Effect of Insecticide Application on Seed Yield and Quality in Egg Plant (*Solanum melongena* L.)

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ABSTRACT

Fruit borer (*Leucinodes orbonalis* Guen., Pyraustidae, Lepidoptera) is an important pest of egg plant (*Solanum melongena* L.). A number of insecticides have been recommended to control this pest, and the effects of carbaryl + sulphur, endosulfan, quinalphos, monocrotophos, phosalone, deltamethrin, cypermethrin and fenvalerate on seed yield and quality in egg plant were evaluated in three field trials, two with cv. Annamalai and one with cv. PLR-1.

In the monsoon season the synthetic pyrethroids (deltamethrin, cypermethrin, fenvalerate) significantly increased seed yield in both cultivars by reducing the incidence of the pest. Insecticide treatment did not directly influence seed quality, but because the presence of the borer in fruit reduced seed vigour, partial control of the pest following insecticide application resulted in reduced seed electrical conductivity and greater field emergence. Of the insecticides trialled, fenvalerate produced the best results, although further work is required to evaluate application rates and timings.

Additional index words: **fruit borer, fenvalerate, seed yield, seed vigour, conductivity.**

INTRODUCTION

Egg plant (*Solanum melongena* L.) is a common vegetable crop in India but fruit borer (*Leucinodes orbonalis* Guen., Pyraustidae, Lepidoptera), can limit successful cultivation, particularly under conditions of high temperature and humidity. Several insecticides are currently recommended to control this pest, but they may also influence seed quality.

Increased oil content of cotton seeds at the expense of protein, following application of thimet was reported by Hacskaylo (1957). Zimmer and Urie (1968) found a similar increase of oil content in safflower after application of the fungicide maneb, and Rajagopal and Vidhyasekaran (1983) reported similar results in peanut. Jayaraj and Karivaratharaju (1986) noted early flowering and fruit set induction in sesame following benlate application, and Jayaraj and Ramakrishnan (1986) reported that application of dimethoate, methyl demeton and monocrotophos was desirable for obtaining good quality sesame seeds. A range of synthetic pyrethroids, e.g. cypermethrin, cis-cypermethrin and deltamethrin had no effect on seed maturity, seed germination, fibre length and fineness of cotton (Hopkins and Moore, 1973), but Krishnasamy, Parameswaran, Ponnuswamy and Ramakrishnan (1985) noted that spraying of flycythrinate followed by cyfloxylate resulted in better seed vigour in cotton.

This study was designed to examine the influence of insecticides recommended for the control of fruit borer on seed yield and seed quality in egg plant.

MATERIALS AND METHODS

Three field trials were conducted, the first in the winter season 1988 using cv. Annamalai, and the second and third in the 1989 monsoon season using cvs PLR-1 and Annamalai, respectively. The first two trials were sown at the Vegetable Research Station Farm, Palur, Tamil Nadu, while the third was sown at the Sugercane Research Station Farm, Cuddalore, Tamil Nadu.

Seedlings were hand transplanted from a raised bed nursery into the field at spacings of 75 x 60 cm. Recommended cultural practices were followed (Krishnasamy and Palaniappan, 1989). Plots were 6 x 4.8 m, but border plants were excluded leaving a plot size for sampling of 4.5 x 3.6 m. Beginning 45 days after transplanting, insecticides (Table 1) were applied in a high volume spray to run off every 15 days until final harvest. The eight insecticide treatments plus an untreated control were arranged in a randomised block design with three replications. An analysis of variance of square-root transformed (70-100%), or arc sine transformed (0-70%) data was used (Gomez and Gomez, 1984).

When fully ripe, fruits were harvested, assessed for fruit borer holes (trials two and three only), and then seeds were extracted (Krishnasamy and Palaniappan, 1989). Seeds were initially shade dried and then sun dried until seed moisture content reached eight per cent. A total of three fruit pickings was made in trials one and three, and five pickings in trial two.

