Agricultural Sciences, 2016, 7, 93-99
Published Online February 2016 in SciRes. http://www.scirp.org/journal/as
http://dx.doi.org/10.4236/as.2016.72009

Effect of Pesticide Residues (Sevin) on Carrot (*Daucus carota* L.) and Free Nitrogen Fixers (*Azotobacter* spp)

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Received 6 January 2016; accepted 19 February 2016; published 22 February 2016

Abstract

Since the pesticides are considered as an essential component for crops production through controlling pests, they have shown a negative effect on crops and soil environment when used intensively. This experiment was conducted at Wadi Soba farm (Sharq Elneel) Khartoum, Sudan. It aimed to study the effect of Sevin residuals on carrot growth and *Azotobacter* spp. colonies growth. Carrot planted in late February 2013, Sevin pesticide (2.5 L/ha and 5 L/ha) was added to estimate plant height, fresh weight, the number of plant leaves and the number of *Azotobacter* spp. colonies isolated from the carrot rhizosphere (0 - 15 cm). The obtained results showed that the Sevin recommended dose (2.5 L/ha) relatively had a positive effect on the plant height, fresh weight, and the number of plant leaves. The average of plant height for recommended dose was 59.67 cm compared to control (53.67 cm) and high dose (27.33 cm). The average of plant fresh weight obtained by the recommended dose was 50.33 g and for control was 47.67 g and for high dose was 16.67 g, it decreased 67% from control and recommended dose. The average of plant leaves number were 25.34, 13.66 and 21.33 for recommended dose, high dose and control respectively, the number of leaves increased about 16% by recommended dose and decreased 35% by high dose. The average of *Azotobacter* spp. colonies obtained by high dose of Sevin demonstrated a lower numbers which were 20 × 10^4, 5.67 × 10^6 and 0.33 × 10^8 compared with control (78.33 × 10^4, 44 × 10^6 and 15.33 × 10^8) and the recommended dose (64 × 10^4, 33 × 10^6 and 7 × 10^8). The high dose of Sevin had a negative effect on both carrot growth and *Azotobacter* spp. colonies growth.

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How to cite this paper: Elbashier, M.M.A., Shao, X.H., Mohmmed, A., Ali, A.A.S. and Osman, B.H. (2016) Effect of Pesticide Residues (Sevin) on Carrot (*Daucus carota* L.) and Free Nitrogen Fixers (*Azotobacter* spp). *Agricultural Sciences*, **7**, 93-99.
http://dx.doi.org/10.4236/as.2016.72009

Keywords

Sevin, Pesticides, *Azotobacter*

1. Introduction

The use of pesticides extensively has created numerous problems, through their residual effect on soil plant and thus human. Vegetables are important components of the human; they provide essential nutrients that are required for most of the reactions occurring in the body [1]. There is a presence of pesticides residuals in various vegetables and different pesticides have different adsorption rate in vegetables [2]. Pesticides improve crops production through controlling pests when there is a good management and applying these pesticides in a right way [3]. The uses of higher doses of Malathion and Sevin have a negative effect on carrot growth and soil [4]. The effect of pesticides on soil microorganisms was studied by many researchers. The normal doses of pesticides have slight effects on soil microflora and microorganisms may coexist pesticides and the type of pesticide is a key factor that affects microbial diversity, moreover, they show that there is an increase in the Gram-positive bacteria and a decrease in the Gram-negative bacteria and fungi on treated soil with numerous pesticides [5]-[7]. The Sevin (Carbamates) residues have a negative influence on the activity of soil microorganisms, therefore, decreased nitrification and CO_2 production [8]. On nitrogen fixing bacteria, it observed that both microorganisms and biological nitrogen fixation process were more affected by pesticides than other populations [9].

Soils have different types and conditions so the effect of pesticides residuals on plant and soil microorganisms may be different, meanwhile there is no plainly information about the effect of Sevin on *Azotobacter* spp. population, therefore, this paper aims to study the effect of Sevin residuals on carrot growth and *Azotobacter* spp. colonies growth.

