NUTRIENTS STATUS OF SOIL UNDER RICE-WHEAT CROPPING SYSTEM OF *MILAK TAHSIL* DISTRICT RAMPUR, UTTAR PRADESH

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Abstract: Soil is one of the most important vital natural resource, defends the life supporting system of a country and socio-economic development of its people. More than ever before, a renewed attention is being given to soil due to rapid declining land area for agriculture, declining soil fertility and increasing soil degradation, wrong land policies and imbalance use of inputs (Kanwar, 2004). All the above factors call for a paradigm shift in research away from maximum crop production to the sustainability of crop production system without degradation of soil health and environmental quality. Soils differ greatly in their morphological, physical, chemical and biological characteristics. Since these characteristics affect the response of soil to management practices it is necessary to have information about these characteristics of each category of soil.Soil fertility is one of the important factors controlling yields of the crops. Within a soil, nutrient variability exists depending upon the hydrological properties of the soil and cropping system. In the present study 249 soil samples were collected from 21 gram panchayats and were analysed. The soil samples were collected from rice-wheat cropping sequence. Analysis of soil samples revealed that 82 per cent samples were medium in organic matter content, 100 per cent soil samples were deficient in available nitrogen, while 92 per cent P and 100 per cent K samples were in medium range respectively. Among the micronutrients tested copper and iron were in sufficient range while manganese and zinc were deficient in soil.

Keywords: Soil fertility, Nitrogen, Phosphorus, Organic matter, Micronutrients, Analysis

INTRODUCTION

Continuous crop cultivation causes depletion of organic matter as well as other nutrients of the soil. Hence, to harvest better crop yields from the soil, it becomes necessary to apply organic manures and inorganic fertilizers to soils. Well-decomposed organic manures have a greater potential to improve the physical condition in terms of water holding capacity, soil porosity, infiltration rate and humus content and also the microbial status of the soil. Use of high yielding varieties, intensive cropping, increase use of high analysis fertilizers and restricted use of organic sources of nutrients has resulted in the deficiency of macro and micro nutrients in general particularly in the irrigated lands. (Ratan and Sharma 2004). Nutrient removed by crop depends on cultivar, soil moisture status, management levels and residue management. Soil fertility is one of the important factors controlling yields of the crops. Soil characterization in relation to fertility status of soil of an area is an important aspect for sustainable agriculture production. Due to imbalanced and inadequate fertilizer use, the response efficiency of chemical fertilizer has declined tremendously under intensive agriculture. Recent diagnostic survey indicate that in many intensively cultivated area farmers use greater than recommended doses of fertilizer, especially nitrogenous fertilizer, to maintained the crop productivity at levels attained previously with relatively small fertilization rates. Low fertility of Indian soil is the major constraint in achieving high productivity goals. In both agriculturally advanced irrigated ecosystems, nutrient replenishment through fertilizers and manures remain far below crop removal, thus causing the mining of native nutrient reserves over year. Wide spread deficiencies of macro and micro nutrients have emerged, and significant crop response to application of these nutrients are reported. The deficiencies are so intense and severe that visual symptoms are very often observed in major crops. The results of numerous field experiments in different parts of India have, therefore indicated *"Fertilizer-induced unsustainability of crop productivity"* (Yadav 2003).
The stagnation in crop productivity is there and yield increase need to be boosted with balanced and optimal dose of inorganic fertilizers, use of organic such as farm yard manure, compost, green manure, crop residue incorporation, use of industrial waste and biofertilizer. Variations in nutrient supply are a natural phenomena and some where may be sufficient while some where deficient. Within a soil, variability may exist depending upon the hydrological properties of the soil and cropping system.
A different location requires different management practices to sustained crop productivity for this full information about the nutrient status is important. Therefore to have complete information about the nutrient status of these soils this study were under taken.

MATERIALS AND METHODS

The district Rampur is located between longitude 78-0-54 & 69-0-28 east and latitude 28-25 & 29-10 north. Spread in area of 2367 Sq Km. Falls in

Moradabad division of Uttar Pradesh state. It is surrounded by district Udham Singh Nagar in north, Bareilly in east, Moradabad in west and Badaun in south. The height from mean sea level is 190.2 meter in north and 166.4 meter in south. The study area covers "Milak" Tehsil of Rampur district of Uttar Pradesh. Soil samples of 0-15 cm depth were collected from 249 sites covering 25 gram panchayats. Collected soil samples were air dried in shade, crushed gently with a wooden roller and pass through 2.0 mm sieve to obtain a uniform representative sample. Samples were properly labeled with the aluminum tag and stored in polythene bags for analysis .The processed soil samples were analyzed by standard methods for pH and electrical conductivity (1:2 soil water suspensions), organic carbon (*Walkley and Black, 1934*), available nitrogen (*Subbiah and Asija, 1956)*, available phosphorus *(Olsen et al.,1954)*, available potassium *(Jackson, 1973)* and available micronutrients (Fe, Mn, Zn and Cu) in soil samples with extracted by diethylene triamine penta acetic acid (DTPA) solution (0.005M) DTPA + 0.01M $CaCl_2$ +0.1M triethanolamine, pH 7.3 as outlined by *Lindsay and Norvell (1978).*

RESULT AND DISCUSSION

The soil samples were collected from the villages where rice-wheat cropping system was followed. Farmers usually apply 120-150 kg nitrogen per hectare along with 60-75 kg phosphorus per hectare and 50 kg/ha potassium use is largely practiced. Zinc application in rice was done by all the farmers and compost application was done by 45 per cent farmers, while green manuring was practiced by 12 per cent farmers and bio fertilizers use was not prevalent. 84 per cent of the farmers reported increase in fertilizers use to harvest same amount of crop.

