EXPERIMENTS ON WATERLESS SPRAYING WITH SYSTEMIC INSECTICIDES IN CONTROLLING THE BEAN PESTS

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INTRODUCTION

Most bean pests damage the plant by sucking its juices. An experimental field in the plant Pests and Diseases Research Institute was attacked in August 1970 by the following pests.

1- *Macrosiphum pisi* (Kalt.) (= *Acyrthosiphon pisum* (Harr.) = *A. onobrychis* B. & F.)
2- *Aphis laburni* Kalt.
3- *Empoasca* sp. *faba* ? (Homoptera, Cicadellidae)
4- *Tetranychus bimaculatus* Harvey

The biology and life cycle of these pests have been widely studied and discribed in general text books of economic entomology such as Metcalf and Flint (1962). Recent methods for controlling these pests involve spraying the plants with organophosphorus insecticides or acaricides such as phencapton or tedion. These pesticides usually are applied on the plants after diluting the poison in water. It is however possible to spray undiluted pesticides on the plants. Experiments on waterless spraying of crops in Iran were carried out using Turbair X handsprayer atomiser for controlling aphids, *Bulaea* and thrips on various crops. (Hodjat, & Hunter-Jones, 1970). The control of *Aphis gossypii* was only achieved when systemic insecticides were used by Turbair X. Waterless spraying of non-systemic organophosphorus insecicides was not effective (Tirgari, Hunter-Jones & Hodjat, 1970). The following experiments were made with systemic insecticides sprayed by Turbair X against common bean pests.

METHODS

The experimental field was divided into four plots:

- Plot number (1), 3.5 X 5.5 m, control. Three days after the start of the experiment this plot was sprayed by 20 % emulsion of dimecron.
- Plot number (2), 3.5 X 5.5 meter, sprayed by 40% emulsion of perfekthion.
- Plot number (3) and (4), 3 X 4 meter, sprayed by 25 % emulsion of metasystox and 50% emulsion of carbicron consecutively.

In each plot 20 cc of insecticides, regardless of their original emulsion concentration were sprayed by Turbair X.

The concentrated insecticide was poured into the spraying bottle and screwed to the sprayer. The sprayer is powered by a 12 volt dry battery. The drops of poison when sprayer is kept at upward position run onto a spinning disc which turns at 6000 r.p. m.

The droplets which are sprayed on the plants are of 50 – 100 m in diameter. There was no wind at the time of spraying and most droplets covered the green parts of the plant in each plot.

The number of aphids, leaf hoppers and mites were counted before and after spray by taking 4–10 random leaf samples from each plot and counting the number of each pest per leaf.

RESULTS

Effects on aphids: Before spraying the mean number of aphid per leaf was determined by taking ten random leaf samples (with three leaflets) from each plot. Each untreated plot had an average of 19 to 24 *A. pisum* per leaf. After spraying the number of aphids in each plot was determined by taking four leaf samples in each plot and counting the number of pests 2, 4, 24 and 48 hours after treatment. In treated plots after 48 hours no aphid infestation was recorded while an average of 18 aphids per leaf was found in control plot (Table, 1).

TABLE 1: The mean number of *A. Pisum* in treated plots before and after spraying.

Treatment and plot number		Mean number of aphid per leaf				
		Before spraying	After spraying (hours)			
			2	4	24	48
Control	(1)	22.5	26.5	22.5	7.7	18.5
Perfekthion	(2)	19.1	8.5	4	0	0
Metasystox	(3)	22.7	3	0	0.2	0
Carbicron	(4)	24.4	1	0.5	0	0

Three days after the start of experiment the control plot was sprayed by 20 cc dimecron. In the dimecron treated plot one day after spraying only one aphid was found in four leaf samples and up to one month no other aphid infestation was recorded. In plots number (2) and (3) an average of one to two aphids per leaf was found ten days after spraying but no aphid was recorded 25 and 30 days after spraying. From one day after treating plot number (4) with carbicron for one month no aphid infestation was recorded in this plot.

Only a few plants were infested heavily by *Aphis laburni* Kalt. at the beginning of the experiment. The infested plants had about 75 to 117 aphids per leaf before spraying. The aphid colonies were demolished after spraying but since only a few plants in each plot were infested by this aphid no aphid count was obtained after spraying. However, later in October at the end of the cultivation season heavy reinfestation of plants by this aphid which covered leaves, stems and fruit pods was observed.

Effects on leaf hoppers: At the time of sampling some of the leaf hoppers will fly. The number of remaining leaf hoppers before spraying was 3 to 6 per leaf in each plot. Two, four, 24 and 48 hours after spraying the mean number of leaf hoppers per leaf in each plot was counted. At these periods a mean of 6, 10,1.5 and 2 leaf hoppers per leaf was obtained in control plots respectively after spraying. There was no infestation in other treated plots up to 48 hours after spraying. The treated plots were reinfested seven days after insecticide spraying but no infestation was found in these plots when samples were taken 25 and 30 days after treatment.

Effects on plant mites: Before spraying an average of 3.4 to 22 mites per leaf was counted on each plot. Fourty eight hours after spraying the number of mite per leaf was reduced in all plots. The mean number of mite per leaf was 2.5 in control but no mite was found in sprayed plots after 48 hours (Table, 2).

TABLE 2: The mean number of *Tetranychus* per leaf before and after spraying.

