SEED TREATMENT WITH INSECTICIDES FOR THE CONTROL OF OPHIOMYIA (MELANAGROMYZA) PHASEOLI (TRYON) ON COWPEA IN SRI LANKA

G. A. W. WIJESEKARA and K. G. W. ABEYTUNGE
Regional Research Station, Angunukolapelessa, Sri Lanka.

ABSTRACT

The recommended series of foliar sprays to control *O. phaseoli* in Sri Lanka is beyond the investment potential of most peasant farmers. Therefore, simple economical alternatives are necessary. Six systemic insecticides (carbamates and organophosphates) were used as seed soaking treatments during three seasons beginning Yala 1982. The optimum time of soaking seeds in insecticide solutions was found to be about 6 hours. Germination was not seriously affected when soaked for 6 hours in insecticide solutions at concentrations used in this study. Monocrotophos seed treatments gave consistently good results in controlling the pest during all three seasons. The economy of using the seed treatment over the recommended foliar spray treatment was considerable. The protection afforded during the vulnerable seedling stage, the ease of application and the potential to conserve and promote biological control agents in an integrated pest management programme, by reducing the number of foliar sprays are advantages of the seed treatment method.

INTRODUCTION

The beanfly *Ophiomyia (Melanagromyza) phaseoli (Tryon)* (Diptera: Agromyzidae) is a serious pest of major economic importance in some species of the genus *Phaseolus*. *Phaseolus* belongs to the tribe *Phaseoleae* of the sub-family *Papilionoideae* and is morpholgically similar to *Vigna* (cowpea) and *Lablab* (hyacinth bean) in the same tribe. Green gram *(Vigna radiata)* and black gram *(Vigna mungo)* are among those species recently transferred from *Phaseolus* to the cowpea genus *Vigna* (Cobley and Steele 1976). Infestation of the pest also occurs in some species of the genus *Glycine*. The pest

has been recorded in Egypt, Sudan, Kenya, Uganda, Tanzania, Zaire, Malawi, Mauritius, Rhodesia, Senegal, South Africa, Israel, Sri Lanka, India, China, Indonesia, Malasia, Phillippines, Singapore, Australia and Pacific Islands (Anon. 1961). In Sri Lanka, the grain legumes in order of susceptibility to *O.phaseloi* are cowpea *(Vigna unguiculata (L) Walp)*, green gram *(Vigna radiata (L.) Wilezek)* and soybean (*Glycine max (L.) Merr*). Infestation does not occur in pigeon pea (*Cajanus cajan (L.) Millsp.*) (Banda and Fernando 1981). In the DL_1 agroecological region of Sri Lanka, the pest is very destructive during the period from March—June causing mortality upto 100% (Banda and Fernando 1981). The adult fly has been observed to lay eggs on tender stems (Babu and Rajasekaran 1981) and petioles (Walker 1960); but oviposition is mostly on the upper leaf surface. The eggs hatch after two days and the larvae mine sub-epidermally through the leaves, petioles and stems of the seedlings and pupate within the stem close to the ground level. On older plants, the larvae pupate at the base of petioles resulting in swelling, splitting-open or rotting of these parts. Seedlings suffer the most damage and are stunted or killed outright. Older plants are stunted but are not usually killed.

The objective of the work reported here was to find economic control methods against *O.phaseoli* in cowpea. The recommended control method at present is a schedule of foliar sprays with systemic organophosphate insecticides commencing at the two-leaf stage of the plants. The spray is repeated at bi-weekly intervals, if necessary. However, the Sri Lankan farmers find this treatment expensive (about Rs. 122/- per application per acre) and do not adopt the practice readily. In the present study, six systemic insecticides (carbamates and organophosphates) were tested as pre-plant seed soaking treatments during three seasons beginning Yala 1982. Pre-plant seed soaking treatments for the control of *Melanagromyza phaseoli* in bean with organophosphorus and chlorinated hydrocarbon insecticides were studied by Wickramasinghe and Fernando (1962).

