Int.J.Curr.Microbiol.App.Sci (2020) Special Issue-10: 770-776

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-10 pp. 770-776**
Journal homepage: http://www.ijcmas.com

Original Research Article

Assessment of Soil Fertility Status under Rice - Wheat Cropping System of Chandausi Tehsil of Sambhal District (Uttar Pradesh)

Devendra Pal[1*], Raksha Pal Singh[2], Arvind Kumar[1], Ravindra Kumar[3] and Vipin Kumar[4]

[1]Krishi Vigyan Kendra, Sambhal,(SVPUA&T, Meerut) U.P.
[2]Swami Keshwanand Rajasthan Agricultural University, Bikaner
[3]Krishi Vigyan Kendra, Thakurdwara, Moradabad,(SVPUA&T, Meerut) U.P.
[4]Deptt. of Agriculture Chemistry & Soil Science R. B. S. College, Bichpuri, Agra

**Corresponding author*

A B S T R A C T

The present investigation, an attempt has been made to examine the chemical properties of soil in rice - wheat cropping system. The study area covers Chandausi Tehsil of Sambhal district of Uttar Pradesh. Macro and micro nutrients are important soil elements that control its fertility. Soil fertility is one of the important factors controlling yields of the crops. Soil characterization in relation to evaluation of fertility status of soil of an area or region is an important aspect in context of sustainable agriculture production. Because of imbalanced and inadequate fertilizer use coupled with low efficiency of other inputs, the response efficiency of chemical fertilizer nutrients has declined tremendously under intensive agriculture in recent year. Soil samples of 0-15 cm depth were collected from 142 sites covering 12 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. The processed soil samples were analyzed by standard methods. The pH varied from 5.8 to 7.9, organic carbon content varied from 4.3 to 6.4 g Kg^{-1} soil. The available N content was varied from 182.16 to 251.26kg ha^{-1} with an average value of 226.75 kg ha^{-1} The available phosphorous content varied from 32.8 to 43.47 P_2 O_5 kg ha^{-1} with a mean value of 37.84 P_2O_5 kg ha^{-1}.Status of available potassium in the ranged from 187.35 to 241.43 K_2O Kg ha^{-1} with an average value of 221.72 K_2O kg ha^{-1}. Cu in the surface soil was found to sufficient and varied from 0.618 to 1.271 mg kg^{-1} the iron content varied from 4.887 to 9.275, Mn from 1.948 to 4.153 mg kg^{-1}. The available Zn in surface (0-15 cm) in soil ranged from 0.436 to 1.312 mg kg^{-1} soil in rice – wheat farming system. Nutrient status regarding to the available macro and micro nutrient in surface soil indicate that soils are low in available N and medium in available P and K and in general marginal in available Cu, Fe, Mn and Zn. Normal to mildly alkaline in reaction, low to medium in organic carbon content.

Keywords

Soil fertility, Macro & micro nutrients, Availability, Cropping system

Introduction

The physio-chemical properties of soils and their interaction with one another and variation in nutrients supplying capacity is a natural phenomenon. Therefore, the different management practices are required at different locations to sustained crop

productivity hence, the nutrient status of soil is very important. It has been observe that soil differs generally in their morphological, physical, mineralogical, biological characteristics. According to the International Food Policy Research Institute, between 1993 and 2020 A.D. the global demand for cereals is expected to increase by 41%. It has been projected that annual rice production must increase from 556 million tons in 2000 A.D. to 758 million tons by 2020 A.D., a 36% increase. Rice-wheat cropping system (RWCS) is a long-established grain production system in China. The wheat yield following rice was only 0.7 to 1.0 tons ha^{-1} until the 1940s and it increased progressively after the 1950s as a result of improved varieties, better agronomic management, and pest control. RWCS in the Indian subcontinent is quite new and started only in the late 1960s with the introduction of dwarf wheat from CIMMYT, Mexico, which required a lower temperature for good germination than that required for traditional tall Indian wheat. Considerable research has been conducted in India on the irrigation of wheat. Currently, there is a growing concern in sustainability of RWCS as the growth rates of rice and wheat yields are either stagnant or declining. Studies on socioeconomic and policy factors on the productivity of RWCS will be effective for measuring outcome of RWCS.

