Insecticidal Management of Thrips in Texas Peanut Fields

Forrest L. Mitchell*
Texas Agricultural Experiment Station, Route 2 Box 00, Stephenville, TX 76401
J. W. Smith, Jr.
H. B. Highland
Dept. of Entomology, Texas A&M University, College Station, TX 77843-2402

ABSTRACT

Studies testing insecticidal compounds against thrips feeding in peanut were conducted at two sites in Texas--Stephenville (Erath County) in the northern region and Pearsall (Frio County) in the southern region. Products tested were aldicarb, acephate and disulfoton in at-plant, sidedress and split applications, and sulfur in split applications. Thrips populations were sampled weekly in terminals and flowers. A weekly census of both the number of terminals and flowers was used to establish absolute population densities of thrips. Control was obtained with all compounds tested except sulfur. However, control in northern Texas was reduced compared to studies conducted in previous years.

KEYWORDS: Thysanoptera, *Frankliniella fusca*, *Frankliniella occidentalis*, *Arachis hypogaea*

Thrips are not usually considered to be a major pest of peanut (*Arachis hypogaea* L.) (Smith, 1981). Feeding damage by adults and larvae causes unsightly leaf scarring, especially in small plants, but yields are not normally increased by insecticidal control (Smith and Sams, 1977). However, thrips become a severe pest of peanut when they vector tomato spotted wilt virus (TSWV) (Mitchell et al., 1990). The two most common species of thrips feeding in peanut are the tobacco thrips [*Frankliniella fusca* (Hinds)] and the western flower thrips [*Frankliniella occidentalis* (Pergande)] (Mitchell and Smith, 1991), both of which are capable of transmitting TSWV (Sakimura 1962, 1963).

TSWV epidemics may spread through peanut fields in two ways. Primary spread is propagated by immigrant thrips bringing the disease into the field from sources outside the field. Insecticidal control will probably not result in economic benefit in this circumstance, as the incoming thrips will likely feed and transmit the disease before being killed (Chamberlin et al. 1992). Secondary spread occurs when thrips acquire TSWV from diseased peanut plants in the field and trasmit it to other uninfected plants in the same field. Since only immature thrips can acquire TSWV for later transmission (Bald and Samuel, 1931), insecticidal control might provide relief (Mitchell et al., 1990). Earlier reports on control of thrips in Texas peanut indicated that up to 100% kill could be obtained (Smith and Sams, 1977; Sams and Smith, 1978; Smith et al. 1982). However, observations by the authors in grower fields in 1987 indicated control was erratic. The objective of this study was to

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determine efficacy and duration of thrips control for variously timed foliar and granular applications of labelled insecticides. In addition, sulfur was included to determine whether or not it would act as a feeding deterrent at a reasonable application rate.

MATERIALS AND METHODS

Two tests were conducted. The first was on the grounds of the Texas Agricultural Experiment Station in Stephenville. Four replications of each treatment were made in a randomized complete block design. Each treatment plot was 4 rows (36 in [0.91 m] centers) by 30 feet (9.14 m) long. Six feet (1.83 m) of buffer space was left between plots in a block and ten rows between blocks. These treatments are listed in Table 1.

The treatments were made on Florunner peanut that was planted 26 May 1988, and emerged one week later. Treatments 1, 3, 4,and 6 were made on 27 May. Treatments 7, 8, 9, 10, and 11 were made on 17 June. Treatments 2 and 5, and split treatments 3, 6, and 8-11 were made on 7 July. All plots were irrigated as necessary. The field was given standard treatments of herbicide and fungicide. Sampling began with the appearance of the first terminals and continued for ten weeks. A sample consisted of five terminals, and each sample was placed in a bottle with a preservative and surfactant (AGA; Mound and Pitkin, 1972). The bottle was shaken and the plant parts discarded. The solution was filtered and the number of adult and immature thrips counted. This number was adjusted to account for the thrips discarded in the foliage and flowers (data not shown). Five samples were drawn weekly from each plot in each block. At the onset of flowering, five samples of five flowers each were also collected. Since terminals and flowers represent the major niches for thrips feeding in peanut, an absolute population density was obtained.

The second test was conducted in an irrigated production field in Frio County. The purpose of this experiment was to determine if sidedress or split treatments were effective as used. All plots received the same herbicide and fungicide treatments as the rest of the field. The field was planted in Florunner peanuts on 7 June 1988. Peanuts emerged 7-10 days later and were treated at-plant with aldicarb 15G in-furrow at 1 lb ai $acre^{-1}$ (1.12 kg ai ha^{-1}) by the grower. Four 0.155 acre (0.063 ha) areas were left untreated, one at each cardinal compass point. Each of these four areas was combined with an equal sized area of the production field to make four blocks 0.31 acres (0.125 ha) in size. Treatments within the study are found in Table 2.