Chemical Properties

It was observed that soil pH varied from 7.2 to 8.2 with an average of 7.8 according to classification of soil reaction suggested by Brady (1985), 23 samples were normal (7.2 to 7.3), 49 samples were mildly alkaline (pH 7.4 to 7.8), 123 samples were moderately alkaline (pH 7.9 to 8.2). The minimum value of pH 7.2 was observed in Durgapur and Maximum value of pH 8.2 was observed in Nangla Udai, Nipanya and Kamrudeen Nagar villages (Table-1). The relatively high pH of soils might be due to the presence of high degree of base saturation. The electrical conductivity of the soil varied from 0.190 to 0.545dSm^{-1}. In the soils samples having moderately alkaline pH values there growing of green manures, use of acid forming fertilizers was recommended to farmers.

Organic Matter Content

Organic carbon content of the soil varied from 3.4 to 6.8 g Kg^{-1} soil.The organic carbon content was low (<0.50%) in 1.8 %, medium (0.5 to 0.75%) in 82 % soil samples (Table-1). High temperature and more tillage practice in the soil increases the rate of oxidation of organic matter resulting reduction of organic carbon content. Regular application of compost, FYM and green manuring has been suggested to farmers to maintain the organic matter content in the soil.

Available Nitrogen Content

The available nitrogen content varied from 155.58 to 252.79 kg ha^{-1} with an average value of 220.09 kg ha^{-1} (Table 1). On the basis of rating suggested by Subbiah and Asija (1956), all samples were low (<250 N kg ha^{-1}) in available nitrogen (Table-1). Recommendation of 150 kg N/ha to rice and wheat respectively has been suggested to the farmers along with application of organic material and green manuring because most of the soil nitrogen is in organic form. Similar results were also reported by Verma *et al.* (1980).

Available Phosphorous Content

The available phosphorous content varied from 25.09 to 51.61 P_2O_5 kg ha^{-1} with a mean value of 37.02 P_2O_5 kg ha^{-1}. On the basis of the limit suggested by Muhr *et al.* (1963), 92 % samples were medium (20 to 50 P_2O_5 kg ha^{-1}) and 8% were high (>50 P_2O_5 kg ha^{-1}) in available phosphorus (Table-1). In soil more than 50 per cent of phosphorous is present in organic form, so maintenance of soil organic matter by application of organic materials has been suggested to farmers.

Available Potassium Content

Status of available potassium in the soil ranged from 168.5 to 267.6 K_2O Kg ha^{-1} with an average value of 213.2 K_2O kg ha^{-1}. According to limit suggested by Muhr *et al.* (1963), all samples were medium (125 to 300 K_2O kg ha^{-1}) in potassium content (Table-1). To maintain the potassium level in soil farmers were recommended to apply 60kg potassium to both rice and wheat crop.

Micronutrients

Copper: The DTPA extractable copper in the surface soil (0-15cm) of 21 gram panchayat was found to sufficient and varied from 0.265 to 2.422 mg kg^{-1} soil. All the observed values were well above the critical limit of 0.20 mg kg^{-1} as proposed by Lindsay and Norvell (1998) (Table-2).

Iron : The DTPA -extractable iron in the surface soil of 18 gram panchayat was found to be sufficient and varied from 3.212 to 16.925 mg kg^{-1}. The critical limit for iron is 4.5 mg kg^{-1} soil as suggested by Lindsay and Norvell (1978) (Table-2).

MANGANESE : The DTPA- extractable manganese in surface soil of 12 gram panchayat was found deficient in available manganese and varied from 1.701 to 8.351(Table-2). The critical limit of available manganese in soil is 1.0 mg kg^{-1} as proposed by Lindsay and Norvell (1978). Hence application of Mn as manganese sulphate 5kg/ha as basal has been recommended to the farmers.

Zinc: The available Zn in surface (0-15 cm) ranged from 0.423 to 1.923mg kg^{-1} soil. According to critical limit 0.6 mg kg^{-1} as proposed by Lindsay and Norvell (1978) all the surface soils with exception of Sayeednagar, Dhamora and Daniyapur were sufficient in available Zn content (Table-2). Where deficiencies were recorded there application of 25 kg/ha zinc sulphate was suggested every year and where it was sufficient there application once in three years had been suggested.

Table 1: Soil properties (weighted mean) of Rampur district of Uttar Pradesh.

