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The effect of sevin and malathion pesticides application on jews mallow (*Corchorus olitorius* L.) growth and soil

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Abstract

This study was conducted at the College of Agricultural Studies, Sudan University of Science and Technology Farm to evaluate the residual effect of the recommended dose of Sevin, a carbamate insecticide, and Malathion, an organophosphate insecticide, on the growth of jews mallow and soil. Two doses of each insecticide (recommended 1.9kg/ha and higher 2.8kg/ha, respectively) in addition to a control without pesticide were used in two separate experiments. The experimental units were in completely randomized design with four replications. The parameters measured were (plant height, leaf area, root length and shoot fresh and dry weight) for jews mallow growth and pH, total nitrogen, extractable phosphorus and electric conductivity (Ece.) of the soil. The result showed that, the recommended dose of both pesticides (Sevin and Malathion) has significant positive effect on all growth parameters. The recommended dose gave the highest plants (72 and 76cm), leaf area (171.7and 220 cm^2) and shoot fresh and dry weight (7.3, 2.2, 7.4 and 2.7g) compared to the control or the highest dose for Sevin and Malathion , respectively. The total nitrogen percentage was significantly affected by both pesticides. The soil pH and electric conductivity (Ece.) were not significantly affected.

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Introduction

Jute mallow or jews mallow (*Corchorus* spp.), a member of the family *Tiliaceae*, is a nutritious leafy vegetable. Its leaves are rich in iron, protein, calcium, thiamin, riboflavin, niacin, folate, and dietary fiber. Moreover, its fiber is strong and waterproof, making it perfect for making burlap sacks, furnishings and even clothing. It has many species more than 15 in total (Anonymous, 2014). The most widely cultivated species is *C. olitorius* L. It is widely grown in Sudan and Egypt, however, no statistical information of areas grown and average production is available. In Sudan it grows well from April to October. It can be grown in rotation with other crops, resulting in healthier plants that are more resistant to damage by pests. However, the foliage and shoot tips of jews mallow are susceptible to damage by insects and spider mites. Nematodes (*Meloidogyne* spp.) cause stunting of plants. Pest damage is usually less severe in plantings that are well fertilized and rotated with other crops (Abou-Hadid *et al*.,1993). Nevertheless, pesticides are useful for controlling pests when they cause significant damage. However, the lack of awareness of the risk involved in using pesticides has lead to environmental, pollution and contamination of agricultural resources namely soil and underground water. So farmers have to choose a pesticide that targets the pest and avoid pesticides that kill beneficial organisms. To choose pesticides that last only for a short period. To avoid exposing consumers to pesticide residues, instructions for time intervals between spraying and harvesting should be followed. Previous studies (Zaki, 1978) have shown that the residues of certain pesticides in soil lead to either increase or decrease in minerals in soil depending on many interacting factors. Potera (2007) and Shahla and D´Souza (2010) showed that the relationship between the concentration of different pesticides in the soil and in the plant depended on soil and pesticide type. Denis (1999) observed that tomato suffered from dwarfism when treated with an over dose of Sevin, whereas, the vegetative part of carrot was greatly increased. The same result was obtained by Abedalgwad (2001).

Omer (2001) found that a soil treated with Sevin within 7years remained contaminated throughout these years and about 0.156 ppm of Sevin was detected at the end of the 7 years. The fate of pesticides in soils is greatly determined by soil pH. According to Hagar (2002) most soils have pH that ranges between 4.5 and 8.0. However, the adsorption of pesticides is usually greater in soil with high degree of acidity. Gigliotti and Allievi (2001) and Farenhorst (2006) stated that pesticides reduced the absorption of some minerals. Gafar *et al*. (2011 and 2013) showed the adverse effects of both Malathion and Sevin on both crops and soil.

This study was conducted to investigate the effects of Sevin and Malathion on both jews mallow growth and soil.

Materials and methods

A field experiment was conducted at the College Farm (380 m) above sea level) to study the effect of two pesticides (Sevin and Malathion) on jews mallow growth and soil.. Two concentrations, the recommended dose (1.9 kg/ha) and the higher dose (2.8kg/ha) of both Sevin and Malathion, respectively, in addition to the control (without pesticides) were used. Jews mallow seeds were drilled on both sides of 70cm ridges. Urea and phosphorus fertilizers were used at a rate of 150kg/ha and 120kg/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 30cm. depth for all treatments. Measurements taken were plant height, leaf area, root length, and fresh and dry weight, soil pH, total nitrogen% and Ece (ds/m),) were recorded. The experimental units were in completely randomized design with four replications and data collected were statistically analyzed using the soft ware packet MSTATC programme and the means were compared using the least significant difference (LSD) method at $p \leq 0.05$(Gomez and Gomez, 1984).

