EFFECT OF INSECTICIDES ON THE GROWTH PARAMETERS, YIELD AND OIL CONTENT OF MUSTARD

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ABSTRACT

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The experiment was conducted at the research farm of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh during November 2001 to February 2002 to determine the effectiveness of three insecticides namely Metasystox-R 25 EC, Dimethion 40 EC, and Fentro 50 EC on the yield and yield attributing characters as well as oil content of mustard. The crop was sprayed with the insecticides twice after sowing at the rate of 0.05% and 0.025% a.i. and growth parameters, yield and oil content were observed. It was found that these three insecticides influenced on the various growth parameters and yield attributing character leading to much higher seed yield as compared to control. The yield of all the treatments was significantly better than the control. The response of Metasystox-R @ 0.05% was comparatively better for various growth parameters and yield of mustard. Oil content in seeds was found to be marginally decreased due to insecticide application, though the values were statistically significant.

Key words: Mustard, insecticides, growth parameters, yield, oil content

INTRODUCTION

Mustard (*Brassica* sp.) is the major source of cooking oil among the oilseeds grown in Bangladesh. It covers an area of 344132 hectares of land from where about 252515 metric tons of rape seed and mustard (Anon, 2001a) are produced. This amount is not sufficient at all and Bangladesh imports 100890 metric tons of oil to meet her annual requirement, which costs Tk. 2613930000 (Anon, 2001b). The average yield of mustard is very low in Bangladesh. One of the major factors responsible for such low yield is the ravage caused by insect pest attacking at various stages of the crop. Among them *Lipaphis erysimi* Kaltenbach, (Aphididae, Homoptera) is the most serious pest (Morzia and Husain 1994, Morzia *et al.* 1996, Rouf and Kabir 1997) in Bangladesh and is distributed in many other countries (Hamid and Ahmed, 1980 and Setokuchi, 1983). Yield loss caused by aphid infestation in mustard ranged from 87.16 to 98.16% (Anon, 1995). For controlling this insect farmers' used several types of insecticides. Many workers have tried to control this insect with varying degree of success by frequent applications of insecticides as foliar treatments (Chowdhury and Roy, 1975). Objective of the application of these insecticides is to manage the insect pests but main goal is to increase the yield of crop. In view of the aforesaid perspective the present research work was undertaken to determine the impact of applied insecticides on various growth parameters, yield, and oil content of mustard.

MATERIALS AND METHODS

The study was conducted at the research farm of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh during the period from November 2001 to February 2002. Three insecticides, Metasystox- R 25 EC, Dimethion 40 EC, and Fentro 50 EC were used against *L. erysimi* Kalt. in this study. Each of them two different concentrations viz. 0.05% and 0.025% were applied, where no insecticides applied in control. Application of insecticides were done at 50 and 70 days after sowing (DAS) of mustard. Seeds of both BINA Sarisha-4 and *Brassica napus* L. varieties were collected from the Genetics and Plant Breeding Division of BINA. The experiment was conducted in RCB design with 3 replications. The unit plot size was 5m x 4m where spacing between block to block and plot to plot were 1m and 0.5m, respectively. The plots were exposed to natural infestation.

Land was prepared with four ploughings followed by laddering and proper leveling. Fertilizer applied with cowdung, urea, TSP, MP, borax, and gypsum at the rate of 1000 kg, 250 kg, 180 kg, 70 kg, 10 kg, and 125 kg per hectare respectively. The half of the urea and whole amount of all other fertilizers were applied during final land preparation. The remaining half of urea was applied after 15 days of sowing. Seed rate used 7 kg per hectare. Necessary intercultural operations were carried out as and when required. Only one flood irrigation was given at 40 days after sowing.

The crop was harvested when they were fully matured and was done with sickle at ground level. The yield of seeds per plot was recorded. The results were expressed as kg per hectare. Plant height, number of branches per plant, total number of pods per plant, pod length, number of seeds per pod were recorded after harvest. Plant height was measured by meter scale and pod length was measured by centimeter scale.

Protection efficiency and yield losses for each schedule were calculated with the following formula:

$$\text{Protection efficiency} = \frac{B}{A} \times 100, \quad \text{Yield losses (\%)} = \frac{A-B}{A} \times 100$$

Where, A= Seed yield in best treatment and B= Seed yield in testing treatment

The oil content of the mustard seed was determined by Folch (1957) method. One gram mustard seed was taken in a mortar. The seeds were completely grinned with a pestle. Thirty ml of chloroform and fifteen ml of methanol (i.e. 2:1 ratio) solution was added to it. After through mixing the melt was filtered through Whatman no. 42 filter paper. The filtrate was taken in a beaker and allowed to stand for about six hours for air drying and then dried in an oven for about half an hour to determine total oil. Proper care was taken so that chloroform and methanol completely dry out. Oil content was calculated by the following formula:

$$\text{\% of oil} = \frac{\text{Weight of extract (gm)}}{\text{Sample weight (gm)}} \times 100$$

The experimental data were statistically analyzed by RCB design using MSTAT statistical software. The means of statistically significant parameters were separated by using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The effect of three insecticides on different parameters and yield of mustard crop were measured and compared with control (without insecticides) and was tested statistically. The treatment-wise mean crop characters and yield are presented in the Table 1.