Seed treatments (coating, soaking or grannular) with chlorinated hydro carbons affect a limited soil area and only insects within the vicinity of the seeds are killed. Organophosphorus and carbamate seed treatments on the other hand can also afford protection to growing seedlings against foliar pests. The eflect of the insecticide lasts four to eight weeks depending on the material used, thus affording protection over the vulnerable seedling stage

of the plant. Seed treatments are more effective in protecting seedlings than foliar sprays, since spray recovery by seedlings is poor due to low leaf to ground area ratio. (Varma 1974).

MATERIALS AND METHODS

Cowpea variety MI. 35 was used in all experiments. The experimental design was a complete randomized block with three replicates. The plants were spaced at 0.3 m between rows and 0.15 m within the row. The plot size was 3 m × 3 m. Demetonmethyl (Metasystox)* profenophos (Selecron), thiodicarb (Larvin) and monocrotophos were used as the treatments during Yala 1982. During Maha 82/83, demetonmethyl (Metasystox) was replaced by carbosulfan (Marshal). During Yala 83, omethoate (Folimat) and the recommended foliar spray of monocrotophos (Azodrin) were included as treatments in addition to the Maha 82/83 treatments. The treatments were compared with untreated plots in all experiments. The pest infestation level was evaluated two weeks after sowing by uprooting the seedlings and counting the number of plants with swollen or split stems.

The optimum time of soaking the seeds in insecticide solutions was determined by soaking 100 g samples of cowpea seeds in beakers containing 250 ml of water in each. The amount of water absorbed by the seeds at a given duration of soaking was determined by straining the seeds with a sieve and measuring the remaining volume of water in the beaker. The seeds were allowed to drain into the beaker for two minutes before the water was measured. Standard germination tests in petri dishes (diameter 110 mm) were carried out using batches of 100 seeds, soaked in insecticides under evaluation except demetonmethyl (Metasystox) (See table 1 for concentration and amounts of solutions used). The seeds for germination studies were soaked in insecticide solutions over the optimum period determined by the previous study. The germination tests were replicated three times. For field planting the seeds were drained of excess insecticide solutions by sieving. The seeds were then transferred to a plastic bucket and an old discarded table spoon was used to drop the seeds from the bucket into planting holes.

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* Mention of a trade mark, proprietary product, or vendor does not constitute a guarantee or warranty of the product by the Department of Agriculture, Sri Lanka, and does not imply its approval to the exclusion of other products or vendors that may also be suitable.

Table 1: Percentage germination of cowpea seeds soaked for six hours in different insecticide solutions compared with seeds soaked in water (control).

Treatment	*Concentration in 500 ml. of water*	*%Germination after soaking for six hours*
Monocrotophos 60 EC	0.75 ml.	95
Carbosulfan 20 EC	0.75 ml.	96
Thiodicarb 375 EC	1.00 ml.	97
Profenophos 50 EC	0.25 ml.	89
Omethoate 50 EC	0.25 ml.	85
Control — —	—	92

RESULTS AND DISCUSSION

Figure 1 shows the relationship between the amount of water absorbed and the time of soaking cowpea seeds in water. Lines a and b show the relationships determined with seeds of an initial moisture content of 8% and 13% respectively. Both lines indicate similar relationships. The difference in the volume of water absorbed at a given soaking duration between the two samples was due to the different initial moisture contents of the seeds. In both lots of seeds the water absorption was virtually complete after 6 hours of soaking. The volume of water absorbed after 3 hours of soaking was about 90% of the volume of water absorbed after 6 hours. We decided 6 hours to be the optimum time of soaking cowpea seeds in water.

Table 1 shows the percentage germination of cowpea seeds soaked in different insecticide solutions for 6 hours compared with the control. Analysis of variance of sin $\sqrt{\times}$ transformed percentage values showed that the differences between treatments were not significant ($P>0.05$) showing that phytotoxicity due to soaking in insecticide solutions was not a serious problem at the concentrations used for the treatments.

