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Effect of application of different pesticides to leguminous crops on soil microflora of Sidhi district (M.P.)

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ABSTRACT

The pesticides contributing to the contamination of soil may influence microbial population of the soil and in turn fertility of soil. The present experimental work clearly indicates the effect of different pesticides such as carbofuran, phorate, carbosulfan and thiomethoxam on soil microflora. The viable count of rhizobia and phosphate solubilizing bacteria from rhizospheric soil of leguminous crop ranged between 10^7 – 10^5 Cfu/g soil which was comparable to the count of bacteria from untreated (control) soil. No significant changes in the total viable count of any kind of Bacteria due to application of Pesticides has been found showing their ability to degrade these pesticides.

KEYWORDS

Pesticides;
Soil Microflora;
Phosphate Solubilizing bacteria;
Rhizoibia;
Leguminous crops.

INTRODUCTION

Pesticides are the important agrochemicals used for prevention of crops from pests. Their use has been largely increased in last few decades. The application of pesticides starts from pre sowing stage. Different treatment includes soil application, seed treatment, foliar spray etc. Repeated application of pesticides contaminates the soil. Soil is the most important site of biological interactions. The indiscriminate use of pesticides disturbs the soil environment by affecting flora and fauna including microflora of soil and also the physio-chemcial properties of soil like PH, salinity, alkalinity leading to infertility of soil.

The important microflora, beneficial for the growth of plants includes nitrogen fixing bacteria and phosphate solubilizing bacteria, present in the rhizosphere of the plant. The excess application of these pesticides may adversely affect the function of these rhizospheric microorganism. Since the fertility of the soil depends on the number and type of micro organism present in the soil studies on effect of pesticides applications on soil were carried out.

Presently some information is available on effect of commonly used organophosphorus and organochlorine pesticides on soil micro organism such as urea hydrolyzing organism, heterotrophic nitrogen fixers, nitrifiers, heterotrophic bacteria and fungi. The effect of pesticides on some important soil enzymes were also describes.

Leguminous crop such as Soybean is an important soil crop of not only of district Sidhi (M.P.) but of India, it is also cultivated as rotational crop to increase fertility of soil by fixation of atmospheric nitrogen, Rhizobia associated with rhizosphere of the plant are responsible for nitrogen fixation.

This research paper reports the observation on field scale studies carried out to se the effect of application of different pesticides to Soybean belonging to different chemical classes with different mode of application, on soil microflora with respect to rhizobia and P.S.B. The studies also included the observations on effect of repeated application of monocrotophos as foliar spray to Soybean in mini plot experiments on total microbial count and rhizobia.

MATERIAL AND METHODS:

Effect of application of different pesticides: Field scale experiment

These experiments were carried out in randomized block design with three replication in the selected field of Sidhi block of district Sidhi. Soybean seeds (MACS 450 variety) were sown in the field. Pesticides used in this study for seed treatment included carbosulphan 25 DS, thiamethoxam 70 WS, imidacloprid 70 WS, Chlorpyriphos 20 EC. For soil application phorate 10G and carbofuran 3G and for foliar spray chlorpyriphos 20 Es, thiamethoxam 25 WG and imidacloprid 200 EC (TABLE 1). These pesticides were used as per All India Coordinated Entomology Experiment for control of seedling Soyaban insect pest. The dosage of application in given in (TABLE 1).

Soil sample from experimental plots at 20-30 cm depth were collected randomly from five places and composited 10 % (w/v) suspensions of soil samples in sterile distilled water serially diluted for determining total count of rhizobia and PSB using pour plate technique. For enumeration of rhizobia Congo Red Yeast extract mannitol agar (CRYEMA) medium containing mannitol 10.0 K_2 HPO_4 0-5, mg SO_4 7 H_2O O.2, Nacl 0.1, $CaCO_3$ 4.0, Yeast extract (difco/oxoid) 0.4 agar 15 g. in one L. distilled water with PH adusted to 6.8 – 7.0 was used 10 ml of separately sterilized 1.400 aqueous congo red solution was added to the serilized solution. The plates were incubated at 30^0 C upto 7 days. Since rhizobia do not absorb red colour of Congo Red, the number of colourless colonies represented the number of rhizobia. Rhizobial colonies on CRYEMA are characteristically watery. Such morphologically distinct colonies were counted.