S. N.	Name of village	No of samples collected	pH	EC (dSm^{-1})	OC (gmkg^{-1})	Available N (kgha^{-1})	Available P_2O_5 (kgha^{-1})	Available K_2O (kgha^{-1})
1	Lohapatti Bhagirat	10	7.1	0.191	5.4	250.60	25.80	235.80
2	Sandoli	10	7.9	0.392	6.4	228.65	17.25	203.87
3	Ashokpur	10	8.1	0.341	5.6	235.12	37.50	199.45
4	Lakhnakhera	10	7.4	0.362	4.7	199.56	40.21	219.78
5	Pagamberpur	13	7.9	0.366	6.4	245.34	35.40	223.12
6	Brijpur	12	7.8	0.416	5.3	216.16	31.16	205.98
7	Sayeednagar	15	8.0	0.436	6.3	240.42	40.83	241.52
8	Nipanya	8	8.2	0.241	5.5	221.09	38.88	178.10
9	Jadopur	15	8.0	0.290	6.6	232.60	43.87	220.62
10	Kamrudeen Nagar	15	8.2	0.396	6.6	247.88	51.61	263.70
11	Shankarpur	10	7.8	0.340	4.8	207.21	27.34	200.76
12	Niyamatnagar	15	8.0	0.339	4.5	189.80	34.80	171.69
13	Maghhra Brijpur	6	7.8	0.421	3.4	155.58	25.09	168.51
14	Maghhra	11	7.9	0.455	6.5	248.36	40.78	198.10
15	Dhamora	8	7.4	0.292	5.5	223.25	29.79	220.27
16	Haraiya	8	7.3	0.190	5.7	222.90	39.98	218.06
17	Himmatganj	5	8.1	0.257	6.2	234.45	36.25	267.60
18	Imratpur	5	8.0	0.424	5.1	209.15	40.23	226.2
19	Kamora	7	7.8	0.374	6.3	243.07	46.21	207.30
20	Daniyapur	6	7.4	0.545	5.4	213.54	38.33	193.93
21	Mankara	7	7.6	0.440	4.6	202.17	27.7	209.67
22	Duganpur	15	7.2	0.357	5.6	190.46	28.16	187.39
23	Narkhera	7	7.9	0.376	5.4	217.92	32.86	198.04
24	Naglaudai	6	8.2	0.388	6.8	252.79	42.84	237.90
25	Nankar	15	8.0	0.215	5.2	207.76	45.31	238.26
Range			7.2-8.2	0.190-0.545	3.4-6.8	155.58-252.79	25.09-51.61	168.51-267.60
Mean			7.8	0.353	5.5	221.43	35.92	213.42

Table 2: DTPA- extractable micronutrients (Cu, Fe, Mn and Zn) status in soil of Milak Tahsil of district Rampur.

S.N.	Name of village	No of samples collected	Cu Mg/kg	Fe Mg/kg	Mn Mg/kg	Zn Mg/kg
1	Lohapatti Bhagirat	10	0.880	6.055	5.015	0.554
2	Sandoli	10	1.038	7.026	8.053	0.765
3	Ashokpur	10	1.621	10.210	5.103	1.001
4	Lakhnakhera	10	1.351	9.536	3.806	0.533
5	Pagamberpur	13	0.932	6.155	3.139	1.923
6	Brijpur	12	0.879	6.235	4.153	0.824
7	Sayeednagar	15	0.753	8.572	5.501	0.534
8	Nipanya	8	1.027	3.212	1.926	0.774
9	Jadopur	15	1.321	4.810	2.961	0.831
10	Kamrudeen Nagar	15	2.422	5.639	2.255	1.639
11	Shankarpur	10	2.033	8.211	3.997	1.314
12	Niyamatnagar	15	1.712	4.839	3.217	0.673
13	Maghhra Brijpur	6	0.873	7.620	2.843	0.645
14	Maghhra	11	1.373	3.739	1.701	0.756
15	Dhamora	8	1.223	11.269	5.191	0.423
16	Haraiya	8	0.620	6.383	2.667	0.854
17	Himmatganj	5	1.531	4.035	5.160	0.605
18	Imratpur	5	1.168	4.544	4.617	0.885
19	Kamora	7	0.913	5.619	2.957	1.079
20	Daniyapur	6	0.793	4.985	2.562	0.585
21	Mankara	7	2.041	10.592	8.351	1.735

22	Duganpur	15	0.835	16.925	3.550	1.562
23	Narkhera	7	0.854	10.783	2.669	1.631
24	Naglaudai	6	0.265	8.536	3.526	0.820
25	Nankar	15	0.871	13.645	5.524	1.702
Range			0.265-2.422 1.173	3.212-16.925 7.567	1.701-8.351 4.017	0.423-1.923 0.985

CONCLUSION

The study of soil samples reveals that the soil of Milak Tehsil of Rampur District did not followed a particular pattern due to variation in management practices. Nutrient status regarding to the available macro and micro nutrient in surface soil indicated that soils are low in available nitrogen and medium in available phosphorus and potassium. Soils were deficient in micronutrient as zinc and manganese and were normal to slightly alkaline in reaction, low to medium in organic carbon content.

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