Table 2 shows the percentage pest damage two weeks after sowing seeds treated with insecticides used in the study, compared with the control and the recommended practice. During Yala 82, seeds treated with both concentrations of monocrotophos gave significantly higher control of the pest than the other chemicals used, and there was no significant difference in the pest incidence between the untreated control and the remaining insecticide treatments. During Maha 82/83, once again monocrotophos treatments were superior to the other treatments. There too was no significant difference between the untreated control and the other insecticides used. The pest incidence among the four concentrations of monocrotophos tried out was not significantly different. During Yala 1983, even though the monocrotophos

seed treatments gave effective control, there was no significant difference in the pest incidence compared with either the recommended control procedure (foliar sprays) or the carbosulfan treatment. The consistent good performance of monocrotophos seed treatments during all three seasons in controlling the pest shows the practical applicability of the treatment under field conditions. The acceptable performance of carbosulphan during one of the two seasons when it was used as a treatment is not consistent enough to arrive at a conclusion. Admittedly, the standard recommended practice should have been included in all three experiments rather than during Yala 1983 alone. Therefore, it is not possible to compare its effectiveness with the monocrotophos seed treatments.

Table 2. Percentage damage due te *O.phaseoli* in two week old cowpea seedlings grown with seeds soaked in different insecticide solutions.

		Yala 82		*Maha 82/83*		*Yala 83*	
Insecticide	*Dosage ml/l.*	*%* *mean*	*Arc. sine* *mean*	*%* *mean*	*Arc. sine* *mean*	*%* *mean*	*Arc. sine* *mean*
Organophosphates							
Demetone methyl (25 EC)	0.75	41.13	40.26 b	—	—	—	—
Demetone methyl (25 EC)	0.37	40.44	39.37 b	—	—	—	—
Profenophos (50 EC)	4	—	—	13.37	21.30 b	72.89	63.98 b
Profenophos (50 EC)	2	—	—	14.33	22.08 b	—	—
Profenophos (50 EC)	1	24.27	29.51 b	—	—	—	—
Profenophos (50 EC)	0.5	24.05	29.36 b	—	—	—	—
Monocrotophos (60 EC)	3	—	—	4.57	11.85 a	—	—
Monocrotophos (60 EC)	1.5	—	—	8.47	15.93 a	21.76	27.67 a
Monocrotophos (60 EC)	1.0	5.56	13.63 a	8.30	16.65 a	—	—
Monocrotophos (60 EC)	0.5	6.64	14.91 a	8.33	16.62 a	31.13	36.33 a
Omethoate (50 EC)	2	—	—	—	—	—	—
Carbamates							
Thiodicarb (375 EC)	4	26.16	30.81 b	12.23	20.40 b	—	—
Thiodicarb (375 EC)	2	45.42	42.36 b	12.80	20.50 b	84.95	67.34 b
Carbosulfan (20 EC)	3	—	—	14.13	22.07 b	44.99	42.09 a
Carbosulfan (20 EC)	1.5	—	—	11.63	19.53 b	—	—
Recommended control*	—	—	—	—	—	31.15	33.66 a
Untreated control	—	38.63	38.43 b	19.87	24.46 b	74.13	59.89 b
S.E. of treatment mean	—	—	3.104	—	2.394	—	5.668

Values followed by a common letter are not significantly different
The ANOVA was on Arc. sine transformed values

*Recommended control—Monocrotophos (60 EC) 366 ml. per acre as foliar spray.

Cost of the treatments

At a planting rate of 18 kg of cowpea seeds per acre, the amount of monocrotophos (Azodrin 60 EC) required for the seed soaking treatment (at the rate of 1 ml monocrotophos per litre of water) is 21.69 ml. The cost of this amount of chemical is Rs. 7.80 (400 ml Azodrin costs Rs. 144.00). The cost of a single application of the recommended treatment (Azodrin 60 EC at 336 ml per acre) is Rs. 122.00. In addition to the considerable economy, the ease of the seed soaking treatment and the elimination of the use of an applicator are two clear advantages of the method tested.

CONCLUSION

The use of monocrotophos as a pre-plant seed soaking treatment in the control of *O. phaseloi* (*tryon.*) in cowpea gave consistently superior control during three seasons, compared to other similar treatments. The superiority of the monocrotophos seed treatment over the present recommendation was not established. However, the advantages of using monocrotophos seed treatment over the recommended practice are considerable. The monocrotophos seed treatment affords protection against infestation by *O.phaseoli* during the vulnerable seedling stage (two-weeks after sowing) of cowpea plants. Determinations of natural enemies of *O.phaseoli* in Sri Lanka by Fellows and Amarasena (1977) yielded a range of hymenopteran parasites with overall parasitism reaching about 40%. Reducing the number of foliar sprays by adapting the seed treatment method may conserve the parasite population at a level sufficient to strengthen the biological control aspect of an integrated pest management programme. This is another advantage of a seed treatment method.