For enumeration of Phosphate solubilizing bacteria (PSB) pikovskaya's solid medium containing tricalcium phosphate 5.0, glucose 10.0 ammonium sulphate 0.5, Sodium chloride 0.5, Potassium chloride 0-5, Magnesium sulphate 0.1, yeast extract 0.5 g in one Litter distilled water with manganese and ferrous sulphate in trace amount was used PH of the medium was adjusted to 7.2 – 7.3. The number of colonies showing zone of clearance due to solubilization of calcium phosphate in the medium indicated the number of PSB well isolated colonies showing zone of clearance around them were counted and noted (TABLE 3). The data on total number of rhizobia and PSB were analyzed statistically as per the methods given. (TABLE 4).

Effect of application of monocrotophos as foliar spray: A mini plot experiment

Seeds of Soybean were sown in 1 m × 1 m plots in the field and 0.5 PPM MCP was used as a foliar spray on the plants after 30, 45 and 60 days after sowing.

TABLE 1 : Pesticide Treatment under the study

Sr. No.	Pesticide used		Mode of Application	Dosages
	Trade Name	Technical Name (active ingredient)		
1.	Furadan	Carbofuran 3G	Soil Application	30 Kg/ha
2.	Thimet	Phorate 10G	Soil Application	10 Kg/ha
3.	Marshal	Carbosulfan 25 DS	Seed Application	30 g/kg
4.	Cruiser	Thiomethoxam 70 WS	Seed Application	3 g/kg
5.	Radar	Chlorpyriphos 20 ES	Seed Application	4 ml/kg
6.	Actara	Thiomethoxam 25 WG	Foliar spray (7-10 day after growth)	100g/ha
7.	Undertrade name	Imidacloprid 200 EC	Foliar spray (7-10 day after growth)	100 g/ha
8.	Radar	Chlorpyriphos 20 EC	Foliar spray (7-10 day after growth)	1.5 l/ha

Rhizospheric soil sample were collected in triplicate from different sites in the same plot after 2 hours of spraying. 10 % (w/v) suspension of soil samples in sterile distilled water were serially diluted and used for determination of total viable count (TVC) of bacteria and Rhizobia by pour plate technique media used include SPCA for TVC of Bacteria and CRYEMA for rhizobial count. The plates were incubated at 30^0 c upto 2 days for total bacterial count and 7 days for rhizobial count. The well isoloated colonies were counted and noted.

RESULT AND DISCUSSION

Effect on rhizobial population of rhizpsheric soil of soybean

The Results are detailed in TABLE 2, it showed that there was an increase in the rhizohial count with the application of carbofuran 3 G, thiomethoxam 70 ws, chlorpy riphos 20 EC applied as both seed application and foliar spray,. The decrease in the rhizobial count was observed with the application of phorate 10 G, carbosulfan 25 DS and thiomethoxam 25 WG as foliar spray. By comparing the mean of all replications of all treatment with control, it was found that the effect of treatment is nonsignificant.

TABLE 2 : Effect of Pesticide application on total count of Rhizobia

Sr. No.	Treatment	Rhizobial count CFu/g soil
1.	Carbofuran 3G	3.97×10^8
2.	Phorate 10G	3.21×10^7
3.	Carbosulfan 25 DS	6.5×10^7
4.	Thiomethoxam 70 WS	4.45×10^8
5.	Imidacloprid 70 WS	1.36×10^8
6.	Chlorpyriphos 20 EC	4.29×10^8
7.	Thiomethoxam 25 WG	3.8×10^7
8.	Imidacloprid 200 EC	3.29×10^8
9.	Chlorpyriphos 20 EC	7.21×10^8
10.	Control	3.58×10^8

Effect on PSB population of rhizosheric soil of soybean

Total count of PSB was found to decrease with the application of almost all of these pesticides applied in any form (TABLE 3). The maximum decrease was found with the application of chlorpyriphos 20 EC when applied as foliar spray. Application of carbosulfan 25 DS to seeds had no adverse effect on the count of PSB. By comparing the mean of all replications of all treatment with control. It was found that the treatment of different Pesticides is nonsignificant.