2. Materials and Methods

This experiment was conducted at Wadi Soba farm (Sharq Elneel) about 50 kilometers from Khartoum—Sudan to study the effect of Sevin pesticide on carrot growth and *Azotobacter* spp. population. Climate in this region is considered as semi-arid with the temperature of 30˚C. The soil of experiment had a sandy clay loam texture and pH ranging from 7.0 to 8.5 and electrical conductivity (EC) ranging from 0.8 to 2.1 dS/m. The recommended dose of Sevin (2.5 L/ha) and high dose (5 L/ha) were used. The Carrot seeds were grown on ridges 8 cm among plants on 18/2/2013. Super phosphate and urea were used according to Gafar *et al.* (2014) [4]. The Sevin pesticide was sprayed after 21 days after carrot has grown.

2.1. Morphological Estimation

At the stage of harvesting the plant samples were collected and the morphological characters such as plant height (cm), the number of leaves and fresh weight (gm) were measured on the laboratory according to Gafar *et al.* (2014) [4].

2.2. Soil Samples Collection and Isolation of *Azotobacter* spp.

2.2.1. Soil Sampling

Three soil samples were collected (one soil sample for each treatment) after harvesting using sterile tools from the depth of (0 - 15 cm), then transferred directly to the laboratory according to method that described by Gerhardt (1985) [10].

2.2.2. Isolation of *Azotobacter* spp.

Bacteria (*Azotobacter* spp.) were isolated using the sodium benzoate medium that described by Aleem (1953) [11], isolates obtained after soil water suspension (1 g to 10 ml distilled water), some biochemical and identification tests including, catalase test, citrate test, indole test, urease test, methyl red test and *Azotobacter* cysts were performed according to method that described by Gerhardt (1985) [10].

2.3. Statistical Analysis

Means and variations acquired by ANOVA were employed for correlating the effect of Sevin on carrot growth and *Azotobacter* spp. colonies growth.

3. Results

The Carrot height, fresh weight, leaves number and the number of *Azotobacter* spp. colonies obtained by control and Sevin treatments are shown in **Table 1** and **Table 2**, respectively. The statistical analysis; the average and variations for the effect of Sevin on Carrot growth and the number of *Azotobacter* spp. colonies are shown in **Table 3** and **Table 4**, respectively.

Table 1. Effect of Sevin on Carrot height, fresh weight and leaves number.

Lab. No.	Treatments	Plant parameters		
		Plant height (cm)	Fresh weight (gm)	Number of plant leaves
1	Control	56	45.0	20
2		52	48.0	21
3		53	50.0	23
4	Recommended dose 2.5 L/ha	58	50.1	25
5		60	50.6	27
6		61	50.3	24
7	High dose 5 L/ha	30	25.0	16
8		25	15.0	14
9		27	10.0	11

Table 2. Effect of Sevin on *Azotobacter* spp. colonies.

Lab. No.	Treatments	*Azotobacter* spp. colonies cfu·gm^{-1}		
		10^4	10^6	10^8
1	Control	72	50	21
2		78	47	18
3		85	35	7
4	Recommended dose 2.5 L/ha	70	33	7
5		68	35	5
6		54	31	9
7	High dose 5 L/ha	30	10	0
8		21	5	1
9		9	2	0

Table 3. The average and variations of carrot height, fresh weight and leaves number under Sevin treatments.

Treatments	Plant parameters		
	Plant height (cm)	Fresh weight (gm)	Number of plant leaves
Control	53.67^b	47.67^a	21.33^b
Recommended dose 2.5 L/ha	59.67^a	50.33^a	25.34^a
High dose 5 L/ha	27.33^c	16.67^b	13.66^c

Mean values with different superscript letters in the same column differ significantly ($p < 0.05$).

Table 4. The average and variations of Azotobacter spp. colonies under Sevin treatments.

