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# Effect of deltamethrin and profenofos on soil microflora

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***Abstract:*** *A laboratory incubation experiment was conducted with deltamethrin a synthetic pyrethroid insecticide, and profenofos an organophosphate insecticide to study their influence at 0, 5, 10, 15, 20, 50 and 100 ppm levels of fortification against the microbial activities of soil micro-organisms which is measured in terms of $CO_2$ evolved in the incubation chamber. The amount of $CO_2$ evolved was calculated by standard formula. Carbon dioxide evolved from soil is positively related with the microbial population and their activity in the soil. The result indicated the trend of gradual decrease from 5.01 and 5.24 mg/g against the fortification range of 5 to 20 ppm with deltamethrin and from 4.1to 4.42 with profenofos respectively. Little influence at higher level of 50 and 100 ppm fortification indicated that due care should be taken to avoid excessive accumulation of deltamethrin and profenofos in soil. Based on the present studies the accumulation of pesticide residues in soil up to 20 ppm can be considered most safe for microbial activities.*

***Keywords:*** *$CO_2$ evolution, deltamethrin , pesticide fortification, Profenofos, soil micro-organisms*

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## I Introduction

The wide spread use of pesticides is very common in agricultural crop production regarding yield and quality of crops. Pesticides when applied on crop as foliar spray fall on soil and affect the population and activity of beneficial microorganisms in soil as well as physico- chemical properties of soil. [1]Soil is a complex matrix consisting of organic and inorganic material. It possesses many active sites (polar, non-polar and ionic) that are capable of retaining pesticides and other residues. Soil contamination pose threat to soil microflora and microfauna as well as their environment [2] as Pesticides interact with soil organisms and their metabolic activities. [3] Monitoring the changes in number and metabolic activities of these microorganisms enables the assessment of the effects on specific species by pesticides .It is suggested that careful screening of pesticide effects on soil microflora should be done in laboratory before their field applications because pesticides tend to accumulate in soil due to repeated applications over time and can pose adverse effects on soil microflora.[4]To determine any soil disturbances microbial activities must be determined. [5] Measurement of soil respiration, as indicated by oxygen consumption or $CO_2$ evolution is one of the oldest and still the most frequently used parameter for quantification of microbial activities in soil. Determination of soil respiration is the appropriate method to determine the general metabolic activity of soil microorganisms. [6] Generally, a decrease in soil respiration reflects the reduction in microbial biomass. [7]

Hence the present investigations were carried out to study the influence of deltamethrin 2.8 EC and profenofos 50 EC on soil microbial respiration.

## II Material And Methods

In order to evaluate, the effect of deltamethrin and profenofos on soil microflora , soil samples was collected from the experimental farm at Mahurzari, Nagpur, India. Carbon dioxide ($CO_2$) evolved from soil is positively related with the microbial population and their activity in the soil. Hence, a laboratory experiment was conducted during 2014 to study the influence of deltamethrin and profenofos on soil microflora. Effect of pesticide was studied by fortifying the soil at 0, 5, 10, 15, 20, 50 and 100 ppm and measured the quantity of $CO_2$ evolved during the incubation period of 50 days. Incubation chamber was prepared using conical flask (500ml) with tightly stoppered rubber cork. Glass vial (25ml) was kept suspended in the flask with the help of thread hooked on the bottom surface of the cork. In each conical flask, 50gm soil was kept and vial was filled with 10ml of 0.5 N NaOH. Soil in the flask was maintained at the field capacity by adding appropriate quantity of water uniformly to all sets. The vial in chamber was taken out at 5, 20, 35, and 50 days from the start of the experiment. At each time content in the vials was used for titration and the vials were replaced immediately with fresh vial containing 10 ml of 0.5 N NaOH. The content of the vial was titrated with 0.7N HCL using 1N $BaCl_2$ solution to phenolphthalein end point. The amount of $CO_2$ evolved from the soil was calculated by formula given below.

$CO_2$ evolved (mg/g soil) $= B - A \times 2.2 \times \frac{1}{0.1} \times \frac{N}{50}$

Where,
A= ml of 0.7 N HCl required to neutralize NaOH in the vial from incubation chamber.
B= ml of 0.7 N HCl required for blank reading.
N= Normality of acid used (1ml of 0.1N HCl is equivalent to 2.2 mg $CO_2$)
The calculated quantity of $CO_2$ per gram soil from four observations for the incubation period of 50 days was considered together and used for comparison.

## III Result And Discussion

In experiment on effect of deltamethrin and profenofos on soil microbial respiration ,the mean data (Table 1 and 2) on $CO_2$ evolution against various fortification levels of deltamethrin and profenofos indicated the trend of gradual decrease of $CO_2$ evolution as against the increasing level of fortification of soil with the pesticides (Fig. 1) .

At fortification level of 5 to 20 ppm deltamethrin , $CO_2$ evolved in mg/g soil, ranged between 5.01 and 5.24 mg/g soil. Whereas in case of profenofos range was found between 4.1 to 4.42 mg/g soil, respectively.Similar trend was also recorded with 50 to 100 ppm fortification of deltamethrin ,recording 3.92 and 3.12 mg/g soil, respectively. Whereas profenofos, recorded 3.23, 3.04 mg/g soil, respectively.

