Tobacco budworm invades Imperial Valley cotton

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Changes in production practices, as well as insecticides, should help control destructive budworm populations that have developed in late-season cotton.

In 1972, the tobacco budworm, *Heliothis virescens* (F), was found in cotton in California's Imperial Valley. This species is well known in this state, but it has not been a serious agricultural pest, attacking primarily flowers in yards and sometimes causing serious damage to commercial ornamental crops. For a number of years, however, the tobaccco budworm has extensively damaged cotton in Texas, Louisiana, and Mississippi. Some suspect that this "race" of budworm has immigrated into parts of southern California. Studies are under way to clarify the situation—whether it is a recent invader, a different race, or perhaps even a different species despite similarities in appearance to our native budworm.

Budworm larvae feed on cotton flowers, squares, and young bolls in a fashion typical of the better known bollworm, *H. zea* (see photos). Unchecked high budworm populations may reduce cotton yields. In Imperial Valley, the late, actively growing cotton crop is most likely to be attacked. Several predator and parasite species normally destroy a relatively large number of budworm eggs and larvae, but repeated applications of broad-spectrum insecticides to suppress pink bollworm populations in Imperial Valley cotton destroy the predators and parasites. Growers are therefore totally dependent on insecticides to suppress the budworm.

Population dynamics

A survey was initiated in 1973 to estimate the abundance of *Heliothis zea* and *H. virescens* populations in the Imperial Valley. Heliothis eggs were collected from 10 cotton fields. The larvae from these collections were reared in the laboratory until large enough for easy identification. Based on plant stand, plants examined, and eggs collected, the potential number of larvae per acre was calculated.

The graph shows the seasonal abundance of the two species in fields heavily treated for pink bollworm. The tobacco budworm is primarily a late-season pest. Data obtained in subsequent years bear out these data, and, in fact, populations of the budworm have been much more abundant in late-season cotton in production seasons after 1973.

Tobacco budworm larva feeding on cotton boll.

Chemical control

Preliminary large field trials conducted in 1973 and 1974 showed that multiple applications of Azodrin, Guthion, Sevin, Monitor, and methyl parathion applied every seven days did not control the tobacco budworm. However, there were some indications that methomyl alone and methomyl or *Bacillus thuringiensis* (Dipel) applied in combination with chlordimeform would suppress budworm populations, when natural enemies were lacking.

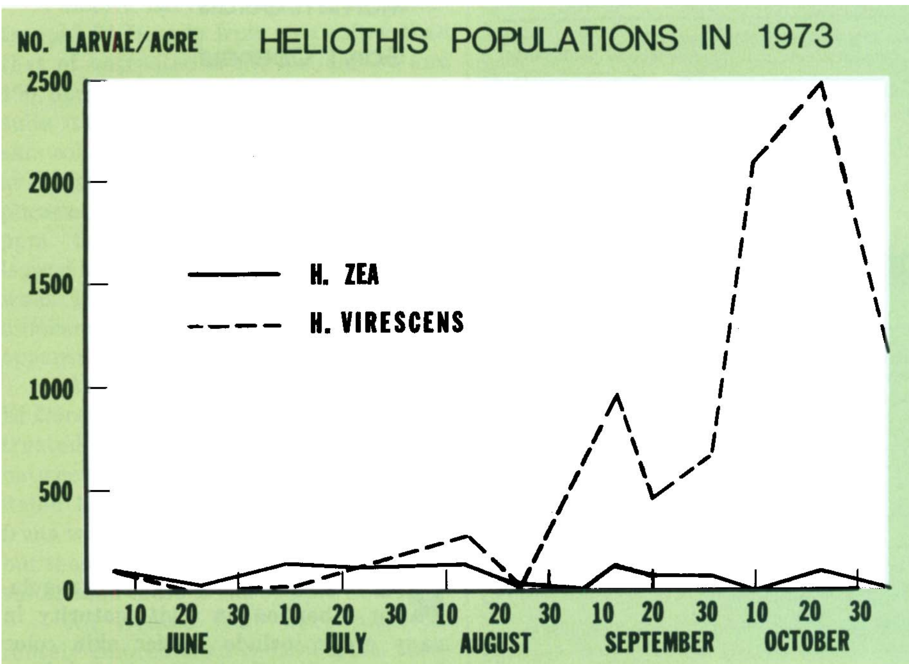
1975 field trials

During the early fall, two field trials were conducted near Holtville on late-planted, actively growing cotton. The purpose was to further test commercially available insecticides for tobacco budworm control. Table 1 shows materials used and application rates.

