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INSTITUTE OF AGRICULTURAL RESEARCH

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* Chemical Control of Potato Tuber Moth (Phthorimaea Operculella (Zeller) in the field.

Adhanom Negasi

The potato tuber worm P.Operculella has long been considered to be a storage pest rather than a pest of crops in the field (Akade et. al., 1970). Control measures devised by earlier workers (Mukherjee, 1949; Lal, 1949; Rahman, 1944, Nirula, 1960; Nirula and Kumae, 1964) were mainly confined to storage. However, this pest has been taking a heavy toll of potato, both in the field and in the stores in many parts of potato, growing regions. According to Akade (1970), larvae of potato tuber moth damage reached 30 to 70 percent at field condition in the plateau regions of India. Since the initial infestation of the pest is carried from the field to stores greater attention on field is also called for. Control of PTM by insecticides is one of the methods applied in the field. Several chemicals have been observed to be effective against PTM in the field. Bacon (1960) found endrin and azinphos methyl to be effective against PTM in the field. Isobenzan and endrin were effective in India as evaluated by Kumar and Nirula (1964). Carbaryl, formathion, bromophos methyl, demeton-s were the best treatments against leaf mining larvae of P-Operculella on potato in feild plots tested in Egypt (EL - Hemaesy et. al., 1975). Moreover, the following chemicals have been reported as giving food control of the insect on other solanaceous plants. Organophosphorus compounds (azinophos - ethyl, azinophosmethyl, chlorfenvinphos, dimethoate, fensulfathion, formathion, phorate, phosalone and phosphamidon); Organochlorine compounds (DDT, endrin other compounds (carbaryl, isobenzan). Among those most studied and recommended recently have been azinophos- ethyl, azinphos - methyl and carbaryl (Gubbaih and Thontadarya, 1975; Dethe and Naik, 1975; Foot, 1975; Awate and Naik, 1970; Hofmaster and Waterfield, 1972; Mahajan and Mogal et. al., 1977; EL - Malsy, 1974).

Materials and Methods

Experiments were carried out at Melkassa I, (IAR), Nazret in 1980 - 81, 1981 - 82, 1982 - 83. The trial was carried out on a light soil of a 0.064 hectare field divided into 28 plots, each 2.1 meters (3rows) wide and 4.5 meters long with hills 30 cms apart and 70cms between rows planted with a local variety in 1980 - 81 and ANITA in the other years. All the usual cultural practices were followed. The source of moisture was irrigation. Treatments were arranged in a completely randomized block design replicated four times. The insecticides used and their rate of application are as follows:-

Chemicals		Rate of Application Kg. a.i./ha
Parathion methyl	50 E.C.	0.450
Methamidophos	50 E.C.	2.150
Decamethrin	2.5% E.C	0.018
Selecron	500 E.C	0.750
Diazinon	60% E.C	0.300
Cypermethrin	10 E.C	0.150
Check		Untreated.

The insecticides were applied with Gloria 160 Knapsack sprayer at the rate of 700 litres of water per hectare. Three applications at 15 days interval were carried out. Two counts were taken every seven days following each application. Nine plants from each plot replicated four times per treatment (Total of 36 plants) were selected at random and counts to determine the effects of insecticides on live larval and mines on the foliage were made without uprooting the plants. Tubers from each plot were separated into two categories those with no holes were considered marketable and those with one or more holes were identified as unmarketable. Weights of marketable tubers in each plot were recorded.

Results and Discussion

Table 1 shows the overall mean number of mines and live larvae of the potato tuber worm for the first, second and third applications of the 1980 - 81. The overall observation show that application of methamidophos, decamethrin and cypermethrin resulted in the fewest number of mines which means that these three insecticides were more effective than the others tested in decreasing larval activities followed by selecron. Diazinon was the poorest of all the insecticides tested in controlling PTM throughout the season. The mean number of live larvae showed that decamethrin, cypermethrin and methamidophos were the best insecticides used against PTM larvae. According to the results obtained, the effects of the insecticides were more dramatically evident on the numebr of mines because they curtailed the activities of the larvae which were responsible for the mines out of proportion to their number as was noted by EL - Hemeasy (1974).

Good results were obtained from a study on the effects of PTM control on the quality of potatoes. Table 2 shows that Decamethrin and cypermethrin gave significantly higher yields of marketable potatoes over diazinon and the untreated check. Some of the insecticides, for example parathion methyl, methamidophos and selecron which were good in controlling foliage attack were not good in the control of tuber attack by the PTM larvae because their yields were the same as that of diazinon and the untreated check. The treatments in controlling leaf miners on the foliage throughout the season though control foliage infestation did not always prevent tuber infestation as was also reported by Bacon (1960) EL - Hemeasy (1974) and Foot (1974).

The overall observation of the 1981 - 82 trial as indicated in Table 3 application of cypermethrin, diazinon and selecron resulted in the fewest number of mines. The mean number of live larvae showed that cypermethrin, diazinon and selecron were the best insecticides used against PTM larvae. However, there was not significant difference on the yield of marketable potatoes among the treatments as shown in Table 4.

