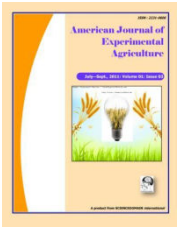

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Residual Effect of Malathion (Organophosphate) and Sevin (Carbamate) Application on Potato (*Solanum tuberosum*)

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Research Article

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ABSTRACT

An experiment was conducted at Shambat Agricultural farm to study the effect of pesticides residues on soil and potatoplant. Potato was planted on January, 2009 on ridges with a spacing of 70 cm between rows and 10 cm between plants. Sevin and Malathion pesticides were added at different concentrations to evaluate their effect on the plant growth and soil. The measurement taken was plant height (cm), fresh and dry weight (gm), leaf area (cm2), pH, total nitrogen %, phosphorus (ppm), leaf number and size of tubers. The results revealed that both chemicals affected negatively the vegetative growth of potato and its yield. It was noticed that the yield was generally less due to the effect of the heavy clay soil of Shambat. Addition of Sevin increased the total soil nitrogen and reduced soil organic carbon while the reverse was noticed for Malathion. Both chemicals lowered soil pH, from alkaline to neutral or slightly alkaline. However, they increased soil salinity which in turn affected potato growth and yield.

Keywords: Malathion; Sevin; pesticide; residues; potato;

1. INTRODUCTION

The excessive use of pesticides results in a great damage to the ecosystem. The production is greatly affected by this phenomena and the soil is polluted. Zaki (1978) stated that some

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pesticides might undergo a lot of changes and become more toxic. Khashin (1980) reported the effect of pesticides on plant part. Abdel Hamed (1989) pointed out that the residues might affect the presence of some minerals especially trace elements. Soil fumigation with carbon sulphate resulted in manganese and potassium increase. On the other hand, addition of sodium nitrite and DDT to the soil decreased the production of ammonia and the change of ammonia to nitrate. Omer (2001) studied the residues at Fashir district. He found high amount of pesticides of 0.0156 ppm of Sevin in the soil.

When the soil is treated it is difficult not to find a trace of residues in the plant parts (Mansour, 1971). An experiment of tomato conducted by Zaki (1978) showed a destructed effect on growth when treated by Sevin. Younis (1979) studied the effect of Sevin on lettuce and noticed an increase in the vegetative growth two weeks after treatment. He explained that, the pesticides might work as foliar fertilizer. Using malathion in tomato, he found no effect on hights but the roots were greatly affected. Traul (1987) in South Africa, found a negative results of Malathion in Alfalfa, maize and watermelon.

Pesticides effect on the soil was studied by many researchers (Shiah, 1980; Al jundi, 1972). They reported that soil worms were related to fertility specially forest soil where it acts as natural ploughing. Decreases of some nutrients were found by Dennis (1999), especially heavy minerals. When soil was fumigated by sodium sulphate an increase of phosphorus was detected in the soil. Abdel Al-Hamed (1989) stated that, the presence of pesticides residues in soil, lead to the decreased of many essential nutrients especially copper, zinc, manganese, iron and calcium. A study at a College of Agricultural studies (2004) revealed that Sevin and Malathion at different concentrations affected the growth of radish. The result in soil revealed a positive effect on radish growth at the recommended dose and negative effect at the higher dose (Samoul and Gamal, 2004). Another experiment was carried out at the College to find the effect of pesticide on wheat growth (Mobark, 2009). The results showed the negative effect and poor growth of wheat.

The main objectives of this study are:

1. To study the effect of the pesticides residues on potato growth.
2. To study the effect of the pesticides on agricultural soil.

2. MATERIALS AND METHODS

A field experiment was conducted at the College Farm (380 m. above sea level) to study the effect of two pesticides on the potato growth. The treatments viz., control, Malathion and Sevin were used in six plots each. Two concentrations and the recommended dose of each of Malathion (2.70kg/ha, 0.95kg/ha and 1.80kg ha) and Sevin (2.85kg/ha, 0.95kg/ha and 1.90kg/ha) respectively were used. Potato was planted on January (2009) on ridges with a spacing of 70 cm between rows and 10 cm between plants. Urea and phosphorus fertilizers were used at a rate of 150 kg/ ha and 120 kg/ha respectively. The pesticides were sprayed one month after planting. Plots were separated by sacks to prevent lateral movement of the pesticides. The whole plants were pulled and then washed for different measurements. Soil samples were taken before and after planting from 30 cm. depth for all treatments. Measurements taken were height (cm), fresh and dry weight (gm) leaf area (cm^2), pH, total nitrogen %, phosphorus (ppm) leaf number, and number and size of tuber. The data was taken and subjected to statistical analysis.