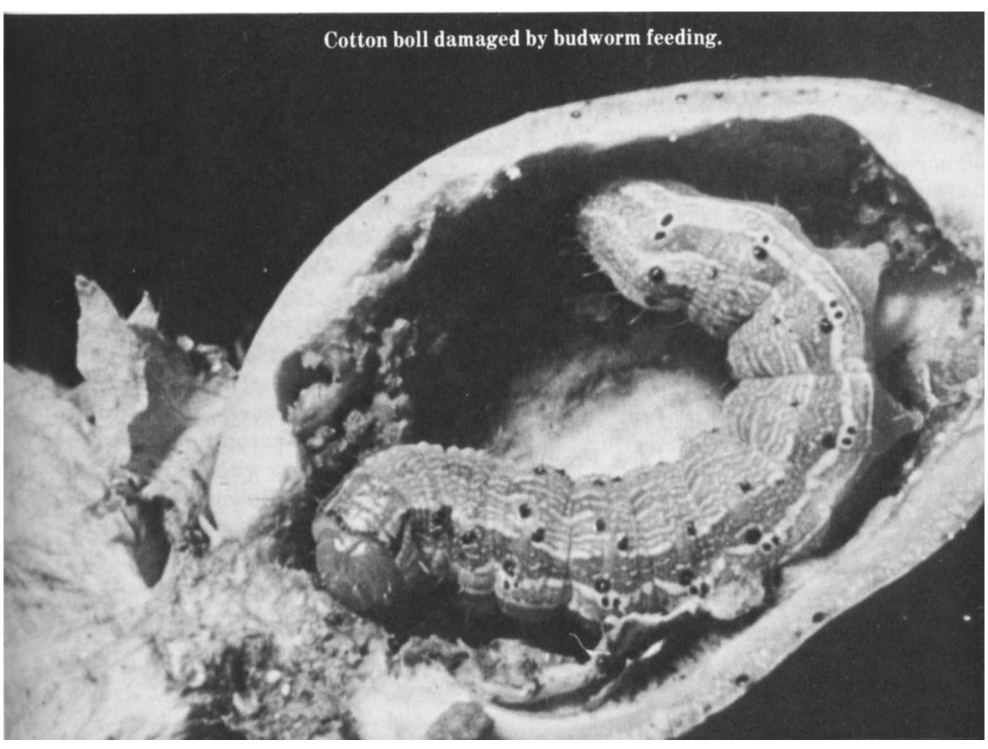
The results indicate that multiple applications of the insecticides tested are necessary to reduce budworm populations. Dipel in combination with chlordimeform, both applied at 0.25 pound active ingredient per acre, significantly reduced budworm populations when compared with the untreated plot after the third application (see table 1). Dipel and chlordimeform alone also gave significant control after the third application.

Three applications of Thuricide also gave some control in the second test (see table 1). In the same test, Lannate, overall, was effective after multiple treatments, considering its early kill of budworm larvae. Sevin alone and in combination with Thuricide gave no significant control of budworm in this experiment. The reduction in larval populations was generally reflected in the damage to the squares in these tests.

Although some of the population reductions were statistically significant with the materials used in these tests, none gave entirely satisfactory reductions of tobacco budworm populations. Lannate gave the best results, but this compound is phytotoxic to the cotton plant and should not be applied more than once or twice.



Estimated Heliothis populations in the Imperial Valley, 1973.



Cotton boll damaged by budworm feeding.

Ovicidal activity

The ovicidal effect of chlordimeform on budworm eggs also was evaluated during these tests. Following the first application, one- to two-day-old budworm eggs were removed from the chlordimeform and untreated plots. These eggs were placed singly in small ice cream cups and retained at room temperature, and hatch was observed.

Ten days after the field collection, 58.8 percent of the eggs had failed to hatch in the untreated plots versus 67.4 percent unhatched in the chlordimeform plots (The difference was statistically significant.)

Synthetic pyrethroids

A field-scale experiment has recently been terminated in which several insecticides were evaluated. Table 2 shows that the two synthetic pyrethroids, PP557 and SD43775, gave better control of the tobacco budworm than other insecticides tested. Although budworm control with Lannate in combination with Thuricide was better than that with Orthene and Dursban, none gave satisfactory results. This trial shows that the synthetic pyrethroids are potential budworm insecticides for the Imperial Valley.