Total dry seed weight per plot was recorded, percentage seed recovery was assessed by dividing the

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weight of dry seeds by the weight of fruits, and one hundred seed weight determined by weighing four lots of 100 seeds and finding a mean. Germination tests were conducted using the roll-towel method (ISTA, 1985), and from the normal seedlings, ten were selected at random from each roll-towel and mean shoot and root length recorded. These seedlings were oven dried at 85°C for 12 hours, and dry weight determined. A vigour index (Abdul-Baki and Anderson, 1973) was calculated,

i.e. vigour index = (shoot length + root length) x percentage germination.

Fifty seeds per treatment were soaked in 50 ml glass distilled water for two hours, and the electrical conductivity of the leachate was recorded using an electrical conductivity meter (Model MCD No. 287, M.C. Dalal Agencies, Madras, India). Field emergence was assessed 14 days after sowing four lots of 100 seeds in raised field beds.

RESULTS AND DISCUSSION

In the winter season sowing (trial one), insecticide application did not significantly increase seed yield (Table 1), but in the monsoon season crops the synthetic pyrethroids (deltamethrin, cypermethrin and fenvalerate) increased seed yield of cv. PLR-1, while all the insecticides trialled increased seed yield of cv. Annamalai. In the latter two trials, fenvalerate application produced the maximum seed yield (Table 1).

The percentage of fruits with no evidence of borer activity was 19% in control plots of cv PLR-1 and 27% in control plots of cv. Annamalai (Table 2). Insecticide application significantly increased the percentage of fruits without borer holes, and the synthetic pyrethroids provided the greatest control of the pest. Lower borer incidence would probably have resulted in less flower and fruit drop, although these data were not recorded. The percentage seed recovery did not differ significantly in any of the three trials.

No differences in seed quality parameters were recorded in the first trial, and no differences between insecticide treatments were found in the second and third trials. However, when seeds were grouped into uninfested (no evidence of borer in fruit) and infested (borer holes present in fruit), it became evident that the insect was affecting seed quality. For example, in cv. PLR-1, seeds containing borer had a lower 100 seed weight, germination vigour index and root length, and higher conductivity (Table 3); in cv. Annamalai root length, seedling dry weight and vigour index were lower and conductivity was increased. These results support the previous findings of Krishnasamy and Palaniappan (1989) who noted that borer reduced egg plant seed vigour.

Field emergence of seeds from borer infested fruits was around 10 per cent lower than that from uninfested fruits for both cultivars (Table 4). Field emergence did not differ between treatments when seed from borer free fruits was sown, but in the presence of borer, field emergence was significantly greater in the three synthetic pyrethroid

TABLE 1
Effect of insecticides on seed yield in egg plant cv Annamalai and PLR-1

		Seed Yield (g) for 5 plants	Seed Yield (g) per plot	Seed Yield (g) per plot
Treatment	**Concentration**	**Trial 1 Annamalai (winter 88)**	**Trial 2 PLR-1 (monsoon 89)**	**Trial 3 Annamalai (monsoon 89)**
carbaryl + wettable sulphur	0.1% + 0.1%	100.6	268.9	168.9
endosulphan	0.05%	86.3	214.4	132.1
quinalphos	0.05%	147.5	276.6	198.4
monocrotophos	0.1%	106.5	264.3	150.5
phosalone	0.1%	143.2	241.8	156.4
deltamethrin	0.005%	123.5	349.2	242.5
cypermethrin	0.005%	130.7	369.2	284.6
fenvalerate	0.005%	130.0	394.6	297.2
control		79.4	186.3	85.3
SED		9.5	52.2	16.6
LSD (0.05)		NS	110.7	35.1

TABLE 2
Effect of insecticides on the percentage of eggplant fruits with different borer hole intensities