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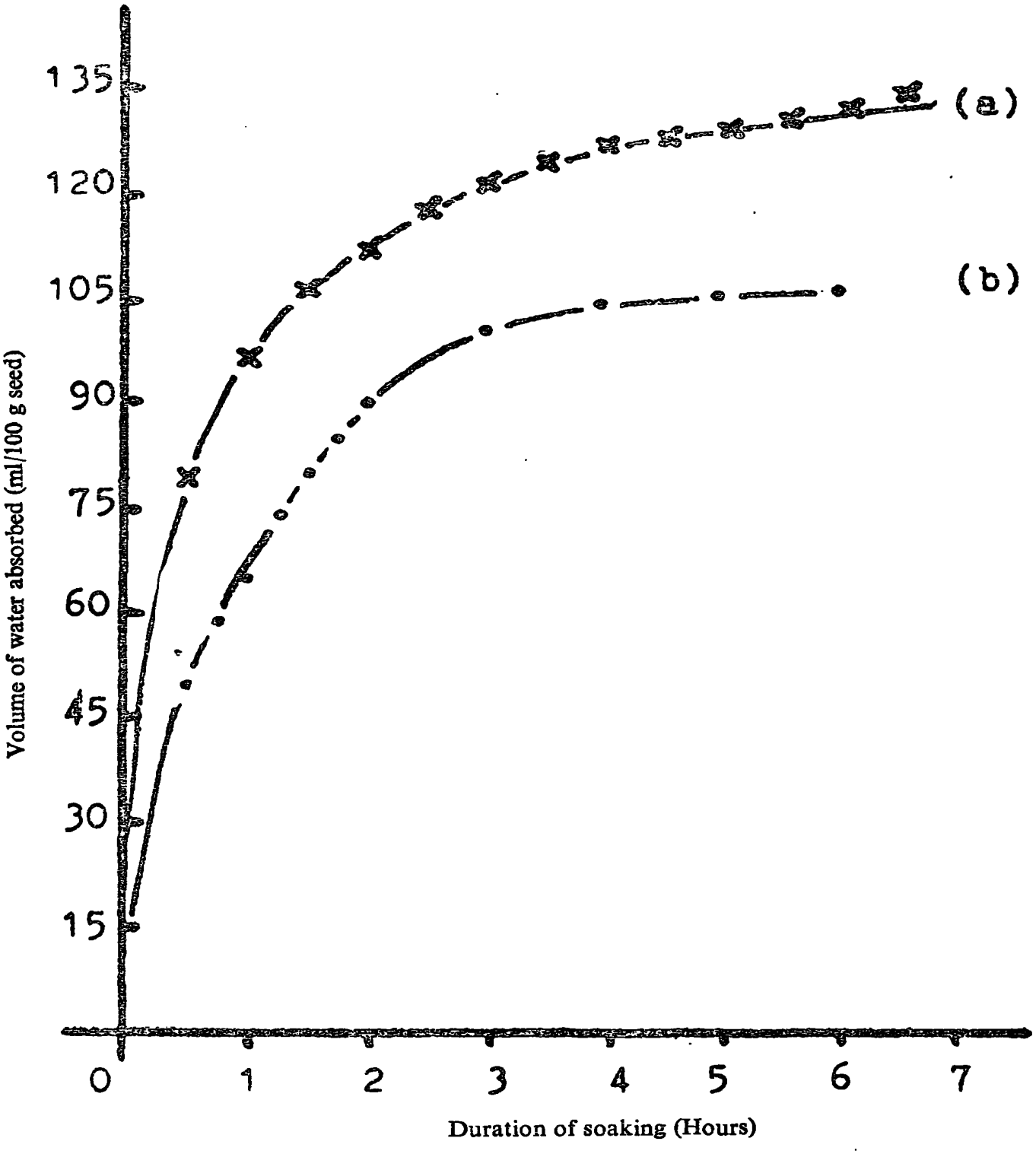

Fig. 1. The relationship between the volume of water absorbed by cowpea seeds and the duration of soaking.