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THE ROLE OF ORGANIC MATTER IN THE REDUCTION OF SOIL BIO-CONTAMINATION DUE TO THE USE OF AGRICULTURAL INSECTICIDES

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ABSTRACT : A study was carried out using the insecticide (Endosulfan) with different proportions of the organic matter to determine the ability of the organic matter on the reduction of bio-contamination (the total number of microbes) by using this insecticide during different intervals. The results showed that the highest impact of the insecticide on the microbes numbers was (80778) logarithm without the presence of organic matter when the incubation period was (60) days. This period exceed all the other periods of time; the highest rate for this trait was (9600) logarithm with significant difference comparing with the period (20) days where the number was (80957) logarithm. The results indicated the existence of a significant effects of the insecticide on the number of microbes in the presence of organic matter, reaching the highest number of microbes (90850) logarithm with organic matter (clover) compared with the concentration (double the recommended dose), which gave lower rate (90288) logarithm. The results revealed significant effects of the triple interaction for the insecticide concentration; the lowest number of microbes was (90 101) logarithm for the concentration (double the recommended dose) of the insecticide. The results of the double interaction also showed significant differences, reaching the highest number with organic matter (clover) about (90715) logarithm when the incubation period was (60) days.

Key words : Organic matter, bio-contamination, agricultural insecticides, microbes.

INTRODUCTION

The using of different types of agricultural pesticides in Iraq is considered new comparing to the agricultural history of ancient Mesopotamia. In spite of the importance of the chemical control in modern scientific agriculture, the pesticides chemical compounds have raised serious threaten for human health through pollution, as well as the elimination of soil living organisms (Al-Dulaimy, 2010). Chemical pesticides are popularized as one of the important methods for improving soil management and then increasing agricultural production. Continuous using of these compounds is causing changes in the ecosystem of the soil, including the impact on the numbers of soil organisms, particularly useful ones that dismantle organic materials and improving soil fertility by destroying plant and animal tissues and integrating products and liberated minerals with the soil (Pandy *et al*, 2004; Wesley *et al*, 2017).

The effect of these pesticides differ in the number of organisms according to the quality of the pesticide and the dose used in the control process and the conditions of the experiment and the duration of treatment, as well as the surrounding agricultural fields circumstances (Bakalivanov, 1990). It was found that the pesticide (Endosulfan) is abundance and adsorbed in the soil causing significant affect on the existing organisms (Marriana, Gonalez *et al*, 2010). The effect of Endosulfan showed less negative impact on soil organisms, due the presence of organic matter which determine the spread of these pesticides in the soil (Congcong Zhao *et al*, 2012).

The carboxyl, hydroxyl and phenol compounds of the organic matter are chelating with many soil components forming complexes with minerals and pesticide residues and thus play an active role in protecting soil from pollution of pesticide residues (Taj-Aldeen, 1997). The impact of pesticides and the duration of their existing in the soil are determined by some of the pesticide properties such as its active group (Salim, 2009). The organic matter in the soil affects the adsorption of many pesticides; the contrasting effects of adding different carbon sources and others depending on the species of microbes that prevailing in the soil.

The organic matter plays an important role in the changing properties of soil, whether physical, chemical, or vital. Also, the organic material has an impact on the contaminants residues in the soil and in particular the pesticides. The presence and movement of a pesticide in the soil depend on its interaction with the soil particles

and organic material through the processes of adsorption and desorption (Feng *et al*, 2003). It was found that the substance of organic matter play an important role in assisting in the absorption of pesticides in soil (EL Arfaoui *et al*, 2012).

The last years of this century has seen a marked increase of the production of chemical pesticides around the world. The pesticides in general and insecticides in particular became one of the inputs technological to increase agricultural production. The use of pesticides in agricultural lands is still one of the most significant soil contamination problems because it affects fertility and eventually the pesticides affect many soil agricultural organisms, so this research aims to study the effect of adding different concentrations of glucose and clover as organic matters on the decomposition of the pesticide (Endosulfan) and on the total number of microorganisms in the soil.

MATERIALS AND METHODS

Collection of samples

In this study, soil samples were collected from different areas of Ramadi city; no pesticides have been used previously in these areas. The samples were taken after removing 2 cm of the surface layer and up to 25 cm in depth, and placed in clean plastic bags after recording on them all the necessary information. The soil samples were air dried and passed through a sieve with 2 mm pores, then the soil samples were analyzed chemically and physically (Table 1).