Treatments	*Azotobacter* spp. colonies cfu·gm^{-1}		
	10^4	10^6	10^8
Control	78.33^a	44^a	15.33^a
Recommended dose 2.5 L/ha	64^a	33^a	7^a
High dose 5 L/ha	20^b	5.67^b	0.33^b

Mean values with different superscript letters in the same column differ significantly ($p < 0.05$).

4. Discussion

4.1. Effect of Sevin on Carrot Growth

It clears from **Figures 1-3** the recommended dose of Sevin showed high values for the plant height, fresh weight and number of leaves related to high dose and control. The average of the plant height was 59.67, 53.67 and 27.33 cm for recommended dose, control and the high dose respectively, the results showed that the plant height of recommended dose has highest values than other treatments, and the high dose has significantly lower values. The average of plant fresh weight was 50.33, 47.67 and 16.67 g for recommended dose, control and the high dose respectively, the results indicated that there was no significant difference between the control and recommended dose, meanwhile, the plant fresh weight of high dose was decreased about 67% from control and recommended dose. The average of plant leaves number was 25.34, 21.33 and 13.66 for recommended dose, control and the high dose respectively, the results revealed that there was a significant difference between recommended dose, high dose and control, the number of leaves increased about 16% by recommended dose and decreased 35% by high dose.

Generally, recommended dose of Sevin showed good results related to high dose and control. This also indicates a high agreement with the results of reference [4].

4.2. Effect of Sevin on *Azotobacter* spp.

The average of the *Azotobacter* spp. colonies obtained by the serial dilution 10^4 was 78.33, 64 and 20 for control, recommended dose and the high dose respectively. The average of the *Azotobacter* spp. colonies for the serial dilution 10^6 was 44 for control, 33 for the recommended dose and was 5.67 for the high dose. The average of the *Azotobacter* spp. colonies obtained by serial dilution 10^8 was 15.33, 7 and 0.33 respectively for control, recommended dose and the high dose (**Table 4**). It clears from **Figures 4-6** that there was no significant difference between the numbers of colonies acquired by recommended dose and control for all bacterial dilutions used and the high dose of Sevin had significantly lower values of colonies numbers. The numbers of bacteria colonies obtained by the high dose of Sevin was decreased 75% (20×10^4) related to control (78.33×10^4) and 87% for (5.67×10^6) compared with control (44×10^6) while for (0.33×10^8) the numbers of colonies were decreased 98% compared with control (15.33×10^8), generally, the high dose of Sevin had a negative effect on *Azotobacter* spp. colonies growth, This also indicates a high agreement with the results of references [5]-[8].

5. Conclusion

Over all from this study, it conducted that the use of higher doses of pesticides, particularly Sevin, led to negative effects on plant growth and bacterial population especially *Azotobacter* spp., while the recommended doses increased plant growth and had slightly effects on *Azotobacter* spp. colonies compared with control, however it can take the advantage of some *Azotobacter* spp. that resisted the high dose of Sevin and develop them. So it is necessary to stop unauthorized and extensive use of these pesticides.

Acknowledgements

This work was funded in part by Research Project of Special Scientific Funds in Public Service Sectors (Water Conservancy) (17/10/2013) and the Fundamental Research Funds for Central Universities (2014B04814, 2015B05814).The authors would like to greatly express their deepest and warm gratefulness to the staff at La-

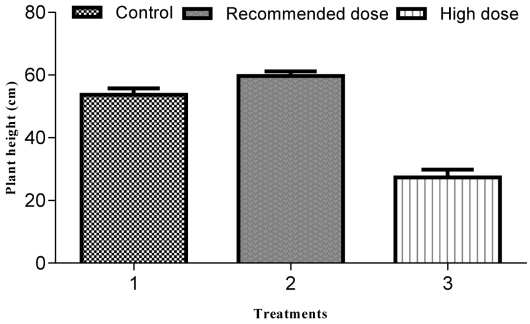

Figure 1. The plant height of Sevin recommended dose and high dose compared with control.

