ALTERNATIVES FOR BOLL WEEVIL MANAGEMENT:LARGE-PLOT EVALUATIONS OF METHYL PARATHION, GUTHION, DIMILIN AND BWACT BAITSTICKS IN MISSISSIPPI - 1996

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Abstract

We compared the efficacy of methyl parathion, Guthion, Dimilin and BWACT baitsticks in large-plot studies in Mississippi. Guthion and methyl had similar efficacy on boll weevils when used at pinhead square and later in the season. Four applications of Dimilin gave weevil control comparable with two applications of methyl when used at pinhead square. Although baitsticks were effective at attracting weevils, they did not delay the need for mid-season control of weevils when they were used at pinhead square in conjunction with methyl application. Based on efficacy and economic considerations, methyl parathion remains a very viable method of controlling boll weevils.

Guthion vs. Methyl Parathion

Benton County, Mississippi

A full-season comparison of methyl parathion versus Guthion was made on a grower's farm in Benton county. Four fields (12, 12, 20 and 50 acres) of conventionally-grown, non-transgenic cotton were planted on 20 May. Half of each field was treated with methyl parathion (0.25 lb ai/a) and the other half was treated with Guthion (0.25 lb ai/a). Applications were made by ground on 20 June, 1 and 31 July, and 3 August. Additional applications for weevils were also made after this time, but sampling was not done after 3 August. This area is characterized by high weevil populations, and a total of 75 pheromone traps placed around the fields caught an average of 54 weevils/trap/week from 27 May to July 1. All fields were treated for other pests on an as needed basis, and each field received a pyrethroid application (Karate) on 27 July primarily for control of cotton bollworms.

The total number of predators and tarnished plant bugs in 100 sweep-net samples and the percentage of 100 squares with weevil damage was determined twice weekly in each replicate. Predators sampled included big-eyed bugs, damsel bugs, minute pirate bugs, lady beetles, and syrphid fly and lacewing larvae.

When averaged over the four replicates, weevil-damaged squares in the Guthion and methyl treated plots exceeded 10% on 29 and 25 July, respectively. On 25 July, an average of 9.6 and 11.0% of squares were damaged in the Guthion and methyl-treated plots, respectively. On 29 July, an average of 16.2 and 12.2% of squares were damaged in the Guthion and methyl-treated areas, respectively. Averaged from 24 June to 29 July, there was no difference in the number of weevil-damaged squares in the Guthion (4.0%, N=4400 squares) and methyl treated plots (3.9%, N=4400 squares) (paired t-test, $P > 0.05$).

The mean number of total predators in Guthion (35.4/100 sweeps) and methyl (33.6/100 sweeps) plots was not statistically different when data were combined across dates from 14 June to 2 August ($P > 0.05$). During the same time period, there were more tarnished plant bugs in the Guthion plots (1.83/100 sweeps) than in methyl plots (0.95/100 sweeps)(paired t-test, $P < 0.03$).

Hinds County, Mississippi

A late-season comparison of methyl parathion and Guthion was made at the Brown Loam Experiment Station. Conventionally-grown cotton (variety DES-119 planted 21 May) was sprayed four times with either methyl parathion or Guthion at 0.25 lb ai/a. There were three 0.2 acre plots per chemical, and applications were made by ground on 16, 19, 23 and 26 August with a volume of 10 gal./acre. Another 0.25 acre plot was not treated. In a pre-application sample on 16 August, 18% weevil-damaged squares were found in 120 squares sampled. On 21 and 28 August, 80 squares from each plot were examined for weevil damage.

There was no statistical difference in weevil-damaged squares for plots treated with Guthion or methyl (t-test, $P > 0.05$). On 21 August, after 2 applications, 20% and 10% of squares Guthion and methyl plots were damaged by weevils, respectively. 37% of the squares in the untreated check plot were damaged. After all four applications, 37% of the squares in the Guthion plots, 35% of the squares in methyl plots, and 75% of the squares in the check plot were damaged by weevils.

Trap Efficiency: Baitsticks vs. Pheromone Traps

The efficacy of BWACT baitsticks (Plato Industries, Inc.) and traditional weevil pheromone traps were compared on a grower's farm in Lafayette county, Mississippi. 45 baitsticks, 9 pheromone traps and 2 yellow broom handles were interspersed around the perimeter of each of four 10-15 acre cotton fields on 14 May. Baitsticks were replaced on 3 July. In each field, five of the baitsticks and the two broom handles were painted with tack trap on a regular basis, and two baitsticks were set into a 5-gallon grease bucket with holes that allowed water drainage. All fields received a pinhead-square application of methyl parathion (0.25 lb ai/a) on 14 June. Traps and sticks were checked twice weekly beginning 21 May through 6 August.