Conclusion

Destructive tobacco budworm populations developed in the Imperial Valley

TABLE 1. Tobacco Budworm Control with Various Insecticides, 1973

Treatment	Rate (ai/acre)* (lb)	Larvae† 9/24	Larvae† 9/30	Larvae† 10/8	Damaged squares† 9/24	Damaged squares† 9/30	Damaged squares† 10/8
Test A							
Dipel + chlordimeform	0.125 / .125	4.86^{a}	8.57^{ab}	9.12^{ab}	10.86^{a}	31.46^{a}	23.36^{ab}
Dipel + chlordimeform	.25 / .25	4.40^{a}	3.26^{b}	3.73^{b}	13.59^{a}	14.22^{a}	9.49^{c}
chlordimeform	.25	4.65^{a}	5.26^{ab}	5.90^{b}	9.14^{a}	19.93^{a}	17.66^{abc}
Dipel	.5	5.03^{a}	6.34^{ab}	4.97^{b}	20.74^{a}	21.20^{a}	14.22^{bc}
untreated		4.25^{a}	11.19^{a}	13.91^{a}	14.96^{a}	26.92^{a}	27.32^{a}
Test B							
Thuricide	0.5	5.65^{a}	6.93^{a}	1.75^{b}	13.11^{a}	20.44^{b}	11.44^{c}
Thuricide + Sevin	.25 / 2.0	3.26^{a}	6.21^{ab}	8.14^{a}	9.91^{a}	22.30^{b}	21.56^{ab}
Lannate SP	0.5	2.98^{a}	2.31^{b}	6.27^{a}	16.91^{a}	8.14^{c}	27.58^{a}
Sevin	2.0	3.82^{a}	8.77^{a}	12.99^{a}	10.69^{a}	25.99^{ab}	26.66^{a}
untreated		4.71^{a}	8.68^{a}	10.69^{a}	8.88^{a}	34.37^{a}	15.31^{bc}

*Materials applied by fixed-wing aircraft in 5 gallons of water per acre (ai/acre = active ingredient per acre). Three weekly applications made, beginning September 20 and ending October 2. Each plot, 50 rows wide by ¼ mile long, was replicated three times in a randomized complete block design.
†Larvae counted on 100 cotton plant terminals in each plot after each treatment, and damage to fruiting bodies recorded for each plant checked. Analysis done on square root of count; treatments with no letters in common are significantly different.

TABLE 2. Tobacco Budworm Control, 1976

Treatment	Rate (ai/acre)* (lb)	Control 6 days after†: 1st treatment (percent)	2nd treatment (percent)	3rd treatment (percent)
Lannate + Thuricide	0.25 / 0.25	38.1	36.0	66.4
PP557 (Ambush)	0.1	63.1	60.0	82.4
SD43775 (Pydrin)	0.1	59.5	69.3	91.2
Orthene	1.0	50.0	50.7	40.0
Dursban	1.0	20.2	26.7	32.8
untreated	—	84‡	75‡	125‡

*Materials applied by fixed-wing aircraft in 7½ gallons of water per acre (ai/acre = active ingredient per acre). Three weekly applications were made on plots 50 rows wide and ¼ mile long. Each treatment was replicated three times in a randomized complete block design.
†Larvae and damaged squares counted on 100 terminals in each plot.
‡Larvae per 300 terminals.

in the 1976 cotton growing season. Fertilization and irrigation practices that prolonged the fruiting period of late-season cotton resulted in the most severe damage by budworms. Repeated applications of available insecticides provided little or no control, although carefully chosen and timed insecticide treatments gave fairly good control in some areas.

Synthetic pyrethroids, while possibly effective, are only part of the answer. Changes in production practices will also help manage budworm populations. Early planted cotton should be terminated earlier than it is now; for late-season planting, rapidly fruiting cotton varieties with early cutout and harvest can be used. Such agronomic practices would be economically and environmentally sound and would have the added benefit of reducing overwintering pink bollworm populations.

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Ethephon

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Reported effects of the growth regulator ethephon on fruit maturity in many crops include earlier skin color changes, earlier flesh softening, and occasional increases in soluble solids. In 1975, preharvest ethephon applications on Japanese plum (*Prunus salicina*) were evaluated for their influence on fruit maturation and postharvest ripening.

El Dorado and Queen Rosa plum varieties were treated with foliar applications of ethephon at 50 and 100 ppm. Two application dates, 6 weeks and 4 weeks before harvest, were compared on El Dorado. The Queen Rosa variety had one treatment, 4½ weeks before harvest.

Fruit maturity tests were made before, at, and after harvest. Before-harvest measurements included flesh firmness and visual observation of color break. These same measurements were made at harvest, along with soluble solids and acid content. Following 1 week of storage at 32°F, the fruit was ripened at 68°F. During ripening, flesh firmness, acid, ethylene evolution, and respiratory activity (CO_2 evolution) were measured.