Plant height

At the high dose, the highest plant height (92.73 cm) was observed from Metasystox-R treated plants while minimum plant height was observed in the control plots (53.63 cm). At low dose, the highest plant height (84.50 cm) was observed from Metasystox-R which was significantly different from other treatments exception of high dose of Dimethion. Dimethion and Fentro were statistically identical at high dose. Low dose of Fentro showed the least plant height (69.50), though significant over the control.

Number of branches per plant

As regard the response of insecticides, high dose of Metasystox-R treated plants produced significantly higher number of branches per plant than other treatments. Low dose of Metasystox-R, high and low dose of Dimethion and Fentro treated plants produced significantly higher number of branches per plant over the control but they are statistically similar. Regarding the branch production high dose of Metasystox-R was significantly superior.

Number of pods per plant

Higher number of pods were observed at high dose of Metasystox-R treated plants (122.7), lowest was observed in control crops (64.67), formation of pods due to the effect of low dose of Metasystox-R (110.4), high and low dose of Dimethion (100.7 and 96.67) and Fentro at high and low doses (87.67 and 71.67) were second, third, fourth, and fifth in order of significancy. All the treated plants increased pod number significantly over the control, while high dose of Metasystox-R showed the most promising effect.

Pod length

Significantly highest length of pod (5.60 cm) was found at the high dose of Metasystox-R treated plants followed by high dose of Dimethion (5.35 cm) and low dose of Metasystox-R (5.12 cm). Lowest pod length was observed in control plants (3.03 cm). All the treated plants increased pod length significantly over the contol.

Number of seeds per pod

Maximum number of seeds per pod were observed at high dose of Metasystox-R treated plants (23.33 seeds) followed by high dose of Dimethion (19.33 seeds) and low dose of Metasystox-R (19.00 seeds) which were significantly different from control. Low dose of Dimethion, and both doses of Fentro showed statistically significant but similar with control, although control treated plants produced lowest number of seeds per pod (12.67).

Seed yield

From the Table 1 it can be seen that all insecticides treated plants produced significantly higher yield over the control. High dose of Metasystox-R treated plants produced highest amount of seeds (1750 kg/ha). Lowest amount of seeds were observed in the control plots (500 kg/ha). Low dose of Metasystox-R and high dose of Dimethion treated plots computed statistically second (1200 kg /ha), low dose of Dimethion and high dose of Fentro (950 kg/ha and 980 kg/ha respectively) computed third, and fourth was low dose of Fentro (800 kg /ha) in order of seed yield respectively. All of the treated plants showed significant increase of seed yield over the control. High dose of Metasystox-R was the best in performance. In an experiment with mustard Ramkishore and Phadke (1988) reported yield increase in mustard with Oxydemeton methyl. Vir and Henry (1987) reported that 4 sprays of 0.03% Dimethoate at fortnightly intervals gave significantly higher yields.

From the above discussion it was evident that all the growth parameters namely, plant height, number of branches per plant, number of pods per plant, pod length, number of seeds per pod, and seed yield were significantly increased over control with the application of insecticides. The over all growth in insecticides treated plants might be due to the control of mustard aphid, which led the plants a healthy growth over control. Similar findings were also obtained by Hossain (1993).

Oil content

Oil content in mustard seed showed statistically significant differences among the treatments. Maximum oil content was found in control (39.65%) which is statistically similar with low dose of Metasystox-R (39.10%) and same of Dimethion (39.10%). Minimum oil content was found at high and low doses of Fentro treated plants (37.95% and 38.72%) which was statistically similar with the treatment of high dose of Metasystox-R (38.71%) and same of Dimethion (38.75%) treated plants. Although higher percentage of oil was found in control plot over the insecticide treated plots but variation was within a narrow range. Hossain (1993) also observed that oil content reduced due to insecticides application which confirms this study.