With increasing demographic pressure coupled with scarcity of soil and water resources, sustainable agriculture is not synonymous with low-input. In some cases, low-input system may be acceptable for a short time, but in others like major food grain crops it may not be acceptable at all. As there is no alternative to agricultural intensification in our country, we must ensure using soil resources as per their capability and adopting the practices that improve soil quality and maintain a favorable soil condition for plant growth and environmental health (Mishra, 2005). 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. Recent diagnostic survey indicate that in many intensively cultivated area farmers have resorted to use greater than recommended doses of fertilizer, especially N Fertilizer, to maintained the crop productivity at levels attained previously with relatively small fertilization rates. This is an indication of decline in factor productivity. Low fertility of India soil is the major constant in achieving high productivity goals. The stagnation in crop productivity cannot be boosted without balanced and optimal dose of inorganic fertilizers along with use of organic such as farm yard manure, compost, green manure, crop residue incorporation use of industrial waste Biofertilizers, N fixers both symbiotic and associate and p solubilizers. Variations in nutrient supply are a natural phenomena and somewhere may be sufficient while some where deficient. Within a soil, variability may exist depending upon the hydrological properties of the soil and cropping system therefore 12 locations will required different management practices to sustained crop productivity and for this full information about the nutrient status is important. Therefore to have sound information about the nutrient status of these soils this study was under taken.

Materials and Methods

District Sambhal comes under western Uttar Pradesh well known for its handicraft,

famous in the world and specially famous for bone jewellary, decorative items and bone pots etc., and it is the leading agriculture district. Sugarcane Paddy, wheat, mustard, urdbean, maize, bajra are the main crops of the district. It is situated between 28°59′ North Latitude and 78°57′ East Longitude. It is bounded on the north by Moradabad district, on south by Bulandshahar district and east by Badaun and west by Amroha district. The Chandausi Tahsil is located at a major road and rail junction, is a trade centre for agricultural product, industries including mentha oil extraction unit, sugar refining, handloom, weaving and calico printing etc.

The study area covers Chandausi Tahsil of Sambhal district of Uttar Pradesh. Soil samples of 0-15 cm depth were collected from 142 sites covering 12 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 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).

Results and Discussion

The soil samples collected from different locations of 12 gram panchayat namely Gumthal Akroli, Maithra, Nagla Poorva, Lakhneta, Paltha Mithanpur Navabpura, Rasulpur Kaili, Majhawali, Nagliya Ballu, Kareli of Chandausi tehsil of Sambhal district at surface and subsurface soil where sugarcane - wheat farming system was followed by farmers usually apply 120-140 kg N ha $^{-1}$ along with 60-70 kg P ha^{-1}. Zinc application in rice-wheat farming system done by 40 percent of farmers while green manuring practiced by 8-10 percent farmers and Biofertilizers use was not prevalent. It was noted that 85 percent farmers reported increased use of fertilizers to harvest same quantity of yield at different locations of Chandausi Tahsil of Sambhal districts of Uttar Pradesh. The soil fertility status of the study area was assessed with respect to pH, organic carbon macro and micro nutrients such as Cu, Fe, Mn, and Zn and results obtained are presented and discussed in the following headings.

Chemical properties

Soil pH is an important chemical parameters as its help to insuring available of plant nutrients. It was observed that soil pH varied from 5.8 to 7.9 with an average of 7.0 according to classification of soil reaction suggested by Brady (1985), 93 samples were normal (7.2 to 7.3), 39 samples were mildly alkaline (pH 7.4 to 7.8), 10 samples were moderately alkaline (pH 7.9 to 8.2). The minimum value of pH 5.8 was observed in Kareli and Maximum value of pH 7.9 was observed in Majhawali. 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 0.225 to 0.648 dSm^{-1}.

Organic matter content

Organic matter has a vital role in agricultural soil. Organic carbon content of the soil in rice-mentha+wheat varied from 4.3 to 6.4 g Kg^{-1} soil. The organic carbon content was

low (<0.50%) in 43 %, medium (0.5 to 0.75%) in 57 % soil samples. High temperature and more tillage practice in the soil increases the rate of oxidation of organic matter resulting reduction of organic carbon content. Agarwal et al., (1990) reported that organic carbon content of some soil Rajasthan ranged from 0.142 to 0.40 percent.

Available nitrogen content

Nitrogen is one of the most important plant nutrients and frequently deficient of all nutrients. The available N content in rice-wheat varied from 182.16 to 251.26 kg ha^{-1} with an average value of 226.75 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. A significant positive correlation (r =0.933) was found between organic carbon and available nitrogen. This relationship was found because most of the soil nitrogen is in organic form. Similar results were also reported by Verma *et al.,* (1980).