Treatment and plot number		Mean number of mite per leaf				
		Before spraying	After spraying (hours)			
			2	4	24	48
Control	(1)	9.2	29	9.5	5	2.5
Perfekthion	(2)	8.2	8	2	0.2	0
Metasystox	(3)	3.4	0	0	0.5	0
Carbicron	(4)	21.9	0.2	2.5	0.5	0

An average of six mites per leaf were counted two hours after the control plot was sprayed by dimecron. No infestation was found from the next day for one week in this plot. However, 22 and 27 days after dimecron treatment an average of 27 and 11 mites per leaf was obtained. Reinfestation was also seen in other treated plots one weak after spraying (Fig. 1).

In the first three days after spraying the mean number of dead mites per leaf increased in treated plots. The count of dead mites 25 and 30 days after treatment by systemic insecticides showed that it has almost reached its pretreatment level (Fig, 1).

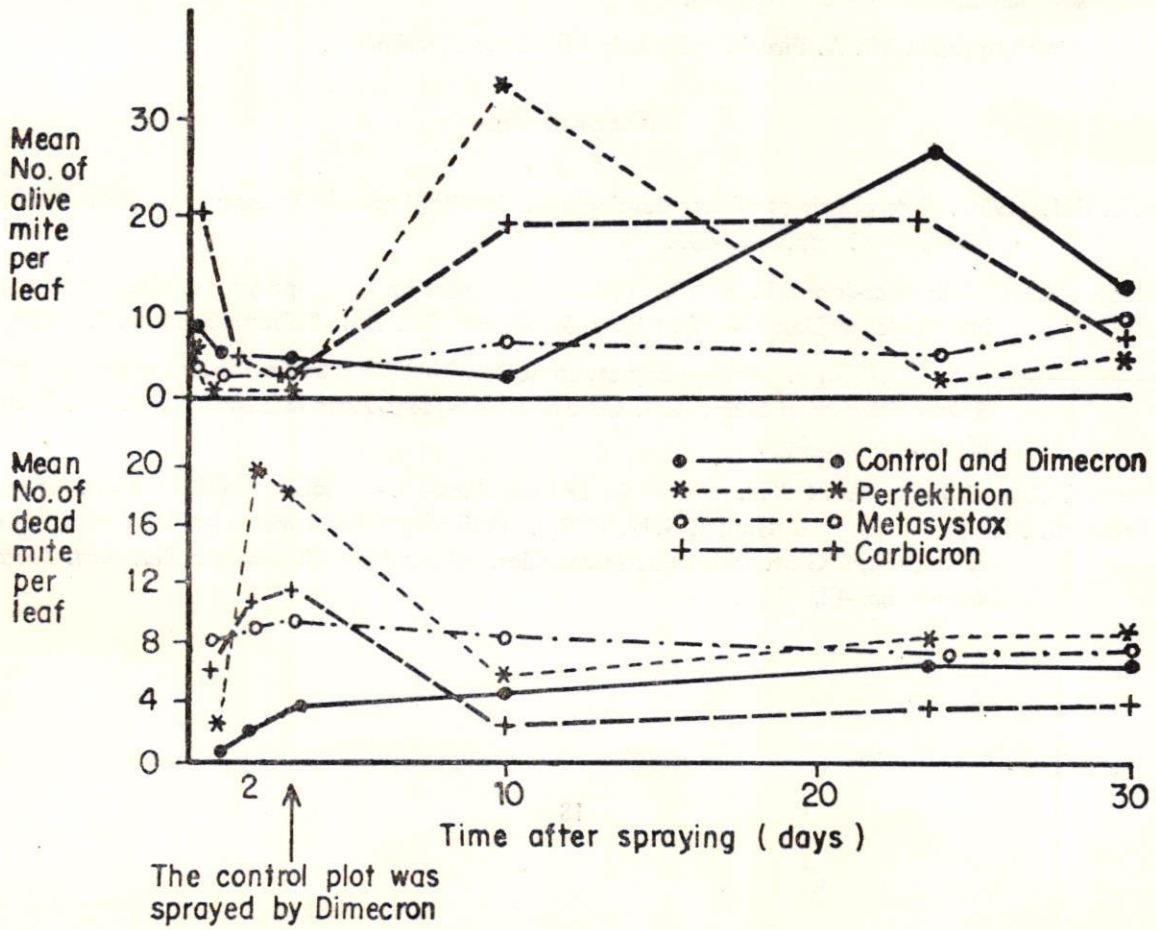

Fig. 1 : The mean number of alive and dead mite per leaf. The above curves show the increase in the number of alive mites about one week after spraying. In the second set of curves the number of dead mites in each plot was reduced to its pretreatment level about one week after spraying. The population of mite was very low and showed little fluctuation in plot number (3) which was treated by metsystox.

DISCUSSION

Waterless spraying of organophosphorus systemic insecticides when sprayed by Turber X can give effective control of juice sucking bean pests in Iran. The period of effectiveness was about one week on mites while for one months after spray the plants were free from aphids and leaf hoppers. The reason for the short time of insecticide effectiveness on mite is not known. The higher population of mites on adjacent crops and low effectiveness of these pesticides against their eggs suggest that they are only effective at high concentrations for short period of time. The general reduction of pest population in control and treated plots can be explained by the fact that small droplets of poison might have drifted to control plots.

Organophosphorus insecticides especially when used as waterless spray leave high residues. It is best to delay the harvest of pods even longer than the original recommendation by the manufacturers. The insecticides used in these experiments at the rate of 20 cc per 12.to 20 square meters were not phytotoxic to plant. It seems that even by spraying lower dosages of these pesticides on bean a similar control might be achieved.

Experiments have shown that ultra-low-volume sprays give a better cover of the crops when compared by conventional methods (Bals, 1969). Further experiments are needed to find the least amount of poison that can give effective control.

I wish to thank Mr. A. Firuzi for his help with these experiments.

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