Results and discussion

The results (Table 1) revealed that the plants at the recommended dose of Sevin were significantly taller than the others. The highest dose resulted in significantly shorter plants (60.1cm). Also the other growth parameters (leaf area, root length and shoot fresh and dry weight) were significantly increased by the recommended and significantly reduced by the highest Sevin dose. The same positive effects (Table 2) on the growth were shown by the recommended dose of Malathion and the reverse was shown by the highest Malathion dose. In general the recommended dose of Malathion has better effects on growth than the recommended dose of Sevin. Similar results were obtained by Denis (1999) who observed that tomato suffered from dwarfism when treated with an over dose of Sevin, whereas, the vegetative part of carrot was greatly increased. The same results were also obtained by Abedalgwad (2001) and Gafar *et al.*(2011 and 2013). They attributed that to the effect of higher pesticides doses on root ability to absorb water and nutrients or their effects on the activity of soil microorganism which lead to the reduction of mineral absorption. Also pesticides may be phytotoxic at higher doses.

Table 1. Effect of Sevin doses on growth of jews mallow.

Treatment	Plant Height (cm)	Leaf area (cm^2)	Root length (cm)	Shoot fresh weight (g)	Shoot dry weight (g)
Control	65.2	169.7	14.0	6.9	1.4
Recommended dose (1.9 kg /he)	72.6	171.7	19.7	7.3	2.2
Higher than recommended dose (2.8 kg /he)	61.1	63.0	12.0	3.0	1.1
LSD (p≤ 0.05)	2.1	1.5	3.3	0.9	0.2

Table 2. Effect of Malathion doses on growth of jews mallow.

Treatment	Plant Height (cm)	Leaf area (cm^2)	Root length (cm)	Shoot fresh weight (g)	Shoot dry weight (g)
Control	68.6	207.0	14. 0	7.0	2.4
Recommended dose (1.9kg/ha)	76.6	220.2	16.5	7.4	2.7
Higher than recommended dose (2.8kg/ha)	62.4	122.7	7.3	3.9	1.0
LSD (p≤ 0.05)	2.9	7.8	0.8	0.6	0.3

Table 3. Soil analysis before and after addition of Sevin and Malathion.

Parameter	Total Nitrogen percentage	Extractable Phosphorus ppm	pH paste	Ece. dS/m
Soil before planting	0.09	6.0	7.0	0.7
Recommended Sevin dose (1.8 kg/ha)	0.1	6.0	7.0	0.7
Higher Sevin dose (2.8 kg/ha)	0.04	5.0	8.0	0.8
Recommended Malathion dose (1.8 kg/ha)	0.1	6.0	7.5	0.7
Higher Malathion dose (2.8 kg/ha)	0.04	5.0	8.0	0.8
LSD (P≤ 0.5)	0.04	2.0	0.5	0.4

The effect of Sevin and Malathion addition to the soil was variable (Table 3). The total nitrogen percentage and extractable phosphorous were higher in the soil before planting and reduced with the pesticides addition. The pH was not affected that much by the addition of different doses but it was higher for Malathion than for Sevin. The fate of pesticides in soils is greatly determined by soil pH. According to Hagar (2002) most soils have pH that ranges between 4.5 and 8.0. However, the adsorption of pesticides is

usually greater in soil with high degree of acidity. Mallik and Tesfai (1985) and Relyea (2005) reported that adsorption could be one of the most important factors that affect pesticides fate in soils and their distribution. Gigliotti and Allievi (2001) and Farenhorst (2006) stated that pesticides reduced the absorption of some minerals. Gafar *et al.* (2011 and 2013) showed the adverse effects of both Malathion and Sevin on both crops and soil and the great effect of soil pH on pesticides fate.

Conclusion

The use of insecticides in the recommended dose or less can be of greater value for jews mallow production and it has no negative effect on soil. Both Sevin and Malathion can be applied safely when a few basic rules are followed and common sense is used.

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