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Insecticides for the control of *Heliothis* species on tomatoes in the dry tropics of Queensland

I. R. Kay

Summary

During 1981 11 insecticides were sprayed weekly onto tomatoes in the field in two trials at Bowen to control *Heliothis armiger* (Hübner) and *H. punctiger* Wallengren. The most effective insecticides (dose rate in grams ha^{-1} a.c.) in reducing damage to tomato fruits were cypermethrin (60 or 80), deltamethrin (12.5), FRC 1272 (25), permethrin (100) and fenvalerate (60). Methamidophos + parathion (696 + 500), sulprofos (720), and monocrotophos (1000) were effective, while acephate (750), methamidophos (1102) and endosulfan (735) gave poor results.

1. INTRODUCTION

Two species of *Heliothis,* the tomato grub, *H. armiger* (Hübner), and the native budworm, *H. punctiger* Wallengren, are important members of the pest complex of tomatoes in the dry tropics of north Queensland. Insecticidal control measures against *Heliothis* spp. are regularly required to prevent damage to the tomato fruit.

In south east Queensland, Smith (1978) reported that acephate, methamidophos and methomyl, used at 7 day intervals, were effective against *H. armiger* and *Phthorimaea operculella* (Zeller), while Hargreaves and Cooper (1979a) found that sulprofos was the most effective insecticide against both pests, with several other insecticides including methamidophos, acephate, endosulfan and monocrotophos being satisfactory.

The trials reported in this paper were done to test these insecticides against *Heliothis* spp. on tomatoes in the dry tropics, and to establish the efficacy of newer synthetic pyrethroid insecticides for this purpose.

2. MATERIALS AND METHODS

The insecticides used were:

acephate	750 g kg^{-1}	Soluble powder
cypermethrin	100 g L^{-1}	Emulsifiable concentrate
deltamethrin	25 g L^{-1}	Emulsifiable concentrate
endosulfan	350 g L^{-1}	Emulsifiable concentrate
fenvalerate	75 g L^{-1}	Emulsifiable concentrate
FCR 1272 (cyfloxylate)*	50 g L^{-1}	Soluble concentrate
methamidophos	580 g L^{-1}	Emulsifiable concentrate
monocrotophos	400 g L^{-1}	Emulsifiable concentrate
parathion	500 g L^{-1}	Emulsifiable concentrate
permethrin	500 g L^{-1}	Emulsifiable concentrate
sulprofos	720 g L^{-1}	Emulsifiable concentrate

* Proposed name.

Two trials were conducted during 1981 at the Bowen Horticultural Research Station using the cultivar Flora-Dade grown as a ground crop. Trial 1 was undertaken from April to August, and Trial 2 from September to November. Each trial consisted of nine treatments replicated four times in a randomised block design. Each plot comprised 10 plants in one row.

Insecticide treatments were applied at weekly intervals from planting-out to harvest in 1000 L ha^{-1} of water using a Rega Pneumatic Sprayer at about 200 kPa. Trial 1 and Trial 2 received 12 and 9 spray applications respectively. The plants in both trials received weekly sprays of the fungicide propineb. Trial 1 was sprayed three times, and Trial 2 fortnightly, with dicofol to control the tomato russet mite, *Aculops lycopersici* (Massee).

All fruit were harvested from eight plants per plot in three picks separated by 14 days and 12 days in Trial 1, and in two picks a week apart in Trial 2. Coloured and green-mature fruit were harvested in the early picks, and all remaining fruit were harvested in the final pick for both trials. Fruit were counted, weighed and inspected for *Heliothis* damage. Data from all picks were combined for analysis.

Heliothis spp. larvae and eggs were collected occasionally during the trials, and were reared to the adult stage when the genitalia were dissected out for species identification (Common 1953).

3. RESULTS AND DISCUSSION

H. armiger only were reared from 65 larvae collected from Trial 1. *H. armiger* and *H. punctiger* were reared in almost equal proportions during the first 7 weeks of Trial 2, but *H. punctiger* predominated (80% of 40 specimens) in a sample of eggs collected in the last 2 weeks of the trial.

Table 1. Trial 1: Mean percentage of *Heliothis* damaged fruit and mean fruit yield (weight and number)

Treatment		Percentage *Heliothis* damaged fruit		Yield	
Insecticide (g ha^{-1} a.c.)		Transformed mean*	Equivalent mean	Weight (kg)	Number
Untreated		0.4165	16.37	69.46	547.50
methamidophos	1102	0.2177	4.66	60.88	472.25
acephate	750	0.1961	3.80	73.53	573.00
methamidophos + parathion	696 + 500	0.1440	2.06	70.29	562.25
fenvalerate	60	0.1429	2.03	69.12	550.50
permethrin	100	0.1410	1.98	74.39	577.75
FCR 1272	25	0.1332	1.76	74.59	591.25
deltamethrin	12.5	0.0950	0.90	74.75	594.25
cypermethrin	80	0.0865	0.75	79.37	631.00
Necessary differences for significance	5%	0.0502		8.48	79.27
	1%	0.0681		11.50	107.43

* Arcsin transformation applied before analysis of variance.

Table 2. Trial 2: Mean percentage of *Heliothis* damaged fruit and mean fruit yield (weight and number)

Treatment		Percentage *Heliothis* damaged fruit		Yield	
Insecticide (g ha^{-1} a.c.)		Transformed mean*	Equivalent mean	Weight (kg)	Number
Untreated		1.1290	81.72	4.91	50.00
endosulfan	735	0.6949	41.00	32.94	269.00
monocrotophos	1000	0.4661	20.20	38.00	326.75
methamidophos + parathion	696 + 500	0.4631	19.96	40.26	352.50
sulprofos	720	0.4172	16.42	40.10	321.00
cypermethrin	60	0.3206	9.93	47.85	393.25
deltamethrin	12.5	0.3202	9.91	51.06	432.00
FCR 1272	25	0.2990	8.68	49.56	400.25
cypermethrin	80	0.2928	8.33	48.77	406.25
Necessary differences for significance	5%	0.0722		5.15	40.54
	1%	0.0978		6.98	54.93

* Arcsin transformation applied before analysis of variance.

Data on yields and the percentage of fruit damaged by *Heliothis* spp. are summarised in Tables 1 and 2. Damage levels in the untreated controls and insecticide treatments common to both trials show that *Heliothis* spp. activity was much higher during Trial 2 than during Trial 1.

There was less fruit damage in all insecticide treatments than in the untreated control ($P < 0.01$). In Trial 1 methamidophos and acephate were less effective than the other insecticides, while cypermethrin (80 g ha^{-1} a.c.) was more effective than all the other insecticides except FCR 1272 and deltamethrin, and it was the only treatment that outyielded the untreated control. In Trial 2 endosulfan gave poor control of *Heliothis* spp. Monocrotophos, methamidophos + parathion, and sulprofos were moderately effective, while cypermethrin, deltamethrin and FCR 1272 gave the best control and highest yields. There was no significant difference between cypermethrin at 60 g ha^{-1} a.c. and at 80 g ha^{-1} a.c.

Leaf chlorosis, similar to that reported on seedlings by Hargreaves and Cooper (1979b), was noticed on the younger leaves of plants in the fenvalerate treatment in Trial 1 after 10 spray applications.

Although the potato moth *P. operculella* has been recorded as an important pest of tomatoes in north Queensland in the past, no damage in the present trials was attributable to it. The control of tomato russet mite *A. lycopersici* exercised by dicofol was satisfactory.

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The author is an officer of Entomology Branch, Queensland Department of Primary Industries, and is stationed at Ayr, Q. 4807.