Two replicates of each treatment were made in each block. Samples were collected and processed as in the first test for eight consecutive weeks.

A census was made weekly of the number of terminals and flowers per meter (39.4 in) of row in each plot. For terminals, these values were averaged over all treatments and multiplied by the number of thrips per terminal in each sample to obtain an estimate of the number of thrips per meter of row in the sample. Flower census samples were treated similarly in Pearsall data. In Stephenville census data, flower averages were made by block, and sample data from each block was multiplied by the appropriate value for that week. The number of thrips per meter of row in terminals was added to the same value for flowers to obtain a total number

of adult or larval thrips per meter of row on which to perform analysis.

Table 1. Insecticide application methods and rates for Stephenville experiment on Florunner peanut planted 26 May 1988.

Treatment	Application Rate	Application Method	Application Timing
	lb acre^{-1} (kg ha^{-1})		
Aldicarb 15G	1.0 (1.12)	Banded	At plant†
Aldicarb 15G	1.5 (1.68)	Banded	At peg‡
Aldicarb 15G	1.0 (1.12) 1.5 (1.68)	Banded	Split, at plant & at peg§
Disulfoton 15G	1.3 (1.46)	Banded	At plant†
Disulfoton 15G	1.3 (1.46)	Banded	At peg‡
Disulfoton 15G	1.3 (1.46) 1.3 (1.46)	Banded	Split, at plant & at peg§
Acephate 75S	0.75 (0.84)	Foliar spray	One week after crack¶
Acephate 75S	0.75 (0.84) 0.75 (0.84)	Foliar spray	Split, one week after crack & at peg#
Sulfur 53EM	1.0 (1.12) 1.0 (1.12)	Foliar spray	Split, one week after crack & at peg#
Sulfur 53EM	2.0 (2.25) 2.0 (2.25)	Foliar spray	Split, one week after crack & at peg#
Sulfur 53EM	3.0 (3.37) 3.0 (3.37)	Foliar spray	Split, one week after crack & at peg#
Untreated check	-	-	-

†27 May
‡7 July
§27 May and 7 July
¶17 June
#17 June and 7 July

Data were analyzed with the General Linear Model option of SAS (Statistical Analysis Systems, Cary, NC). If the overall analysis was significant at a level of 95%, then the means of the treatments were separated with a Duncan's Multiple

Range test. Again, a 95% difference threshold between means was used to determine if treatments were different from the untreated check plots.

Table 2. Insecticide application methods and rates for Pearsall experiment on Florunner peanut planted 7 June 1988.

Treatment	Application Rate	Application Method	Application Timing
	lb acre^{-1} (kg ha^{-1})		
Aldicarb 15G	1.0 (1.12)	In furrow	At plant†
Aldicarb 15G	1.5 (1.68)	Banded	50 days post-plant‡
Aldicarb 15G	1.0 (1.12) 1.5 (1.68)	In furrow banded	At plant & 50 days post-plant§
Disulfoton 15G	1.4 (1.57)	Banded	50 days post-plant‡
Untreated check	-	-	-

†7 June
‡27 July
§7 June and 27 July

Adult thrips census data were regressed against flower census data to determine if flower density affected population density. The GLM option of SAS was used to conduct this analysis.

RESULTS

Because adult and larval thrips differ so much in mobility (most adults have wings while the larvae are flightless), the results are tabulated by these two stages. The results are also separated by location, Stephenville and Pearsall. Generally speaking, the analysis could not detect population differences smaller than about 30% between insecticide treatments. Only the first eight weeks are shown for Stephenville results (Tables 3 and 4), as no differences between treatments were detected after this. Eight weeks of the Pearsall test are also shown (Tables 5 and 6, beginning at 50 days post-planting), but no differences in treatments were found after the first 4 weeks of the test. Eight weeks of census data are shown in the figures. Week 1 (Figure 1) begins the first week of crack (when seedling first push through the soil) or 16 days post-planting, on 12 June before the treatment. Week 1 in Figure 2 begins 50 days after planting, before the treatment on 27 July.

Table 3. Mean number of thrips larvae per meter of row in the Stephenville experiment, including samples from both terminals and flowers. Week 1 of the experiment began 16 days after planting.

