FERTILIZERS AND PESTICIDES IN CROP YIELD AND POST HARVEST SOIL HEALTH

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SUMMARY

Present manuscript deals with environmental cum health risk assessment studies may be regarded as an aid towards a better understanding of the problems. Our effort includes investigation of out breaks and accident experiences to pesticides, correlation and prospective studies and randomized trials of intervention procedures. In present study NH_3-N was found maximum in soils supplied with fertilizers only (C_f) and pesticides were found to inhibit the production and maintenance of NH_3-N in soils. Fertilizers and pesticides showed increased percentage of NH_3-N than the original level (OL), although natural soil showed more NO_3-N than the treated soils. In presence of metasystox there was an increase in NO_3-N percentage than the fertilizer (C_f) and fertilizers treated (P) soils. Rate of nitrification was inhibited by the presence of fertilizers and pesticides. However, pesticides increased the rate of nitrification in the soils than fertilizers only. Organic carbon percentage was found to be maximum in the original level. Pesticide treated soils had a higher organic carbon level than the fertilizers treated soil.

INTRODUCTION

Soil carries out an important ecological services of the substences and survival of life. Soil health management is vital for the maintenance of biodiversity and safeguarding sustainable agriculture production. The health of soil is regulated by soil properties, i.e. physico-chemical and biological properties.

In modern farming uses of fertilizers and pesticides are increasing for the improvement of agricultural production. However, the addition of these chemicals cause changes in chemical and biological process. The effect of different fertilizers on the nitrogen and carbon cycles in the soil has been worked out[1,2,3]. Inhibition of nitrification[4-6], enhancement in N-fixation and nitrification[7], unaffected nitrification[8], nitrate accumulation[9], decline a nitrate level[10] and an enhancement in ammonical nitrogen and decline in nitrate nitorgen[11] have been reported as resulting from the application of insecticides/ pesticides. Effect of pesticides on soil organic matter is not well understood, although there are reports on decline the organic carbon level of soil[12], and adsorption of pesticides by organic matter[13].

In the present work an attempt has, therefore, been made to study these effects in detail.

Experimental

5 kg soil was taken in earthen pots and five seeds of turnip (Brassica rapa) were sown in each pot. One set of pots was supplied with inorganic and organic nitrogenous fertilizers alone and in combination with P and K, (C_f) at the rate of 50 : 50 : 100 kg/ha. Another set of pots was supplied with the same fertilizers and carbonate insecticide (P_0) at the rate of 20 kg/ ha. The third set of pots was supplied with fertilizers and organo phosphorus insecticide. Inorganic fertilizers used were ammonium sulphate (N) alone and in combination with superphosphate (P_2 O_5) and muriate of potash (K_2O). Organic fertilizers used were urea (U) alone, ureain combination with inorganic P and K and cowdung manure (CM) alone. Carbonate and organophosphorous insecticides were carbofuran and metasystox, respectively.

Estimation of NH_3- N, NO_3-N and organic carbon : For the estimation of NH_3-N and NO_3-N the reported method of De[14] was used. Organic carbon of the soil was done by chromic acid colorimetric method of M. Glover-Anengor etal.[15] and percentage of organic matter was calculated by multiplying the percentage of organic carbon with 1.670. The whole experiment was done in three replicates.

Results and Discussion

From the data presented in Tables 1(a), (b) and (c), it is clear that in presence of carbofuran there was more nitrate utilization by turnip than in presence of fertilizers or metasystox, although the rate of nitrification was greater in presence of metasystox than carbofuran. It is quite clear that metasystox, being a sulphure containing compound, could not be broken down microbiologically so easily on the surface of the leaves and probably choked the absorbing cells of turnip leaves, thereby hampering CO_2 assimilation and synthesis of glucose. Due to this adverse effect in the process of photosynthesis, the metabolic activities within the plant leaves swayed in a fashion that affected nitrate absorption/utilization for the synthesis of protein and other nitrogenous compounds. This was probably not the case with carbofuran, whose metabolic pathway in plants, insects and mammals was known to show the formation and absorption of additional energy material

(O- glucose) resulting in more utilization and absorption of NO_3-N. Inspite of this result with respect to carbofuran the residual soil treated with this insecticide showed more NH_3-N.

Table 1(a) Post harvest Changes in the Status of NH_3-N, NO_3-N, NO_3/NH_3 and Organic Carbon in Soil Treated with Fertilizers and Pesticides for Growing *turnip (Brassica rapa)* Changes in NH_3-N, NO_3-N, NO_3/NH_3 and organic carbon in soil.

Treatment	NH_2-N %	C_f NO_3-N %	NO_3/NH_2	Organic carbon %	Organic matter %	NH_3-N %	NO_3-N %	P_m NO_3/NH_3	Organic carbon %	Organic matter %	NH_2-N %	P_e NO_3-N %	NO_3/NH_3	Organic carbon %	Organic matter %
Control	0.0084	0.0070	0.83	0.78	1.34	0.0042	0.0056	1.33	0.84	1.45	0.0070	0.0070	1.00	0.86	1.48
N	0.0070	0.0056	0.80	0.86	1.48	0.0070	0.0070	1.00	0.92	1.59	0.0056	0.0056	1.00	1.13	1.95
NPK	0.0070	0.0070	1.00	1.39	2.40	0.0070	0.0084	1.20	1.05	1.81	0.0070	0.0070	1.00	1.30	2.24
U	0.0070	0.0056	0.80	1.32	2.28	0.0084	0.0070	0.83	1.34	2.31	0.0084	0.0056	0.64	1.53	2.64
UPK	0.0070	0.0070	1.00	1.30	2.24	0.0070	0.0056	0.80	1.15	1.98	0.0084	0.0070	0.83	1.20	2.07
CM	0.0070	0.0070	1.00	1.53	2.64	0.0070	0.0084	1.20	2.02	3.48	0.0056	0.0056	1.00	1.36	2.35
Original level (OL)	0.0063	0.0091	1.44	1.41	2.43										