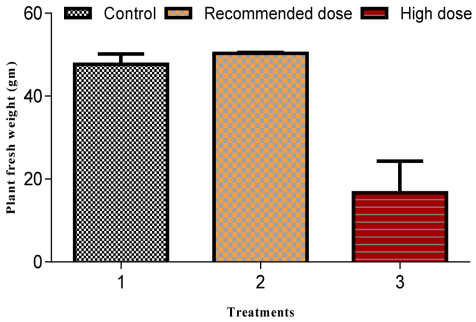

Figure 2. The plant fresh weight of Sevin recommended dose and high dose compared with control.

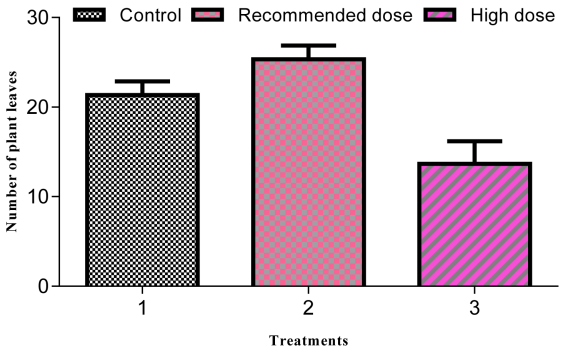

Figure 3. The number of plant leaves of Sevin recommended dose and high dose compared with control.

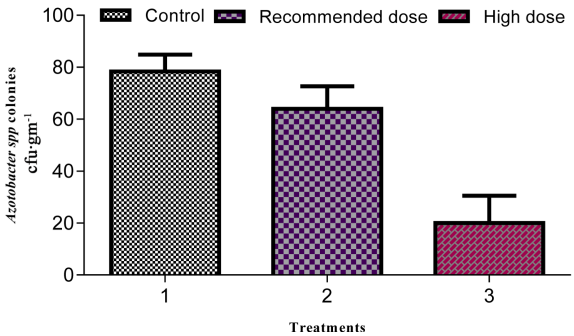

Figure 4. The number of *Azotobacter* spp. colonies (10^4) of Sevin recommended dose and high dose compared with control.

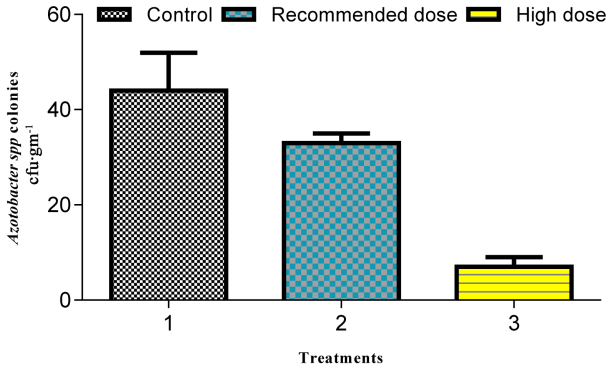

Figure 5. The number of *Azotobacter* spp. colonies (10^6) of Sevin recommended dose and high dose compared with control.

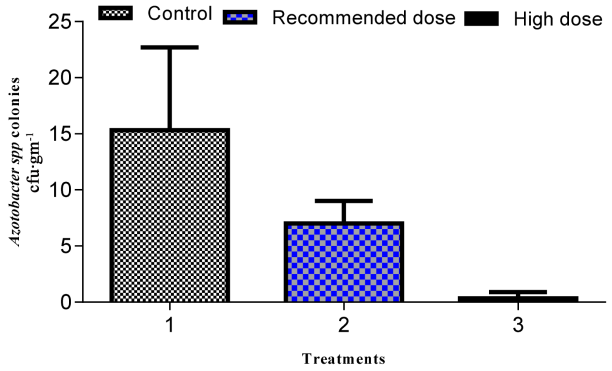

Figure 6. The number of *Azotobacter* spp. colonies (10^8) of Sevin recommended dose and high dose compared with control.

boratory of Agricultural Analysis, Ministry of Agriculture—Khartoum State—Sudan for their remarkable role. We are also thankful to anonymous reviewers and the editor for their valuable review and suggestions.

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