	Week							
Treatment	1	2	3	4	5	6	7	8
Disulfoton plant	14.9bc†	68.2abc	224.7bcd	324.8ab	413.2ab	404.4a	718.3bcd	256.8 bc
Disulfoton side	42.7a	81.6ab	350.9a	297.8abc	298.3bcd	311.1abc	1121.8a	294.1 bc
Disulfoton split	14.3bc	46.4cde	200.8cd	380.7a	407.2ab	281.6bcd	641.6cd	260.7 bc
Aldicarb plant	4.1c	13.9f	132.8de	223.2bcd	399.1ab	318.2ab	424.3de	111.3 d
Aldicarb side	10.8bc	83.3ab	284.9abc	345.8ab	341.1bcd	201.9cde	909.6abc	72.1 d
Aldicarb split	6.3bc	22.8fe	76.8e	163.6d	274.5cd	102.5e	245.2e	71.8 d
Acephate 1X	23.3abc	29.5def	50.2e	312.9ab	388.0abc	345.4ab	162.3e	280.5 bc
Acephate 2X	21.9abc	24.5def	47.0e	183.8cd	248.9d	184.3de	151.1e	124.0 d
Sulfur 1 lb	16.4bc	81.7ab	301.1ab	314.6ab	378.2abc	396.3ab	963.4ab	353.1 ab
Sulfur 2 lb	30.1ab	91.9a	324.5a	303.7abc	312.0bcd	425.4a	1036.7a	228.1 c
Sulfur 3 lb	15.1bc	55.7bcd	349.3a	394.2a	475.7a	402.6a	1115.3a	421.3 a
Untreated check	21.9abc	52.3bcde	300.6ab	296.1abc	355.6bcd	431.2a	960.5ab	344.4 ab

†In a column, numbers followed by the same letter are not significantly different at $P < 0.05$.

Table 4. Mean number of adult thrips per meter of row in the Stephenville experiment, including samples from both terminals and flowers. Week 1 of the experiment began 16 days after planting.

	Week							
Treatment	1	2	3	4	5	6	7	8
Disulfoton plant	26.5 abc†	32.2 b	78.7 a	105.5 abc	208.4 ab	160.1 a	253.5 a	225.4 ab
Disulfoton side	36.0 a	42.7 ab	71.8 a	84.9 bcd	202.5 ab	128.7 a	230.1 a	166.0 ab
Disulfoton split	22.0 cde	41.4 ab	95.1 a	86.9 bcd	244.5 a	138.6 a	304.4 a	206.4 ab
Aldicarb plant	16.9 de	21.4 c	82.9 a	89.6 abcd	245.2 a	107.3 a	265.1 a	158.2 b
Aldicarb side	31.9 ab	44.8 a	81.7 a	104.3 abc	189.1 ab	118.5 a	261.3 a	67.8 c
Aldicarb split	14.8 e	20.8 c	54.9 a	68.1 d	158.0 bc	120.6 a	176.1 a	70.2 c
Acephate 1X	28.2 abc	16.6 c	81.7 a	87.1 bcd	173.1 bc	160.1 a	262.0 a	238.5 a
Acephate 2X	25.3 bcd	12.4 c	73.5 a	79.5 cd	134.8 a	169.7 a	235.9 a	173.0 ab
Sulfur 1 lb	30.0 abc	40.1 ab	78.8 a	114.2 a	212.8 ab	118.8 a	252.8 a	173.8 ab
Sulfur 2 lb	34.4 ab	46.9 a	85.2 a	99.3 abc	210.6 ab	168.4 a	273.0 a	166.8 ab
Sulfur 3 lb	30.5 abc	49.0 a	78.2 a	106.3 ab	214.7 ab	172.4 a	251.1 a	224.1 ab
Untreated check	30.5 abc	41.9 ab	75.3 a	91.1 abcd	194.9 ab	139.2 a	241.5 a	180.8 ab

†In a column, numbers followed by the same letter are not significantly different at $P < 0.05$.