Yield loss and protection efficiency

Three applied insecticides with their two doses were evaluated for protection efficiency and yield loss of mustard. The results on protection efficiency and yield loss are presented in the figure 1. Highest protection efficiency (100%) but lowest yield loss (0%) was found in Metasystox-R, where as the lowest protection efficiency, but the highest yield loss was in control. It was evident that the treatments in which Metasystox-R was used found more effective. Malik *et al*. (1998) reported that the protection efficiency was higher being 89.0, 85.9, 85.1, 84.3, and 80.4% with 10.9, 14.0, 14.8, 15.6, and 19.6% losses in seed yield in Endosulfan 0.07% + Methyl-o-demeton 0.025%, Methyl-o-demeton 0.025% + Methyl-o-demeton 0.025%, Deltamethrin 0.002% + Methyl-o-demeton, Malathion 0.05% + Methyl-o-demeton and Phosphamidon 0.02% + Methyl-o-demeton treated crop respectively. Maximum yield loss of 94.5% was noticed in untreated crop against 10.9 to 54.6% in fourteen insecticidal schedules.

Table 1. Effectiveness of insecticides on growth parameters, yield, and oil content of mustard

Name of insecticides		Dose (%)	Plant height (cm)	Number of branches plant^{-1}	Pods plant^{-1}	Pod length (cm)	Number of seeds pod^{-1}	Seed yield (kg/ha)	Oil content (%)
Trade name	Common name								
Metasysto x-R 25 EC	Oxydemeton methyl	0.05	92.73 a	5.00 a	122.7 a	5.60 a	23.33 a	1750 a	38.71 bc
		0.025	84.50 b	3.33 b	110.4 b	5.12 ab	19.00 ab	1200 b	39.10 ab
Dimethion 40 EC	Dimethoate	0.05	81.90 bc	3.00 b	100.7 c	5.35 ab	19.33 ab	1200 b	38.75 bc
		0.025	74.30 d	2.66 b	96.67 c	4.43 bc	17.67 bc	950 c	39.10 ab
Fentro 50 EC	Fenitrothion	0.05	79.10 c	3.00 b	87.67 d	4.48 bc	17.67 bc	980 c	37.95 c
		0.025	69.50 e	2.66 b	71.67 e	4.08 c	15.67 bc	800 d	38.72 c
Control			53.63 f	1.66 c	64.67 f	3.03 d	12.67 c	500 e	39.65 a
LSD value			4.475	1.50	4.553	0.864	5.155	104.5	0.765
Probability			0.01	0.05	0.01	0.05	0.05	0.05	0.05

Means in a column followed by same letter(s) are not significantly different.

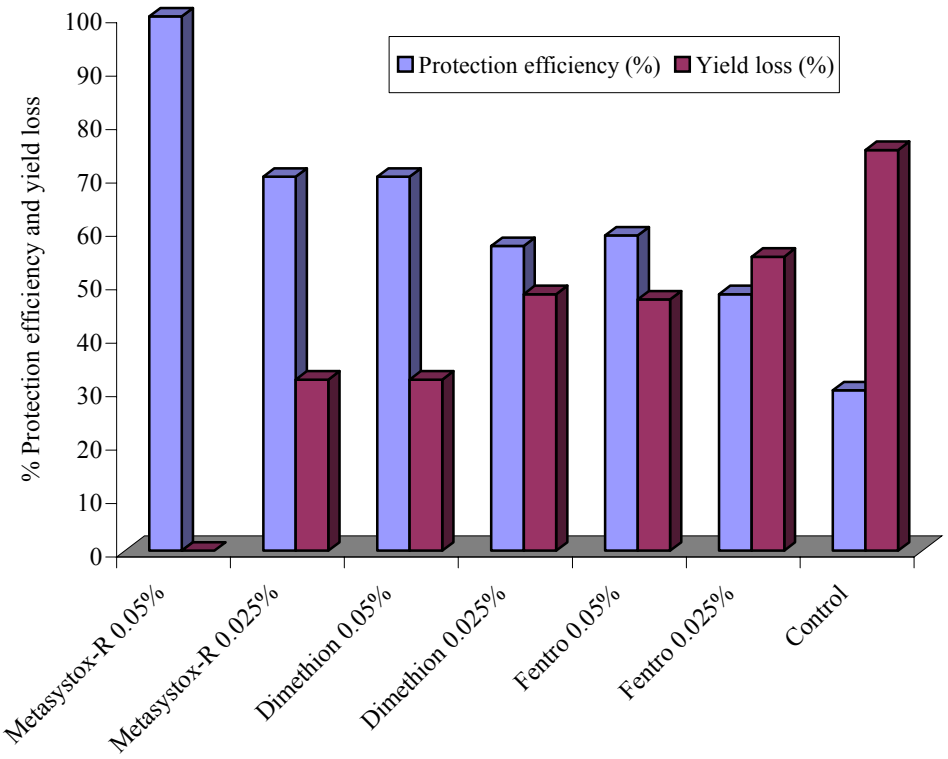

Figure 1. Effect of three insecticides on yield loss and protection efficiency of mustard

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