TABLE 3 : Effect of Pesticide application on total count of PSB

Sr. No.	Treatment	PSB count cfu/g soil
1.	Carbofuran 3G	8.6×10^8
2.	Phorate 10G	6.9×10^7
3.	Carbosulfan 25 DS	7.49×10^7
4.	Thiomethoxam 70 WS	6.6×10^8
5.	Imidacloprid 70 WS	6.9×10^8
6.	Chlorpyriphos 20 EC	9.2×10^8
7.	Thiomethoxam 25 WS	2.1×10^7
8.	Imidacloprid 200 EC	1.93×10^8
9.	Chlorpyriphos 20 EC	6.21×10^8
10.	Control	6.59×10^8

From these results it was observed that thiomethoxam 25 WG when used as foliar spray @ 100 g/hac was found to be more toxic than thiomethoxam 70 WS applied to seed @ 3 g/kg. This indicate that the mode of application of the Pesticide along with concentration may influence the soil microflora.

Carbofuran 3G applied to soil as the dose of 30 kg/hac was found to be toxic to PSB, however in presence of carbofuran, count of rhizobia was found to increase in some extent. Thus is could be said that corbofuran 3G can be applied safely to the leguminous plants like Soybean, which can protect the plant from pest attack as well as can increase the rhizobial count.

Effect of spraying MCP on soil microflora on soybean rhizosphere

The result showed that (TABLE 4) total bacterial count of the soil remains almost same when MCP was applied after 30 days of sowing of Soybean seed (TABLE 4). The total count of bacteria was found to decrease to some extent when MCP was sprayed after 30 days and 45 days of sowing when the experimental plot received three application of MCP there was again slight increase in the TVC of the Bacteria as compared to that from untreated control plot. This can be attributed to the ability of soil microorganism to degrade MCP. Thus it can be said that all the above pesticides

TABLE 4 : Total microbial and rhizobial count in soil exposed to monocrotophos (MCP)

Sample	Count, cfu/g soil	
	Total microbial count	Total rhizobial count
Plot 1	1.4×10^{10}	7.9×10^{8}
Plot 2	6.9×10^{8}	6.7×10^{8}
Plot 3	2.1×10^{10}	2.2×10^{8}
Control	1.4×10^{10}	1.9×10^{9}

Plot 1 : Spraying after 30 days one dose of application; Plot 2 : Spraying after 30 days and 45 days two dose of application; Plot 3 : Spraying after 30, 45 and 60 days three dose of application; Control – No spraying

have no significant influence on soil microflora especially the rhizobia and PSB.

The reports of[2, 3, 7], support the observations in the present investigation. That the pesticides under study have no significant influence on soil microflora. This could be attributed to the fact that certain soil Bacteria can degrade pesticides (as reported by same workers[4, 5], and thus survive in the soil contaminated with pesticides.

REFERENCES

[1] B.J.Bhadbhade, S.S.Sarnaik, P.P.Konekav; Journal of Applied Microbiology, **93**, 224-234 **(2002)**.

[2] A.C.Das, D.Mukharjee; Journal of Agriculture, Food Chemical, **48(8)**, 3728-3732 **(2000)**.

[3] C.C.Ching; Effect of Insecticides on the Population of Soil Microorganism and Crop Growth Chung-Hua Nung Hsuch Hui Pao, in Chinese, **124**, 89-98 **(1983)**.

[4] T.S.Hsu, R.Barha; Applied. Environment microbiology, **37(1)**, 36-41 **(1979)**.

[5] M.K.Megharaja, Venkateswaralu, A.S.Rao; Chemosphere, **17(5)**, 1033-1039 **(1988)**.

[6] V.Rangaswamy, B.R.Redy, K.Ventateswarlu; Agriculture Ecosystem Environment, **47(4)**, 319-326 **(1994)**.

[7] H.S.Sandhu, T.J.Singh; In Babulus Babalis Toxicat.Lett., **48(3)**, 243-243 **(1989)**.

[8] P.K.Shtty, S.P.Magu; J.Environ.Biol., **19(2)**, 141-144 **(1998)**.

[9] N.D.Singh, S.Majumdar, N.A.Kunaraswamy, S.Shakil, M.C.Kumar; Jain in Bull Environ.Contam.Toxical., **62(5)**, 584-590 **(1999)**.

[10] R.Lal, D.M.Saxena; Microbial Rev., **46(1)**, 95-127 **(1982)**.

[11] D.Arora, A.C.Gaur; J.Exp.Biol., **17**, 1258-1261 **(1979)**.

[12] N.J.Hahn; Con.J.Microbial., **12**, 725-729 **(1966)**.