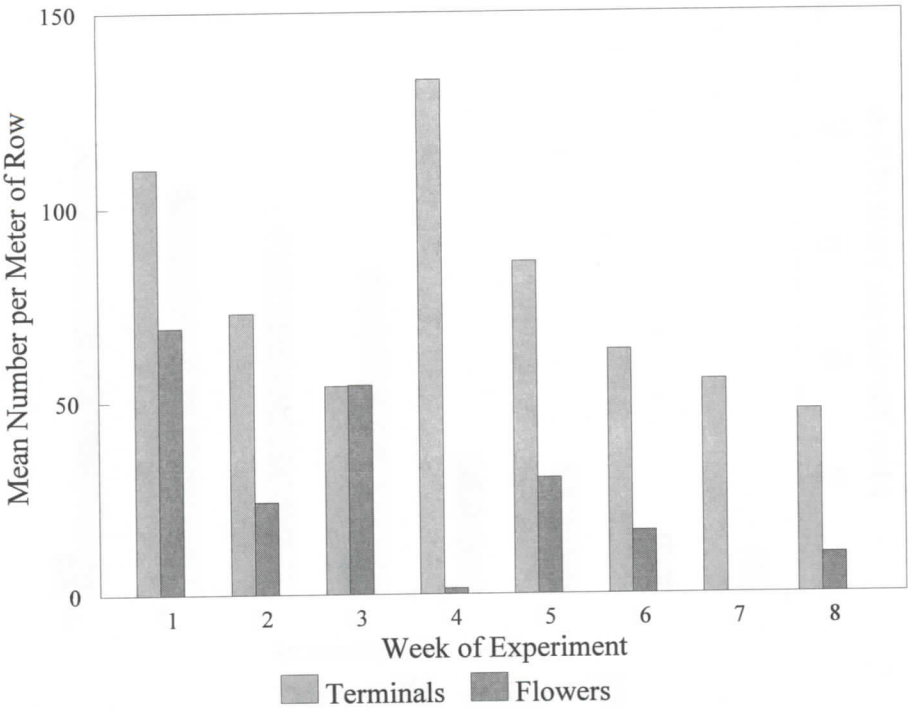

Figure 1. Weekly census of terminals and flowers in Stephenville peanut field plots. Week 1 of the census began 16 days after planting.

Table 3 presents control of larvae achieved at Stephenville. The best results were obtained in the aldicarb and acephate plots. Some measure of control resulted in the disulfoton split treatment plots, while sulphur gave significant results on only one date. Suppression of adults at Stephenville was much more difficult (Table 4). Aldicarb gave two weeks control after peanut emergence, and acephate provided control for one week. Aldicarb sidedress also caused significant population reductions. Control was more pronounced in Pearsall, but lasted only four weeks. Larvae were controlled by all treatments (Table 5). The aldicarb at-plant treatment continued to provide a degree of control against larvae through week 4 of the experiment. Adults were again more difficult to suppress (Table 6). All treatments except for aldicarb at-plant provided some degree of control against adults, as would be expected since the first sample was taken 50 days after planting.

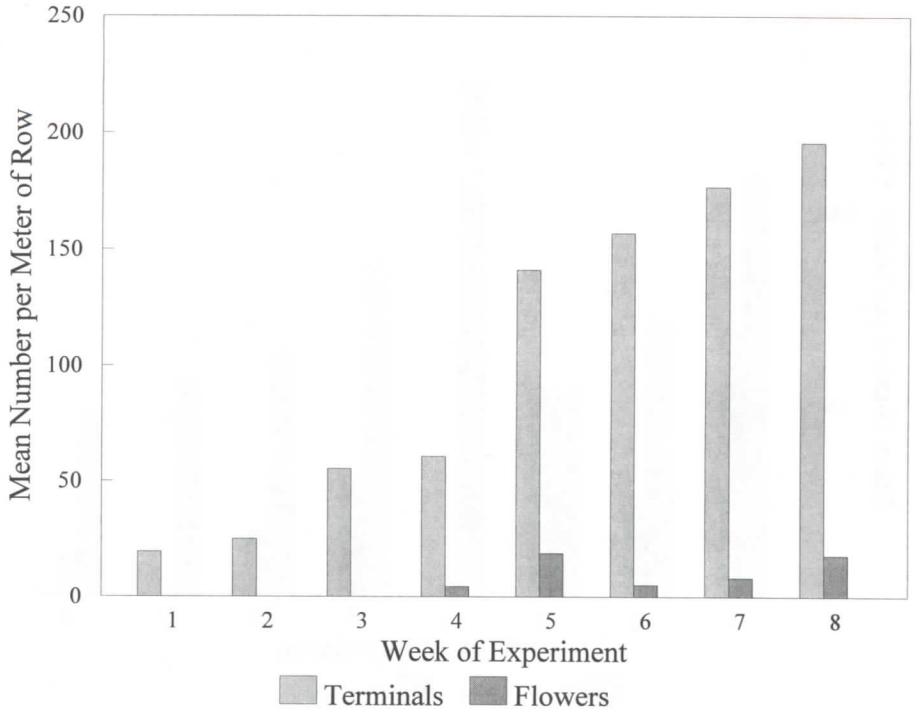

Figure 2. Weekly census of terminals and flowers in Pearsall peanut field plots. Week 1 of the census began 50 days after planting.

