various numbers of in-season insecticide applications.

Late Season Management

From the beginning, growers were informed through a series of seminars, workshops, and newsletters. In two of the workshops, growers were shown simple plant-mapping techniques for tracking the status of the plant. This information was related to water and nitrogen management. In addition, the merits of achieving a heavy, first fruit cycle set were explained. There are multiple benefits, not the least of which is late season pest management. By terminating irrigation after the first fruit cycle set, the growers as a community can avoid building up huge numbers of PBW's in their crops. Prompt defoliation and harvest followed by shredding should eliminate much of the late season diapausing generation of the PBW.

Summary

This program was a cost effective community action approach. The costs of this project were shared among all of the community growers. About 30 growers were involved with about 14,000 acres of cotton. The valley consisted of about 20,000 active acres with minor acreages in wheat, alfalfa, lettuce, and pecans. The Marana-Avra Growers' Task Force (MAGTF) members had assessed themselves $5/acre to fund this project. The actual cost that the MAGTF paid out for trap crop seed (freight only, the seed was donated) and spraying amounted to about $.35/acre for the 14,000 acres of cotton. Individual growers bore the costs of growing the trap crops. A total of 40 acres of trap crops were grown. Depending on how many trap crops individual growers had, the cost of trap crops varied from $.50 to $2.00 per acre of commercial cotton.

This program will be continued in 1992.

Acknowledgements

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