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EFFECT OF NPK COMBINATION ON AVAILABLE P, K &S NUTRIENTS IN SOIL UNDER RICE, WHEAT CROP ROTATION

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Abstract

Available phosphorus content greatly influenced by increasing application of NPK, the availability of phosphorus in soil enhanced by 37, 62, 89 and 101 per cent with fertilizer application of $N_{40}P_{20}K_{20}$, $N_{80}P_{40}K_{40}$,$N_{120}P_{60}K_{60}$ and $N_{160}P_{80}K_{80}$ respectively, compared with no fertilizer-control. Over a period of 4 years, the phosphorus content increased by 32 per cent with fertilizer application whereas it is decrease by 17 per cent in plot receiving no fertilizer as compared to phosphorus content in soil at the starting of experiment (8.0 ppm). Available potassium content of soil increased with application of NPK. The content of potassium in soil increased by 10 per cent in plots receiving NPK fertilizers continuously whereas potassium content declined by 14 per cent in the plot receiving no fertilizer as compared to value of 93.23 ppm in fertilized plot and 95.62 ppm in unfertilized plot after harvesting of wheat . The availability of sulphur in soil, in general, increased progressively with increasing doses of NPK, and highest content of sulphur was found with the highest application of NPK fertilizer ($N1_{60}P_{80}K_{80}$). The availability of sulphur in control on the basis of average of 7 crop seasons reduced to the extent of 11 per cent.

Introduction:

With the use of high analysis fertilizers and high yielding varieties in an intensive cropping system, the depletion of sulphur and micronutrients not being added through fertilizers become more rapid. As the demand for higher yield goenup and the plant requirements for N, P and K are more efficiently met through fertilizers, sulphur and micronutrients in the soil are likely to become limiting. According to Williams and Steinberge (1958) the soil should contain at least 10 ppm of sulphate-sulphur for normal plant growth. Anand Svarup and these (1980) found a rapid decrease in water extractable sulphate in soil where di-ammonium phosphate was applied continuously as phosphorus source in a long term field experiment. Among micronutrients, alne deficiency could more vide spread in the field and fruit cropes in different part of India, An intensive study on changes status of sulphur and micronutrients with the use of fertilizers over a prolonged period under intercropping system is also called far. Intensive use of fertilizers, intensive cropping and high yielding seeds have no doubt brightened the hopes of huminity for successfully meeting

the challange of food shortage but it has also brought into the sharp focus numerous problem of soil fertility, fertilizer, soil and water management Universel deficiency of nitrogen and serious deficiency of phosphorus and potassium and increasing deficiency of micro nutrients particularly Zn, Fe and Mn could be well understood under soil fertility problems. in modern agriculture. The continuous application of fertilizers N,P and K could help to improve such nutrients deficiencies due to imbalanced application of fertilizers under intensive farming systems.

Method 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

It is evident from Table-1 that the available. Phosphorus content greatly influenced by increasing application of NPK as compared to the plot which received no fertilizer control. On an average, the availability of phosphorus in soil enhanced by 37, 62, 89 and 101 per cent with fertilizer application of $N_{40}P_{20}K_{20}$ and N_{80} $P_{40}K_{40,}$ $N_{120}P_{60}K_{60}$ and $N_{160}P_{80}K_{80}$ respectively compared with no fertilizer-control (6.7) Over a period of 4 years, the phosphorus content increased by 32 per cent with fertilizer application whereas it decreased by 17 per cent in plot receiving no fertilizer as compared to phosphorus content in soil at the starting of experiment (8.0 ppm). While the value of available phosphorus content 7.4 ppm under control and 10.5 ppm in varying fertilized plot after wheat was compared with end of experiment i.e.. after wheat , it was observed that no fertilizer application. Reduced 46 per cent availability of phosphorus. However, under such condition with varied application of fertilizers increased phosphorus availability to the order of 22 per cent.