Available phosphorus content

Phosphorus plays an important role in energy transformation and metabolic processes in plants. Status of available phosphorus content in rice- wheat varied from 32.38 to 43.37 P_2O_5 kg ha^{-1} with a mean value of 37.84 P_2O_5 kg ha^{-1}. On the basis of the limit suggested by Muhr et al. (1963), all the samples were medium (20 to 50 P_2O_5 kg ha^{-1}) in available phosphorus. A significant positive correlation (r = 0.683) was observed between organic carbon and available phosphorus. A significant positive correlation (r = 0.684) was observed between organic carbon and available phosphorus. This relationship might be due to the presence of more than 50% of phosphorus in organic form and after decomposition of organic matter as humus is formed which forms complex with Al and Fe and the positive cover for P fixation with Al & Fe thus reduce phosphorus fixation (Tisdale et.al. 1997).

Available potassium content

Potassium is not an integral part of any major plant component but it plays a key role in a vast array of physiological process vital to plant growth from protein synthesis to maintenance of plant water balance. Status of available potassium in the soil in rice- wheat ranged from 187.35to 241.43 K_2O Kg ha^{-1} with an average value of 211.72 K_2O kg ha^{-1}. According to limit suggested by Mahr *et al.*, (1963), all samples were medium (125 to 300 K_2O kg ha^{-1}) in potassium content. A significant positive correlation (r =0.615) was observed between organic carbon and available potassium. This might be due to creation of favorable soil environment with presence of high organic matter. Similar result was also reported by Paliwal (1996).

Micronutrients

Copper

Copper is one of the oldest known metals and is the 25th most abundant element in earth crust. The DTPA extractable Cu in the surface soil in rice- wheat of 12 gram panchayat was found to sufficient and varied from 0.618 to 1.271 mg kg^{-1} soil in surface (0-15cm) with a mean value of 0.915. All the observed values were well above the critical limit of 0.20 mg kg^{-1} as proposed by Lindsay and Norvell (1998).

Iron

Iron is an essential nutrient for plants. It accepts and donates electrons and it plays important roles in the electron transport chain associated with photosynthesis and respiration The DTPA -extractable Fe in the

surface soil in rice- wheat of 12 gram panchayat was to be sufficient and varied from 4.887 to 9.275 mg kg^{-1} with a mean value of 6.642 mg kg^{-1}. According to critical limit of 4.5 mg kg^{-1} soil as suggested by Lindsay and Norvell (1978) (Table 2).

Table.1 Salient soil properties (weighted mean) under rice –wheat cropping system

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	Gumthal	15	7.5	0.315	4.3	182.16	36.72	205.82
2	Akroli	12	7.8	0.580	4.9	218.12	32.38	198.28
3	Maithra	10	6.7	0.225	5.2	223.56	35.56	187.35
4	Lakhneta	10	7.3	0.485	5.4	226.48	40.86	210.66
5	Nagla poorva	12	6.8	0.648	6.4	251.26	42.49	241.43
6	Paltha mithanpur	12	6.5	0.298	5.5	228.38	38.58	213.67
7	Raholi	12	7.2	0.456	5.9	232.54	37.96	218.32
8	Navabpura	10	7.0	0.495	6.0	238.12	36.44	212.46
9	Rasulpur kaili	12	7.6	0.465	5.8	230.64	41.46	217.53
10	Majhawali	10	7.9	0.610	4.8	215.18	34.33	192.87
11	Nagliya Ballu	12	6.0	0.535	6.3	247.76	43.37	238.75
12	Kareli	15	5.8	0.618	5.4	227.14	33.98	203.48
		Range	5.8-7.9	0.225-0.648	4.3-6.4	182.16-251.26	32.38-43.37	187.35-241.43
		Mean	7.0	0.478	5.49	226.75	37.84	211.72

Table.2 DTPA- extractable micronutrients (Cu, Fe, Mn and Zn) status of soil under rice –wheat cropping system