Overall, more boll weevils were caught earlier in the season, prior to June 29, baitsticks treated with tack trap caught the

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:996-998 (1997)
National Cotton Council, Memphis TN

most boll weevils (Table 1). When data were combined over all dates, baitsticks painted with tack trap were about twice as effective as traditional pheromone traps or baitsticks set into buckets. However, from 29 June through 6 August, pheromone traps and baitsticks were about equally effective. The yellow broom handles, covered with tack trap, caught very few weevils.

Dimilin vs. Methyl Parathion vs. Methyl Parathion with Baitsticks

The effectiveness of pinhead-square applications of Dimilin, methyl parathion, and methyl parathion when used in conjunction with BWACT baitsticks was evaluated on a grower's farm in Hind county, Mississippi. Historically, this area has moderate weevil populations. All fields were 25 acres or larger in size and were planted on 4 or 5 May. In one Bt-cotton field and one conventional-variety field, four applications of Dimilin 2L (0.0625 lb ai/a) and Herbimax crop oil (2 qt./a) were made at weekly intervals beginning 5 June. Also in one Bt and one conventional-variety field, two pinhead-square applications of methyl parathion (0.25 and 0.33 lb ai/a, respectively) were made on 5 and 15 June. Methyl was applied as above and baitsticks (1.2 sticks/a) were placed around the perimeter of two other Bt-cotton fields at planting and 50 days later.

Boll weevil pheromone traps were placed around the perimeter of all fields at a rate of 1/20 acres or a minimum of three per field. In each baitstick-treated field, tack trap was applied to three randomly-chosen sticks every week. Baitsticks and pheromone traps were checked weekly to determine the number of captured weevils. Beginning on 25 May, big-eyed bugs, lady beetles, ants, minute pirate bugs and spiders were sampled 1-2 times weekly by taking 25 sweeps with a sweep net at four locations in each field. Beginning 25 June, the percentage of weevil-damaged squares was determined in each field by pulling 25 squares at four locations 1-2 times weekly.

Insecticide applications for other pests were made on an as needed basis. All conventional-variety cotton fields received a pyrethroid sprays(Baythroid) targeting cotton bollworms or tobacco budworms on 18, 22 and 27 June, 11 and 25 July, and 3 August. Bt cotton fields were not treated for worms. Orthene (0.33 lb ai/a) was tank mixed with the second sprays of Dimilin or methyl parathion during pinhead-square applications for tarnished plant bug control. Orthene (0.33 lb ai/a) was also included with the final application Dimilin on 26 June; so, Dimilin-treated field received 2 applications of Orthene, and the other fields received only one application.

The most obvious treatment effect in this test was that caused by multiple pyrethroid applications made for worms in the conventional-variety cotton fields. In these two fields, the percentage of weevil-damaged squares never exceeded 10%, at least prior to 6 August when sampling was terminated. Pyrethroid applications not only suppressed weevil populations but also greatly reduced the number of predators caught in sweep-net samples (Fig. 1, Table 2). In contrast, three of the four Bt cotton fields reached 10% weevil-damaged squares on 16 July. The fourth Bt cotton field, treated only with methyl at pinhead square, reached the 10% threshold on 31 July. However, beginning 17 July, all Bt cotton fields were regularly treated for weevils with methyl parathion.

Weevil populations were relatively light early in the season (Table 3), and no pinhead treatment was clearly superior to the others in reducing weevil damage or subsequent weevil populations (Table 4). On average, pinhead treatments of only methyl appeared slightly superior to other treatments, but these differences likely reflect normal variations in field populations and sampling rather than a treatment effect. For example, the most weevil damage occurred in the field (Bt cotton - Dimilin) with the highest catches in pheromone traps. The least damage was found in the field (Bt cotton - methyl) with the lowest catches in pheromone traps.

Summary

Evidence from these studies indicate that methyl parathion and Guthion have similar efficacy on boll weevils when used at pinhead square or later in the season. Similarly, four applications of Dimilin when applied with crop oil (as recommended by the company) gave control comparable to methyl on overwintering weevils. The low cost of methyl parathion makes its use much more economical. Compared to methyl, Guthion and Dimilin (without oil) are about 100% and 230% more expensive, respectively, not including application costs. The use of Dimilin may have additional value in conserving natural enemies or as a preventative treatment for beet armyworms. However, this benefit was not observed in this study. Beet armyworm populations remained low throughout the test area in 1996. Also, traditional pinhead-square applications with a short-residual insecticide such as methyl may occur early enough so as to not seriously impact subsequent predator populations. In this study, the grower chose to apply an additional application of Orthene in the last Dimilin treatment as a preventative application for plant bugs. The desire to tank mix insecticides for plant bug control with the additional Dimilin treatments reduces this chemical's potential for conserving natural enemies.