C.D. at 5 %		NH_3-N	NO_3-N	NO_3/NH_3	Organic Carbon
	Fertilizer treatment	NS	0.0007*	NS	0.0675*
	Pesticide	NS	0.0005*	NS	NS
	Interaction	0.0028*	0.0012*	NS	0.1172*
	*signature				

Table 1(b)-Efficiency Order of the Changes Shown Under Table 1(a)

Factors	C_f	P_m	P_0
NH_3-N	Cont.>N-NPK-U-UPK-CM>OL	U>N-NPK-UPK-CM>OL>Cont.	U-UPK>Cont.-NPK>OL>N-CM
NO_3-N	OL-Cont.-NPK-UPK-CM>N=U	OL>NPK-CM>N-U>Cont.-UPK	OL>Cont,_NPK-UPK>N-U-CM
NO_3/NH_3	OL-NPK-UPK-CM-Cont.>N=U	OL>Cont.>NPK=CM>N>U>UPK	OL>Cont.-N-NPK-CM>UPK>U
Organic carbon	CM>OL>NPK>U>UPK>N>Cont.	CM>OL>U>UPK>NPK>N>Cont.	U>OL>CM>NPK>UPK>N>Cont.

Table 1 (c) – General efficiency order of the changes shown table 1 (a)

Factors	NH_3-N	NO_3-N	NO_3/NH_3	Organic carbon
Pesticide	$C_f>P_0>P_m>OL$	OL> $P_{m>}$ $C_f>P_0$	OL> $P_m>P_0>C_f$	OL> $P_0>P_m>C_f$
Fertilizers	U>UPK>NPK>Cont.-N-CM>OL	OL>NPK>CM>Cont.=UPK>N-U	OL>NPK=CM>Cont.>N>UPK>U	CM>OL>U>NPK>UPK>N>Cont.
Interaction	Cont.(C_f)=U(P_m)=U(P_0)=UPK(P_0)	NPK(P_m)==CM(P_m)>Cont.(0_f)=NPK(0_f)=UPK(0_f)=CM(0_f)=Cont.(P_0)=NPK(P_0)=UPK(P_0)	Cont. (P_m)>NPK-.(C_f)=UPK.(C_f)=CM.(C_f)=*Cont.*(P_0)=N(P_0)=NPK(P_0)=CM(P_0)	CM(P_m)>CM(0_f)>U(P_0)

OL= Natural soil; C_f= *Fertilizer treated soil*

P_m=Fertilizer treated soil with metasystox

P_0= Fertilizer treated soil with carbofuran

This seems to be a microbial effect in the soil in which the additional glucose as a result of carbofuran addition enhanced the formation of NH_3-N either by nitrogen fixation or by rapid decomposition of root residue to maintain a proper C/N ratio in the soil. Since there was more nitrate absorption in presence of metasystox, the nitrogen content of the soil become less and to maintain a proper C/N ration more carbon was lost from the soil to the atmosphere. Carbofuran applied soils thus recorded more organic carbon content soils in which the plants were grown in presence of metasystox.

The status of different forms of nitrogen in the original soil and soils treated with fertilizers only did not show a fixed tendency of nitrogen utilization/absorption although in general it appears that there was more ammonification and nitrification in the soils treated with the fertilizers. Under such a trend there would be more organic carbon content in comparison to the other treatments of pesticides which was not the case. In the original level of the soil, different forms of nitrogen and organic carbon, barring NH_3-N, NO_3-N, nitrification and organic carbon were the highest in comparison to the other treatments.

Regarding interaction between fertilizers and the two pesticides, it appears that the efficiency order of the soil in relation to the NH_3-N content treated with U and metasystox was the same as the control where no fertilizer was added. So was the case with the soil where U and UPK both were applied with carbofuran. The maximum efficiency order in relation to the NO_3-N or nitrification was found in the soils treatd with NPK and CM in combination with metasystox. Rate of nitrification was increased by the application of metasystox only than other treatments. However, as regards the interaction in relation to the organic carbon content of the soil it appeared that the soils treated with cowdung manure and metasystox is at the highest value followed by cowdung manure only and then urea treated with carbofuran.

It has been observed that for maximum NH_3-N content, interaction between fertilizer treatments and pesticides was significant statistically at 5% [Table 1 (a)]. For NO_3-N, fertilizer treatments, pesticides and their interaction with each other were statistically significant. For percentage of organic carbon, fertilizer treatment and is interaction with pesticides were also significant statistically.

Conclusion

Agriculture is the fundamental mode to satisfy the food demands of mankind and soil is the only medium to practice agriculture. Maintenance of soil quality and fertility is thus most critical to satisfy the world food demand. A basic approach for this has been the introduction of new and improved crop varieties and use of chemical based agents in order to enhance nutrient availability to crop as well as to protect the crop from all kind of pests. As a result of this, modern agriculture has become capital, chemical and technology intensive. While it has been successful to a large extent in keeping pace with the growing food demand, however this has ended up in a number of economic, environmental and social problem. The soil quality and fertility both are closely related with the microbial biodiversity of agriculture lands. Thus any change in the composition and properties of soil microflora may in long run pose a threat to global food security. Hence it may be concluded that excessive and prolonged usage of chemical fertilizers and pesticides has a range of detrimental effect on the soil microflora of agricultural ecosystems.

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