S.N.	Name of village	No of samples collected	Cu mg/kg	Fe mg/kg	Mn mg/kg	Zn mg/kg
1	Gumthal	15	0.756	7.435	2.542	0.759
2	Akroli	12	1.185	5.476	2.864	0.847
3	Maithra	10	1.026	5.732	3.196	0.723
4	Lakhneta	10	0.845	8.946	3.279	1.126
5	Nagla poorva	12	0.788	7.283	1.948	0.526
6	Paltha mithanpur	12	0.915	5.987	2.825	0.648
7	Raholi	12	0.698	7.129	4.127	0.827
8	Navabpura	10	1.271	4.647	3.482	0.596
9	Rasulpur kaili	12	0.618	6.792	2.176	0.629
10	Majhawali	10	0.924	6.120	4.153	0.436
11	Nagliya Ballu	12	0.857	9.275	3.257	1.312
12	Kareli	15	1.102	4.887	2.248	0.547
		Range	0.618-1.271	4.887-9.275	1.948-4.153	0.436-1.312
		Mean	0.915	6.642	3.008	0.748

Mn

Manganese is tenth most abundant element on surface on earth and its involved in many bio-chemical functions. The DTPA-extractable Mn in surface soil varied from 1.948 to 4.153 mg kg^{-1} soil of 12 Gram panchayat under rice- wheat cropping system and is sufficient to high since are well above according to critical limit of 1.0 mg kg^{-1} as proposed by Lindsay and Norvell (1978).

Zn

Zinc plays very important role in plant metabolism. The available Zn in surface (0-15 cm) in rice- wheat ranged from 0.436 to 1.312 mg 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 Majhawali and Navabpura were sufficient in Available Zn content.

Conclusion

The study of soil samples reveals that the soil of Chandausi Tahsil of Sambhal district were did not followed a particular pattern with different gram panchayat which may be due to variation in management practices and yield potential. Nutrient status regarding to the available macro and micro nutrient in surface soil indicate that soils are low in available N and medium in available P and K and in general marginal in available Cu, Fe, Mn and Zn. Normal to mildly alkaline in reaction, low to medium in organic carbon content (Kumar et.al. 2013**).**

References

Aggarwal, R.K., Kumar, P. and Sharma, B.K. (1990) Distribution of nitrogen in some Aridisols. *Journal of the Indian Society of Soil Science* 38,

430-433.

Brady, N.C. (1985). The nature and properties of soil, 8th edition Macmillan publishing Co. Inc., New York.

Jackson M L (1973) Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi.

Kumar Ravindra, Rathi, A.S, Kant,L, Tripathi, N.C. and Pramod Kumar (2013) Soil fertility status of soil of Rampur District of Uttar Pradesh. Journal of Krishi Vigyan Kendra 2013, 2(1): 55-58.

Lindsay, W.L. and Norvell, W.A. (1978) Development of DTPA soil test for zinc, iron, manganese and coper. *Soil Science Society of America Journa*l 42, 421-428

Muhr, G.R., Datta, N.P., Sharma, S.N. Derer, F., Lecy, V.K. and Donahue, R.R. (1963) Soil testing in Indian, USAID mission to India.

Mishra, B (2005) Soil quality and agricultural sustainability. *Training held at deptt. Of Soil Science, GBPUA&T, Pantnagar from 1-12-2005 to 21-12-2005.*

Olsen, S.R., Cole, C.V., Watanabe, F.S. and Deen, L.A.(1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA CIRC. 939.Unied State Dept. of Ag. Wasignton, D.C.

Paliwal, M.L. (1996) Studies on major and micronutrient status of soils of Panchayat samiti Bhinder, Udaypur, M.Sc. (Ag.) *thesis, Rajasthan Agricultural University, Bikaner.*

Ratan,R.K.and Sharma,P.D.2004.Main micronutrient available and their method of use. Proceeding of IFA International Symposium on micronutrients. 110

Subbiah, B.V. and Asija, G.L. (1956) A rapid procedure for the determination of available nitrogen in soil. *Current Sci.* 25, 259-260.

Tisdale, S.L., Nelson, W.L., Beaton, J.D. and Havlin, J.L. (1997) Soils fertility and fertilizer 5th edition, Macmillan publishing Co. New Delhi 144-180, 198-201

Verma L.P., Tripathi B.R. and Sharma D.P. (1980) Organic carbon as an index to assess the nitrogen status of soil. Journal of the Indian society of Soil Science 28, 138-140.

Walkley, A.J. and Black, I.A. (1934) Estimation of soil organic carbon by the chromic acid titration method. *Soil Sci.* 37, 29-38.

Yadav, J.S.P, (2003). Managing soil health for sustainable productivity .Journal of the Indian society of Soil Science 51,448-465.