Baitsticks covered with tack trap did capture more overwintering weevils than did the conventional pheromone traps around the same fields, but baitsticks probably reduce the efficacy of pheromone traps because of the number of sticks used used and their higher concentration of lure. Two baitstick applications around fields that had been treated with methyl did not delay or reduce the need for mid-season control with conventional insecticides when compared to fields treated only with methyl or Dimilin. However, this study was limited in size and scope, and designing experiments that accurately reflect baitstick performance is difficult. This, in part, prevents their recommendation by various state extension services.

Table 1. Mean number of weevils caught per day per trap around four cotton fields in Lafayette county, Mississippi.

Dates	Stick - tack trap	Stick - bucket	Pheromone traps	Broom handles
May 14 - June 28	0.91 a	0.47 b	0.32 b	0.04 c
June 29 - August 6	0.31 a	0.15 ab	0.43 a	0.03 b
All dates	0.63 a	0.32 b	0.37 ab	0.04 c

Means, within rows, not followed by a common letter are significantly different (paired t-test, $P < 0.05$)

Table 2. Mean percentage of weevil-damaged squares and total predators in 100 sweeps of Bt and conventional-variety cotton fields in Hinds county, Mississippi.

Field	Dates	Mean	± SE	N
% Weevil damage				
Bt cotton	Before 17 July	2.8	0.5	96
Conventional		1.0	0.3	44
Bt cotton	Season long	6.0	1.1	125
Conventional		1.1	0.2	57
Predators				
Bt cotton	Before 17 July	30.4	2.4	128
Conventional		9.2	1.6	64
Bt cotton	Season long	27.6	2.4	144
Conventional		9.2	1.3	72

Each sample = 25 squares (4 samples/field/date)

Table 3. Mean number of weevils caught per pheromone trap or baitstick per week, before 17 July, around fields receiving different pinhead-square treatments for boll weevils in Hinds county, Mississippi.

Treatment	Traps	N*	Sticks	N*
Bt fields: sticks + methyl	1.6	54	2.4	54
Bt field: methyl	1.1	27	N/A	N/A
Bt field: Dimilin	7.0	24	N/A	N/A
Conventional field: methyl	2.5	21	N/A	N/A
Conventional field: Dimilin	2.5	20	N/A	N/A

* Trap weeks (= number traps or baitsticks times number weeks checked)

Table 4. Mean percentage of weevil-damaged squares, before 17 July, in fields receiving different pinhead-square treatments for boll weevils in Hinds county, Mississippi.

Treatment	Mean	± SE	N
Bt fields: sticks + methyl	3.3	0.8	48
Bt field: methyl	0.5	0.3	24
Bt field: Dimilin	4.3	1.2	24
Conventional field: methyl	1.3	0.4	24
Conventional field: Dimilin	0.6	0.3	20
Methyl only (1 Bt, 1 conventional field)	0.9	0.2	48
Dimilin (1 Bt, 1 conventional field)	2.6	0.7	44
Baitsticks + methyl (2 Bt fields)	3.3	0.8	48
Methyl or Dimilin (2 Bt fields)	2.4	0.7	48

Each sample = 25 squares (4 samples/field/date)

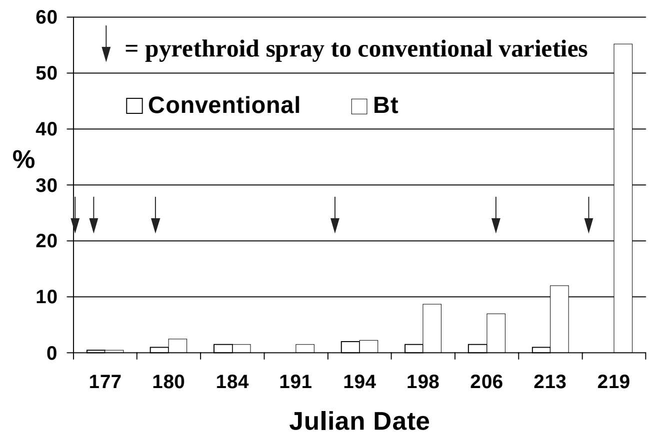

Figure 1. Percentage of weevil-damaged squares in Bt and conventional-variety cotton fields in Hinds county, Mississippi. Arrows show timing of worm sprays made only to conventional varieties.