Table -2 Effect of continuous use of fertilizers on available phosphorus (ppm)

Treatments										**Mean**	**% increase over control**
N	**P**	**K**	**Wheat**	**Rice**	**Wheat**	**Rice**	**Wheat**	**Rice**	**Wheat**		
0	0	0	7.4	8.0	7.2	8.2	5.6	6.5	4.0	6.7	100
40	20	20	8.2	9.4	7.9	8.5	10.9	8.9	10.5	9.1	137
80	40	40	8.8	11.2	9.5	10.2	12.5	11.7	12.5	10.9	162
120	60	60	12.1	12.9	11.6	12.3	13.3	13.5	13.5	12.7	189
160	80	80	12.8	12.9	13.2	13.2	13.6	14.6	14.8	13.5	201
Mean			9.90	10.80	9.88	10.40	11.18	11.04	11.06	10.60	

Effect on available potassium

It is clearly seen from data in Table-2 that the available potassium content of soil increased with application of NPK as compared to no-fertilizer-control plot. The increasing

dose of NPX improved available potassium status of soil and highest content was recorded under $N_{160}P_{80}$ K_{80}. On an averaged value after end of experiment, the value of potassium increased to the order of 5.26 per cent with varying application of NPK over no fertilization (88.74 ppm). The availability of potassium in soil after 7 crop seasons when compared from that initial status of potassium (96 ppm), the availability of potassium increased by 8 per cent with added fertilizer .However, the availability of potassium decreased by 9 per cent without fertilizer as a result of continuous cropping. The content of potassium in soil increased by 10 per cent in plots receiving NPK fertilizers continuously, whereas potassium content declined by 14 per cent in the plot receiving no fertilizer after wheat as compared to value of 93.23 ppm in fertilized plot and 95.62 ppm in unfertilized plot after harvesting of wheat .

Table -3 Effect of continuous use of fertilizers on available potash (ppm)

Treatments										**Mean**	**% increase over control**
N	**P**	**K**	**Wheat**	**Rice**	**Wheat**	**Rice**	**Wheat**	**Rice**	**Wheat**		
0	0	0	95.62	86.87	90.62	83.10	89.50	93.00	82.50	88.74	100
40	20	20	91.80	87.5	98.32	86.80	95.00	99.14	93.12	93.09	105
80	40	40	93.12	100.60	99.75	111.20	112.00	103.70	98.60	102.71	116
120	60	60	97.50	103.16	106.87	107.50	122.50	109.30	109.30	106.59	120
160	80	80	94.50	109.30	108.12	116.87	122.00	119.30	112.79	111.79	126
Mean			94.50	99.49	100.73	101.09	106.20	104.90	99.20	100.58	

Effect on available sulphur

Data in Table-3 indicated that the availability of sulphur in soil, in general, increased progressively with increasing doses of NPK, and highest content of sulphur was Found with the highest application of NPK fertilizer ($N_{160}P_{80}K_{80}$). Based on average of 4 years it is clear that the sulphur content increased by 20-63 per cent with differential doses of NPK over control (8.5 ppm). The availability of sulphur in control on the basis of average of 7 crop seasons reduced to the extent of 11 per cent, when it was compared with values at harvest of wheat . It was observed that the status of sulphur declined by 26 per cent due to intensive cultivation without use of fertilizer, while with fertilizer the status of sulphur increased by 11 per cent. The values of sulphur content in fertilized and unfertilized plots were 11.4 and 9.5 ppm S, respectively. The availability of sulphur irrespective of fertilizer treatment was more or less similar in wheat and rice crop and a par to critical limit of 10 ppm S.

Table -4 Effect of continuous use of fertilizers on available sulphur (ppm)

Treatments										Mean	% increase over control
N	P	K	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat		
0	0	0	9.5	9.0	9.3	9.0	8.0	8.0	7.0	8.5	100
40	20	20	10.0	10.4	10.0	9.4	10.0	11.6	10.0	10.2	120
80	40	40	11.0	11.2	10.7	10.5	11.0	12.0	12.5	11.3	133
120	60	60	12.0	13.5	11.6	11.9	12.6	12.6	13.6	12.5	147
160	80	80	12.6	14.0	13.9	14.2	13.5	14.7	14.5	13.9	163
Mean			10.9	11.5	11.3	11.0	11.0	11.8	11.4	11.2	

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