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EFFECT OF DIFFERENT COMBINATIONS OF NPK ON PH, EC AND ORGANIC CARBON OF SOIL UNDER RICE, WHEAT CROPPING

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Abstract

Continuous use of fertilizer, on an average resulted in an increase in Ec value from 0.385-to 0.399 being lowest under no fertilizer control. Application of fertilizer favoured in increase Ec value. The highest Ec (0.399) was recorded under NPK fertilized plot receiving highest amount. The Ec of the soil was greatly influenced with respect to the crops under test, was higher after wheat crop compared to that after rice crop. Organic carbon content progressively increased with fertilizer application, the value being highest at higher application rate of NPK.

Introduction:

In the interest of sustained crop productivity at high levels of fertilization, it is necessary to look forward into the effect of continuous manuring, fertilization and cropping practices both on the yield as well as on the fertility status of the soil. By considering these views, Laws and Gilbert started the world's oldest classical manurial experiment in 1843 at Broadbalk field in Rothamsted (England). India also started a few long term manurial experiments on Rothamsted model at Kanpur in 1885, Pusa (Bihar) in 1908 and Coimbatore (Madras now TamilNadu) in 1909. However, these experiments were initiated under dryland condition and did not meet the requirements of the modern intensive farming. Production system. The maintenance of soil health is of prime importance to sustain soil productivity, agriculture production of the country depends upon chemical fertilizers to get more and more yield from the shrinking land area. While in early days , it was thought that the use of chemical land and decreases yield of crop. Fertilizer spoil the It could become imperative how to soil might be manipulated without seriously damaging the long term variability as a result of intensive use of fertilizers over a prolonged period of time in the context of sustained crop productivity.

Methods and Material:

The experiment was initiated in rabi with wheat as the first crop followed by rice. The mildly alkaline soil pH (8.03) of the experimental field, on an average was sandy loam in

texture. These soil have a little free calcium carbonate at the surface but the lower layers are rich in this constituents and small calcium incrustation in the form of Kankar nodules are found in the bottom of soil profile. Iron mottling are very common in lower horizons. The soluble salt contents are average to high but the exchange complex is saturated with calcium to the extent of eighty percent. The drainage of the experimental field was excellent.

Table 1 - Important characteristics of the soil of Experimental field

Characteristics	**Content**
Mechanical Composition	
Sand (%)	52.0
Silt (%)	27.5
Clay (%)	20.0
Texture	Sandy loam
Physico-chemical features	
pH	8.03
Ec (dsm^{-1})	0.35
Organic Carbon (%)	0.36
Available P (ppm)	8.00
Available K (ppm)	97.50
Available S (ppm)	10.00
Available Zn (ppm)	0.65
Available Fe (ppm)	2.60
Available Mn (ppm)	7.35
Available Cu (ppm)	1.77

Nitrogen, phosphorus and potash were applied through urea, single superphosphate and muriate of potash, respectively, as per treatments. Nitrogen was applied in two splits, half the quantity at sowing time and the remaining half after first irrigation in wheat. In rice, one-third quantity of N was applied at transplanting and remaining N in two equal splits at tillering and panicle initiation stages. The entire quantities of P and K were applied at the time of sowing/transplanting. The plots were kept free of weeds. Irrigation were done according to crop requirement as and when needed. The effect of five treatments viz., $N_0P_0K_0$, $N_{40}P_{20}K_{20}$, $N_{80}P_{40}K_{40}$, $N_{120}P_{60}K_{60}$, $N_{160}P_{80}K_{80}$ was evaluated in a randomized block design with four replications. Wheat variety HD 2204 and rice variety Saket-4 was grown in cropping sequence.

Result and Discussion:

Effect on soil reaction (pH)

Data on pH of the soil after harvest of wheat and rice crops commencing from rabi are presented in Table-1 The pH of the soil under various fertilizer treatments varied between 8.47 and 8.34 .The pH value of the unfertilized and fertilized plots varied in a narrow range which indicates that continuous use of fertilizer through urea, single superphosphate and

muriate of potash even at higher levels did not make much difference with respect to pH of the soil. The magnitude of decrease was higher under NPK treatment receiving urea, single superphosphate and muriate of potash. The pH value of the plot receiving no fertilizer-control was highest. Between the crops, the pH value of soil after harvest of rice crop was relatively higher than that after harvest of wheat crop.