Table 1 : Some of the soil characters that used in the study.

No.	Characters	Measuring unit	Measurement
1	PH	-	7.65
2	EC	Desmans/ m	4.38
3	Organic matter	gm/kg	10.13
4	Organic carbon	%	0.653
5	Total nitrogen	mg/kg	80.43
6	Available phosphorus	mg/kg	11
7	Total phosphorus	mg/kg	34
8	Calcium carbonate	mg/kg	192.6
9	SO_4	Mg/ L	31
10	HCO_3	Mg/ L	0.134
11	Na	Mg/ L	92.8
12	Mg	Mg/ L	31.6
13	Soil texture	-	Mixed

Chemical pesticide

The insecticide (Endosulfan), which is a common pesticide, was used as recommended by the manufacturer in a dose of 150 ml / 100 liters of water per donum and that is equal to 1500 ppm.

Preparation of treatments

100 grams of soil sample was placed in a small plastic pot with 3 replications per treatment in addition to the control. The organic matter (glucose and ground dried clover residues) was added in 1% per treatment. The organic matter was mixed well with the soil, and different concentrations of the pesticide were added to the soil mixtures according to the required treatments, as shown in the Table 2. The humidity was raised to 65% of the field capacity and the pots were incubated at a temperature of 28 ± 2°C. The study samples were taken at three different periods of time: 20, 40 and 60 days. The humidity was maintained by measuring the weight differences and by adding sterile distilled water. The number of experimental units was 81 that calculated as follows: 9 treatments (soil, organic matter, and pesticide) X 3 replications X 3 periods of time.

Calculating the total number of microorganisms

The nutrient agar was inoculated using casting dishes method for the purpose of calculating the total number of microorganisms in the sample; unit composition of the colony/ gram of dry soil (CFU/ g) (Mahmoud, 1997).

RESULTS AND DISCUSSION

The results of the total number of microorganisms in the soil showed a statistically significant effect among the organic matter, the pesticide concentration, and the time periods and their interaction (Table 3). High impact recorded for twice the recommended dose of the pesticide

Table 2 : Treatments that used in the study.

No.	Treatments	Symbol	Pesticide conc.	Organic matter conc.
1	Control	C	zero	Zero
2	Soil with recommended dose of Endosulfan	N1	150 ml/ 100 L	zero
3	Soil with double the recommended dose of Endosulfan	N2	300 ml/ 100 L	zero
4	Soil with 1% organic matter (glucose) without Endosulfan	N3	zero	1%
5	Soil with 1% organic matter (glucose) plus Endosulfan	N4	150 ml/ 100 L	1%
6	Soil with 1% organic matter (glucose) plus Endosulfan	N5	300 ml/ 100 L	1%
7	Soil with 1% organic matter (clover) without Endosulfan	N6	zero	1%
8	Soil with 1% organic matter (clover) plus Endosulfan	N7	150 ml/ 100 L	1%
9	Soil with 1% organic matter (clover) plus Endosulfan	N8	300 ml/ 100 L	1%

Table 3 : The total number of soil microbes in the presence of organic matter and the pesticide Endosulfan.

Organic matter	Pesticide conc. ml/ L of water	Incubation periods (days)			Organic matter average
		20	40	60	
Zero	Zero	9.231	9.432	9.634	8.784
	1	8.263	8.688	8.959	
	2	7.579	8.489	8.778	
Glucose	Zero	9.344	9.647	10.335	9.602
	1	9.021	9.743	9.813	
	2	9.152	9.626	9.741	
Clover	Zero	9.577	9.979	9.995	9.570
	1	9.346	9.658	9.713	
	2	9.096	9.331	9.436	
Average of incubation periods		8.957	9.399	9.600	-
Organic matter	**Pesticide**	zero	1	2	
Zero		9.432	8.409	8.510	
Glucose		9.775	9.526	9.506	
Clover		9.850	9.572	9.288	
Average of pesticide		9.686	9.169	9.101	
Organic matter	**Incubation periods**	20	40	60	
Zero		8.358	8.870	9.124	
Glucose		9.172	9.672	9.963	
Clover		9.340	9.656	9.715	
Pesticide	**Incubation periods**	20	40	60	
Zero		9.384	9.686	9.988	
1		8.649	9.363	9.495	
2		8.837	9.149	9.318	