3. RESULTS AND DISCUSSION

As in tables 1 and 2 both Sevin and Malathion pesticides affected negatively the vegetative growth of potato. All the growth parameters were affected even by the recommended dose for both of them except for the plant height which was positively affected by Sevin. Such positive effect was also found by Younis (1979) on lettuce which was attributed to the effect of Sevin as foliar fertilizer. However, no significant differences were noticed between the recommended dose and the control. Similar results were obtained by Zaki (1978) on tomato and Traul (1981) on alfalfa, maize and watermelon.

Table1. Effect of Sevin on the vegetative growth (plant height, number of leaves, leaf area and shoot fresh and dry weights) of potato.

Sevin dose, kg/ha	Plant height (cm)	Number of leaves/plant	Leaf area/plant (cm^2)	Shoot fresh weight (g)	Shoot dry weight (g)
Control (0.95)	51.7a	23.0a	12.0a	57.0a	10.0a
Recommended (1.90)	55.0a	14.4ab	10.0ab	41.0a	7.6ab
50% higher (2.85)	39.0a	12.3b	8.0b	32.5a	5.1b

Means having alphabetical letters in common and within the same column were not significantly different at 0.05 using LSD method.

Table 2. Effect of Malathion on the vegetative growth (plant height, number of leaves, leaf area and shoot fresh and dry weights) of potato.

Malathion dose, kg/ha	Plant height (cm)	Number of leaves/plant	Leaf area/plant (cm^2)	Shoot fresh weight (g)	Shoot dry weight (g)
Control (0.95)	51.0a	20.6a	11.0a	47.8a	11.1a
Recommended (1.90)	36.7b	14.9a	9.0a	34.4a	7.7b
50% higher (2.85)	26.7b	12.3a	6.0a	27.4a	6.6b

Means having alphabetical letters in common and within the same column were not significantly different at 0.05 using LSD method.

The same negative effects of both pesticides on vegetative growth were reflected on tuber yield and its components (Tables 1, 2 and 3). Both tuber number and fresh weight (tuber yield/plant) were significantly affected by both pesticides even at the recommended doses it was noticed that the yield was generally low due to the fact that Shambat soil is a heavy clay alkaline soil. Dennis (1999) and Abdel Hamed (1989) noticed similar effects of both pesticides on root quality and yield of beet especially for the higher doses.

Addition of Sevin (Table 4) increased total soil nitrogen while the reverse was noticed by addition of Malathion. Both pesticides lowered the soil pH from alkaline to neutral or slightly alkaline. However, they increased the soil salinity to which their negative effects on potato

growth and yield may be attributed. Similar results were obtained by Abdel Jawad (2001) showing that both pesticides affected both soil nitrogen and pH and they attributed the reduction of total nitrogen to their effects on nitrogen bacteria and other soil microorganisms. Herbicides can have both beneficial and harmful residual effects on the next crop. It was found by Mulder and Barberet (2010) that control with insecticides in alfalfa is usually unsatisfactory due to persistence of attack and restrictions against using chemicals with long residual effects. The preharvest Interval for sevin on Irish potatoes was found to be 7 days while malathion is considered as a long time standard insecticide (Layton, 2006).

Table 3. Effect of Sevin on yield and quality (number of tubers and yield/plant, total yield and dry matter percentage of tubers) of potato

Sevin dose, kg/ha	Number of tubers/plant	Tuber yield/ plant (g)	Total yield (tons/fd)	Dry matter of tubers (%)
Control (0.95)	4.8 (a)	68.4 (a)	1.2 (a)	51.2 (a)
Recommended (1.90)	3.2 (ab)	49.8 (b)	0.9 (a)	50.2 (a)
50% higher (2.85)	1.3 (b)	14.0 (c)	0.3 (b)	51.8 (a)

Means having alphabetical letters in common and within the same column were not significantly different at 0.05 using LSD method.

Table 4. Effect of Malathion and Sevin pesticide on Soil

Dose	Pesticides	Total Nitrogen, %	pH
Before Application	-	0.020	8.1
Recommended Dose (control)	Malathion (1.80kg/ha) Sevin (1.90kg/ha)	0.024 0.038	6.8 6.9
Less than Recommended Dose	Malathion (.90kg/ha) Sevin (0.95kg/ha)	0.019 0.021	7.1 7.3
Excess Dose	Malathion (2.70kg/ha) Sevin (2.85kg/ha)	0.016 0.018	6.2 6.7
LSD (5%)	-	0.004	1.1

4. CONCLUSION

The use of insecticides in the recommended dose or less can be of greater value for potato production. Both malathion and sevin can be applied safely when a few basic rules are followed and common sense is used.

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