The data from present investigations on soil microbial respiration revealed that the difference between quantity of $CO_2$ evolved in untreated and treated soil was practically negligible. The amount of $CO_2$ evolved (mg/g) was 4.44 to 5.28 in untreated soil and 4.1 to 5.24 in the soil fortified at 5 to 20 ppm. Little influence at higher level of 50 and 100 ppm fortification indicated that due care should be taken to avoid excessive accumulation of deltamethrin and profenofos in soil.The fortification level below 5 ppm can be considered safest for soil microbes.The resuls are in agreement with Muñoz-Leoz et *al.*, [8] who reported that at 5 mg $kg^{-1}$ dry weight soil, deltamethrin did not caused significant change in soil microbial parameters. Sethi *et al.*, [9]who reported that deltamethrin demonstrated little change on the growth of all the bacterial populations when compared at different concentrations (100 ppm- 1000 ppm) and control and that only 1000 ppm concentration showed inhibition of the entire microorganism and lower concentrations did not showed any effect. Vig et *al.*, [10] had observed that the applications of deltamethrin at recommended dosages did not cause any adverse effect on the Soil respiration during all the experimental periods. Tejada *et al.*, [11] in their studies determined the impact of continued use of profenofos on soil properties in a cotton field and concluded that the effect on microbial population was minimal. Mall *et al.*, [12] observed that applications of profenofos at recommended dose did not caused significant change on soil microbial population.

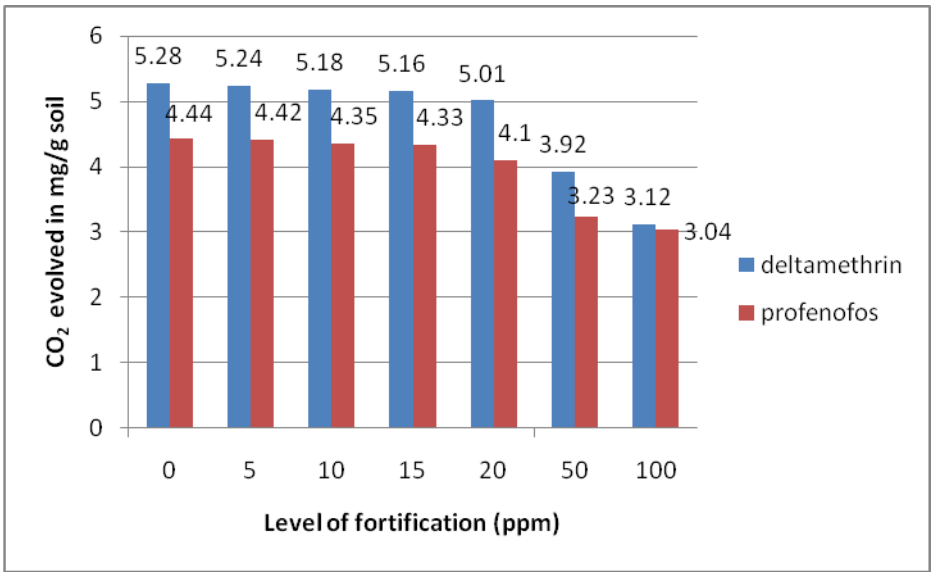


**Fig 1:** Evolution of $CO_2$ in mg/g soil at different fortification level of deltamethrin and profenofos

**Table 1.** Influence of deltamethrin on $CO_2$ evolution from soil

| Level of fortification (ppm) | CO2 evolved in mg/g soil | | | |
|---|---|---|---|---|
| | RI | RII | RIII | Mean (± S.D.) |
| 0 | 5.24 | 5.33 | 5.27 | 5.28 (0.0458) |
| 5 | 5.34 | 5.25 | 5.12 | 5.24 (0.111) |
| 10 | 5.19 | 5.28 | 5.07 | 5.18 (0.105) |
| 15 | 5.16 | 5.08 | 5.23 | 5.16 (0.075) |
| 20 | 5.01 | 5.05 | 4.98 | 5.01 (0.035) |
| 50 | 4.01 | 3.84 | 3.92 | 3.92(0.085) |
| 100 | 3.13 | 3.18 | 3.05 | 3.12( 0.066) |

**Table 2.** Influence of profenofos on $CO_2$ evolution from soil

| Level of fortification (ppm) | CO2 evolved in mg/g soil | | | |
|---|---|---|---|---|
| | RI | RII | RIII | Mean (± S.D.) |
| 0 | 4.52 | 4.44 | 4.36 | 4.44 ( 0.08) |
| 5 | 4.46 | 4.48 | 4.33 | 4.42 (0.081) |
| 10 | 4.32 | 4.45 | 4.29 | 4.35(0.085) |
| 15 | 4.26 | 4.41 | 4.32 | 4.33(0.075) |
| 20 | 4.07 | 4.28 | 3.95 | 4.1 (0.167) |
| 50 | 3.12 | 3.22 | 3.34 | 3.23 (0.110) |
| 100 | 3.02 | 3.12 | 2.98 | 3.04 (0.072) |

## IV Conclusion

Application of pesticides as per the recommended dozes for the pest management normally would not achieve the concentration up to 20 ppm level of pesticides in the soil hence are seldom deleterious to micro organisms and their activities. However indiscriminate and excess use of pesticides may lead to accumulation of pesticides in the soil which in turn cannot be considered safe for in habitat fauna. The present studies indicated that both pesticides deltamethrin 2.8 EC and profenofos 50 EC did not show adverse effect on soil microbial activity up to the contamination level of 20 ppm.

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