L.S.D. (P= 0.05): OM = 0.4245, M = 0.4245, T= 0.4245, OM*M = 0.7352, OM*T=0.7352, M*T= 0.7352, OM*M*T = 1.2734

(Endosulfan) when the duration time of (60) days, which gave a number amounted to (8.778) logarithm without the presence of organic matter. The recommended dose showed less impact than twice the dose and the number was (8.959) logarithm for the pesticide and (60) days duration in comparing with the treatment of organic matter (glucose) and twice the dose of the pesticide, which recorded the number (9.741) logarithm; while the treatment of organic matter (glucose) recorded at a zero concentration of the pesticide the highest rate (10.335) logarithm.

The duration time showed an obvious effect on the number of bacteria; the incubation time of (60) days outperformed all other time periods and gavel the highest rate for this trait (9.600) logarithm comparing with the time (20) days where the number of bacteria was (8.957) logarithm.

For interaction between the organic material and the pesticide (Table 3), the results revealed the existence of a significant effect of the pesticide on the number of bacteria in the presence of organic matter. The interaction between the concentration (zero) of the herbicide with the organic matter (clover) showed significant effect over all other interactions. This interaction gave the highest rate for this trait (9.850) logarithm comparing with the concentration (twice the recommended dose), which gave lowest rate (9.288) logarithm.

With regard to the effect of the concentration of the pesticide, there is a high significant difference among the concentrations on the number of bacteria. The concentration (double dose) of the pesticide showed high effect on bacterial numbers as it gave the lowest number (9.101) logarithm comparing with the concentration (zero) as it gave the highest number (9.686) logarithm (Table 3).

For the effect of the interaction between the organic

matter and duration time, there were significant differences reaching the highest number of bacteria with organic matter (clover) number was (9.715) logarithm when the duration time was (60) days, while the lowest number of bacteria (9.124) logarithm was with the treatment without organic matter (Table 3).

The pesticide with duration times also showed significant effect. The interaction between the concentration (zero) and duration time (60) days gave the highest rate for the number of bacteria and was (9.988) logarithm. The lowest number of bacteria was with (60) days duration time and concentration (twice the recommended dose) for the insecticide (Endosulfan) and the number was (9.318) logarithm (Table 3).

The results of this study indicated that adding 1% of the organic matter to the soil led to increase the overall numbers in the control treatment (without adding pesticides). The numbers after 60 days of incubation reached (10.335, 9.995) logarithm when using glucose and clover respectively as organic matter. This discrepancy is due to the alfalfa needs a longer-degradable as the high period of time increased the decomposition of alfalfa and thus led to faster and more increase in total numbers of bacteria in the soil. When the insecticide (Endosulfan) was used, the numbers of microbes decreased and this decline depending on the concentration and the incubation period. We found that the differences between the treatments and the control were significant, starting from the incubation (20) day until the end of the experiment (60) days. The less impact was for the recommended dose of the pesticide, while a clear inhibition effect was for the use of the pesticide twice the recommended dose. The decreasing numbers as a result of the use of the pesticide in the presence of organic material was little and this indicated that the use of organic matter (glucose and clover) led to reduce the adverse impact of the pesticide on the total numbers of microbes, especially when using a double dose of pesticides used in this study.

The results also indicated that the addition of organic matter had a role in the increasing the number of microbes in the soil as the clover showed high role in this increasing due to its slow decay. It was found that the clover had a role in reducing the inhibitory effect of pesticides under study and this may be due to increase the adsorption of pesticides as the organic carbon increase in the soil due to formation of negative charges helping in pesticide adsorption (Taj-Aldeen, 1997). The addition of clover as organic matter led to the increase in the number of different microbes, which contributed to increased decomposition of used pesticide (Salim, 2009; Lakshmi Kalyani *et al*, 2015). The analysis of methyl bromide is faster in the territory of the forest than in farmland and this could attributed to the large amount of organic matter in forests comparing to the farmlands (Hines *et al*, 1998; Abhishek Walia *et al*, 2018). The results are consistent with a study by Bahareh Aghas *et al* (2011), where they found that the addition of organic matter (1% clover) reduced pesticides effect on microbes number namely (Alfordan, Alcabtan and Alaaksamil).

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