Effect on soluble salt (Ec dsm^{-1})

The soil analysis data regarding Ec of soil presented in Table-2 indicates that continuous use of fertilizer, on an average resulted in an increase in Ec value from 0.385 to 0.399 being lowest under no fertilizer control. Application of fertilizer favored in increase Ec values; the per cent increase being 8-12. The highest Sc (0.399) was recorded under NPK fertilized plot receiving

Table -2 Effect of continuous application of fertilizers on soil reaction (pH)

Treatments										Mean	% increase over control
N	P	K	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat		
0	0	0	8.50	8.64	8.52	8.53	8.20	8.46	8.43	8.47	100
40	20	20	8.56	8.74	8.34	8.39	8.43	8.42	8.40	8.47	100
80	40	40	8.30	8.64	8.33	8.37	8.25	8.27	8.26	8.34	98
120	60	60	8.33	8.59	8.47	8.50	8.48	8.25	8.26	8.41	99
160	80	80	8.52	8.67	8.50	8.47	8.28	8.30	8.24	8.42	99
Mean			8.44	8.65	8.42	8.45	8.32	8.34	8.32	8.42	

Table -3 Effect of continuous use of fertilizers en soluble salt (Ec dSm^{-1})

Treatments										Mean	% increase over control
N	P	K	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat		
0	0	0	0.311	0.338	0.406	0.371	0.407	0.311	0.353	0.356	100
40	20	20	.316	0.341	0.487	0.379	0.433	0.362	0.379	0.385	108
80	40	40	0.311	0.357	0.487	0.371	0.433	0.352	0.406	0.388	109
120	60	60	0.311	0.375	0.406	0.393	0.439	0.368	0.433	0.389	109
160	80	80	0.330	0.385	0.406	0.395	0.439	0.406	0.433	0.399	112
Mean			0.315	0.379	0.438	0.381	0.430	0.359	0.401	0.383	

Highest amount $N_{160}P_{80}$ K_{8o}. The Ec of the soil was greatly influenced with respect to the crops under test, being was higher after wheat crop compared to that after rice crop. As a result of continuous cropping and fertilization, Be values, on an average increased to the extent of 27 per cent from initial level after the harvest of wheat

Effect on organic carbon content

A perusal of the data presented in Table-3 shows that the organic carbon content progressively increased with fertilizer application, the values being highest at higher application rate of APK (N_{160} $P_{80}K_{80}$). On an average of seven seasons, the per cent increases were found in the range of 2-11 per cent due to continuous use of fertilizers as compared with control. The improvement in fertility of the soil as revealed by organic matter content was comparable in both the wheat and rice crop, the magnitude of increase being 4-14 and 9-15 per cent in rice and wheat, respectively from the initial level. The initial value of organic carbon being 0.42 per cent at the start of the experiment. On the basis of organic carbon values (0.40) obtained irrespective of treatments in wheat .

Table - 4 Effect of continuous use of fertilizers on organic carbon content (%)

Treatments										**Mean**	**% increase over control**
N	**P**	**K**	**Wheat**	**Rice**	**Wheat**	**Rice**	**Wheat**	**Rice**	**Wheat**		
0	0	0	0.43	0.43	0.45	0.45	0.45	0.45	0.43	0.44	100
40	20	20	0.44	0.45	0.46	0.46	0.45	0.45	0.49	0.45	102
80	40	40	0.46	0.45	0.48	0.48	0.46	0.51	0.51	0.47	107
120	60	60	0.47	0.46	0.48	0.47	0.48	0.49	0.48	0.47	107
160	80	80	0.50	0.47	0.50	0.50	0.48	0.51	0.50	0.49	111
Mean			0.46	0.45	0.47	0.47	0.46	0.48	0.48	0.46	

Under wheat-rice intensive cropping system. The organic carbon content in no fertilized plots under such condition did not have any acceptable changes up to end of experiment.

As a result of continuous application of NPK fertilizers over period of four years change in soil reaction. was not to well marked. In other studies also application of N through ammonium sulphate alone over a period of 40 years did not make any appreciable change in pH value of the soil (Bandyopadhya at al. 1969; Sahu and Nayak, 1971). Combined application of nitrogen, phosphorus and potassium even at higher levels failed to exert remarkable change in soil pH. sharma at al. (1980), Chaudhry et al. (1981) and Nambiar and Ghosh (1984) also have not found any affect of fertilizers on soil pH in long term manurial trials. The Ec of the soil increased by use of nitrogen fertilization over control but the effect was not significant. Intensively irrigated cropping system results in greater removal of nutrients from the soil and thus the improvement in soluble salt content is not much, Joints application of phosphorus and potassium along with nitrogen further influenced Ec of the soil

which again not reach the level of significance. An improvement in Ec value due to combined use of NPK over a prolonged period has also been reported by sharma at al. (1980), Chaudhry at al. (1981) and Tiwari (1902). Over a period of four years, a considerable reduction in Ec value recorded.

Organic carbon content of soil progressively improved consequent upon nitrogen application. Shinde and Ghosh (1971), Maurya and Ghosh (1972), Sharma et al. (1980) and Verma at al. (1987) have also reported favourable effect of continuous use of fertilizer on organic carbon content of soil. Application of nitrogen alongwith phosphorus further enhanced organic carbon content. similar increase in organic carbon content as a result of combined use of nitrogen and phosphorus have also noticed by several workers (Patel et al.1963; Blawa1967, et al. Nambiar and Ghosh,1984 and Verma, et al. 1987) Addition of potassium over nitrogen and phosphorus resulted in an increase. In organic carbon content to the largest extent.

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