Treatment	PLR-1 (monsoon 89) Borer holes/fruit			Annamalai (monsoon 89) Borer holes/fruit		
	0	3-4	> 6	0	3-4	> 6
carbaryl +	35.5	18.3	9.0	44.3	15.5	7.8
wettable sulphur	(36.6)*	(25.3)	(17.4)	(41.7)	(23.1)	(16.1)
endosulphan	24.6	17.6	17.9	31.7	18.9	15.4
	(29.7)	(24.8)	(25.0)	(34.2)	(25.7)	(23.1)
quinalphos	37.5	19.0	10.5	42.9	17.1	8.6
	(37.7)	(25.8)	(18.9)	(40.9)	(24.4)	(17.0)
moncrotophos	35.0	18.2	10.9	43.2	15.2	7.8
	(36.3)	(25.1)	(19.1)	(41.1)	(22.9)	(16.2)
phosalone	35.0	18.7	10.0	46.5	15.6	6.7
	(36.2)	(25.6)	(18.4)	(43.0)	(23.3)	(14.9)
deltamethrin	44.9	20.3	6.7	50.7	14.2	5.2
	(42.1)	(26.8)	(15.0)	(45.4)	(22.1)	(13.0)
cypermethrin	45.9	15.8	7.4	51.7	12.4	3.9
	(42.7)	(23.4)	(15.7)	(46.0)	(20.6)	(11.2)
fenvalerate	50.4	13.6	4.4	56.8	12.5	2.7
	(45.3)	(21.7)	(12.0)	(28.9)	(20.7)	(9.3)
control	18.7	19.6	19.6	26.8	14.3	21.6
	(25.6)	(26.3)	(26.2)	(31.2)	(22.2)	(27.6)
mean	36.4	17.9	10.7	43.8	15.1	8.9
	(36.9)	(25.0)	(18.6)	(41.1)	(22.8)	(16.5)

	Borer Intensity (BI)	Treatment x Borer intensity (TxBI)	BI	TxBI
SED	0.55	1.66	1.54	1.95
LSD (0.05)	1.10	3.29	3.06	3.87

* Angular value

treatments (Table 4). This suggests that the insecticides did not directly influence seed quality, but by reducing borer incidence, were able to indirectly improve seed performance.

Fruit borer can be a significant pest of egg plant seed crops. These results suggest that insecticide application can provide some control of the pest and that synthetic pyrethroids, in particular fenvalerate could be used for this purpose. Further work is required to evaluate responses to differing insecticide application rates and timings.

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TABLE 3
The effect of fruit borer on seed quality of egg plant cv PLR-1 and Annamalai grown in the monsoon season

Seed quality parameter	PLR-1 Pest free	PLR-1 Pest present	PLR-1 SED	PLR-1 LSD 0.05	Annamalai Pest free	Annamalai Pest present	Annamalai SED	Annamalai LSD 0.05
100 seed weight (mg)	348.2	342.3	0.97	1.96	362.2	262.0	0.9	NS
% germination	77.2	74.8	0.58	1.19	55.6	53.9	2.3	NS
shoot length (cm)	5.7	5.7	0.06	NS	5.5	5.5	0.08	NS
root length (cm)	4.0	3.7	0.07	0.14	3.5	3.3	0.05	0.11
vigour index	742.7	695.6	11.7	23.7	502.1	487.5	10.0	20.4
100 seedling dry weight (mg)	18.1	18.3	0.11	NS	15.0	14.6	0.12	0.25
electrical conductivity (ds $m.^{-1}$/50ml/50 seeds)	14.5	15.9	0.08	0.15	14.9	16.4	0.09	0.18

TABLE 4
Effect of fruit borer and insecticide treatment on percentage field emergence of cv PLR-1 and Annamalai (seed produced during monsoon 1989)

Treatment	PLR-1 pest free	PLR-1 pest present	Annamalai pest free	Annamalai pest present
mean[1]	84	76	93	86
	(66)[2]	(61)	(9.6)[3]	(9.3)
control	82	65	93	80
	(66)	(61)	(9.6)	(9.0)
deltamethrin	84	80	93	88
	(66)	(63)	(9.6)	(9.4)
cypermethrin	84	82	94	89
	(67)	(65)	(9.7)	(9.4)
fenvalerate	84	83	94	88
	(67)	(66)	(9.7)	(9.4)

[1] mean for all treatments
[2] angular value
[3] square root value
[4] analysis for all treatments

	pest (P)	treatment (T)	PxT
PLR-1			
SED[4]	0.32	0.67	0.94
LSD 0.05[4]	0.64	1.36	1.92
Annamalai			
SED[4]	0.03	0.07	0.09
LSD 0.05[4]	0.06	0.13	NS

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