DISCUSSION

Insecticidal efficacy against thrips in Texas peanut has been reduced since tests were first conducted in the 1970s. Against larval thrips, Smith and Sams (1977) were able to achieve 100% and near 100% control of tobacco thrips in peanut foliage at the same location in Stephenville using aldicarb and disulfoton applied at-plant. Acephate, however, was used as a seed treatment by Smith and Sams (1977) and caused plant stand reduction. In the current study, it was applied as a foliar spray. Rohlfs et al. (1981) used acephate as a seed treatment but did not obtain control of thrips feeding in Alabama peanut plots. Phytotoxic effects of the seed treatment were not noted. Tappan and Gorbet (1979) successfully used acephate sprays for control of thrips in a variety of treatments, some of which provided greater than 90% control. Lynch et al. (1984) controlled thrips with aldicarb, while

Table 5. Mean number of thrips larvae per meter of row in the Pearsall experiment, including samples from both terminals and flowers. Week 1 of the experiment began 50 days after planting.

	Week							
Treatment	1	2	3	4	5	6	7	8
Disulfoton side	61.6 a†	5.0 c	20.7 bc	42.5 b	81.0 a	220.7 a	77.9 a	63.3 a
Aldicarb plant	15.4 c	39.5 b	31.4 b	70.8 b	36.2 b	213.1 a	48.1 a	48.6 ab
Aldicarb side	53.7 ab	7.8 c	11.5 bc	50.5 b	30.1 b	103.6 b	36.7 a	63.0 a
Aldicarb split	33.3 bc	7.8 c	4.9 c	53.4 b	36.1 b	81.5 b	42.4 a	52.3 ab
Untreated check	44.5 ab	112.7 a	63.3 a	177.3 a	49.0 b	151.1 ab	33.7 a	33.5 b

†In a column, numbers followed by the same letter are not significantly different at $P < 0.05$.

Table 6. Mean number of adult thrips per meter of row in the Pearsall experiment, including samples from both terminals and flowers. Week 1 of the experiment began 50 days after planting.

	Week							
Treatment	1	2	3	4	5	6	7	8
Disulfoton side	94.0 a†	18.7 b	36.8 a	22.3 b	49.2 a	12.2 b	5.9 a	6.9 b
Aldicarb plant	20.3 b	75.3 a	23.3 ab	70.4 a	22.8 bc	43.7 a	6.3 a	17.8 a
Aldicarb side	92.1 a	9.6 b	5.1 c	14.8 b	32.0 b	8.9 b	13.4 a	8.0 b
Aldicarb split	86.0 a	11.6 b	14.7 bc	8.3 b	26.5 bc	14.0 b	7.6 a	8.0 b
Untreated check	45.7 b	73.6 a	30.4 ab	70.8 a	14.2 c	22.3 b	9.3 a	12.8 ab

†In a column, numbers followed by the same letter are not significantly different at $P < 0.05$.

Tappan and Gorbet (1981) did the same with both aldicarb and disulfoton.

Adult thrips were not controlled as effectively as larvae in previous studies (Smith and Sams, 1977; Tappan and Gorbet, 1979, 1981; Lynch et al., 1984), a fact that is also reflected in the current research. As adults are more mobile, this is not surprising. This study also adds a dimension in that populations of terminals and flowers per unit area are also considered, providing for absolute density estimates of thrips populations when counts are made from the plant samples. Tappan (1986) investigated the effect of flowers on thrips populations, but in a fixed system where excess flowers were removed from experimental plants. Adult thrips often prefer flowers to terminals (Tappan, 1986), and as can be seen in Figure 1, flowers are an ephemeral habitat. There was no relationship between density of flowers and density of adult thrips by regression analysis in Pearsall ($F=0.06$, $P>0.05$), but there was in Stephenville ($F=9.34$, $P<0.05$). However, peak thrips populations in Stephenville were much higher than in Pearsall, which may have contributed to the reduced efficacy at the Stephenville site as compared to the Pearsall site. Historically, thrips populations at the Stephenville site have been high--as many as 47 per terminal have been reported (Sams and Smith, 1978).

Mitchell et al. (1990) reported decreases in TSWV infection in south Texas when insecticides were used against thrips. Prevalence of TSWV fell from 14% to 8%. This would imply that reductions in thrips populations resulted in a decrease in secondary spread of the virus. However, given the lack of complete control of thrips by insecticide, it is difficult to separate the impact of secondary infection from primary infection. Remedial treatments of insecticide for reduction of TSWV via thrips vector control are therefore of uncertain value in South Texas.

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