The 1982 - 83 trial showed that application of decamethrin, selecron and cypermethrin resulted in the lowest number of mines. The mean number of live larvae as shown in Table 5 indicated that decamethrin, cypermethrin and selecron were the best insecticides used against PTM larvae. Though decamethrin gave the highest marketable yield followed by diazinon and parathion methyl, there was no significant difference on the marketable yield among treatment.

Out of the six insecticides evaluated at Melkassa, Nazret Research Station for controlling the potato leaf mine, Ph. Operculella on potato foliage, the best were decamethrin 2.5% E.C at 0.018 Kg. active, cypermethrin 10% E.C at 0.150 Kg active and selecron 500 E.C at 0.750 Kg. active per hectare, respectively.

Table 1.

Average post treatment counts of leaf mines and larvae of PTM on field planted potato

1980 - 81

Treatments	Application Rate Kg. a.i./ha	Mean No. mines	Mean No. larvae
Nethamidophos 50% E.C	2.150	* 4.58 a	1.60 ab
Decamethrin 2.5% E.C	0.018	5.18 a	1.16 a
Cypermethrin 10% E.C	0.150	5.65 a	1.33 ab
Selecron 500 E.C	0.750	8.20 ab	1.83 ab
Parathion methyl 50 E.C	0.750	11.27 bc	2.94 bc
Diazinon 60% E.C	0.300	14.12 c	3.47 cd
Check	Untreated	13.48 c	4.80 d
Mean		8.92	2.44
S.E		1.76	0.55
L.S.D at 5%		5.23	1.62

* Means followed by the same letters are not statistically different at 5% level (Duncan's New Multiple Range Test).

Table 2.

Chemical control of PTM on the weight of marketable potatoes. 1980 - 81

Treatments	Application Rate Kg. a.i./ha	Mean weight in Kg/plot.
Deltamethrin 2.5% E.C	0.018	14.30 a
Cypermethrin 10% E.C	0.150	13.61 a
Methamidophos 50 E.C	2.150	12.70 ab
Parathion methyl 50 E.C	0.450	12.34 abc
Sclecron 500 E.C	0.750	11.08 abc
Diazinon 60% E.C	0.300	9.78 bc
Check	Untreated	9.13 c
Mean		11.84
S.E		1.15
L.S.D. at 5% level		3.41

*) Means followed by the same letters are not statistically different at 5% level by Duncan's New Multiple Range Test.

Table 3.

Average post treatment counts of leaf mines and larvae of potato tuber moth on field planted potatoes.

1981 - 82

Treatments	Application Rate Kg. a.i./ha	Mean No. mines	Mean No. larval
Cypermethrin 10% E.C	0.150	3.23 a	0.165 a
Diazinon 60% E.C	0.300	3.49 ab	0.490 ab
Selecron 500 E.C	0.750	4.82 abc	1.415 ab
Decamethrin 2.5 E.C	0.018	6.40 bcd	1.310 ab
Methamidophos 50 E.C	2.150	7.41 cd	2.910 bc
Parathion methyl 50 E.C	0.450	9.06 de	4.740 c
Check	Untreated	11.50 e	5.410 c
Mean		6.55	2.34
S.E		0.97	0.810
L.S.D at 5%		2.87	2.73

*) Means followed by the same letters are not statistically different at 5% level (Duncan's New Multiple Range test).

Table 4.

Chemical control of potato tuber moth (PTM) on the weight of marketable potatoes.

1982 - 83

Treatments		Application Rate Kg. a.i./ha	Mean Wt. in Kg/plot.
Methamidophos	50% E.C	2.150	11.57
Diazinon	50 E.C	0.300	9.80
Selecron	500 E.C	0.750	9.32
Parathion- methyl	50 E.C	0.450	9.25
Decamethrin	2.5% E.C	0.018	8.60
Cypermethrin	10% E.C	0.150	7.22
Check		Untreated	7.12
Mean			8.98
S.E			1.180
L.S.D at 5%			N.S

1982 - S.

Treatments		Application Rate Kg.a.i./ha	Mean No. mines	Mean No. larvae
Decamethrin	2.5% E.C	0.016	* .21 a	* 1.25 a
Selecron	500 E.C	0.750	6.08 a	2.71 a
Cypermethrin	10% E.C	0.150	6.33 a	1.33 a
Methamidophos	50% E.C	2.150	8.00 ab	3.63 a
Parathion methyl	50 E.C	0.450	10.92 ab	8.58 ab
Diazinon	60% E.C	0.300	17.25 b	9.67 ab
Check		Untreated	27.50 c	14.53 b
Mean			11.61	5.95
S.E			2.32	2.93
L.S.D at 1%			9.44	-
L.S.D at 5%				8.71

*) Means followed by the same letters are not statistically different at 5% level (Duncan's New Multiple Range Test).

Table 6.

Chemical control of PTM on the weight of marketable potatoes.

1982 - 83.

Treatments		Application Rate Kg. a.i./ha	Mean Wt. in Kg/plot
Decamethrin	2.5% E.C	0.018	12.17
Diazinon	60% E.C	0.300	11.22
Parathion methyl	50 E.C	0.450	10.33
Methamidophos	50 E.C	2.150	9.76
Cypermethrin	10 E.C	0.150	9.74
Selecron	500 E.C	0.750	8.32
Check		Untreated	11.56
Mean			10.44
S.E			1.35
L.S.D at 5%			N.S.

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