DISTRIBUTION PATTERN OF AVAILABLE NUTRIENTS UNDER MAIZE-POTATO -SUGARCANE CROPPING SEQUENCE IN DAURALA BLOCK OF MEERUT DISTRICT (UTTAR PRADESH)

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Received-02.04.2015, Revised-23.04.2015

Abstract: The present investigation was undertaken to study of chemical properties of Daurala block Soil (district Meerut) under maize-potato - sugarcane cropping system. The depth wise soils samples in maize-potato - sugarcane cropping system at five different locations were analyzed for pH, EC, organic carbon, total nitrogen, macro and micronutrients. The surface and sub surface soil were in neutral to alkaline and none of the soil was found to be saline category. The organic matter content declined with soil depth, varied from 0.20 to 1.01 % at surface and sub surface soil. The available N, P and K 161 to 220, 8.1 to 42.9 and 144 to 379 kg ha^{-1} at surface and sub surface soil and declined with increasing soil depth. Among the different micronutrients with exception of zinc and Fe, the availability of Cu and Mn micronutrients were in sufficient range. The availability of these micronutrients declined with increase in soil depth.

Keywords: Micro nutrients, Soil fertility, Maize, Potato

INTRODUCTION

Maize-potato-sugarcane is an important cropping system of western Uttar Pradesh. This cropping system is a long duration crop with luxuriant vegetative growth which requires more amount of nutrient resulted into higher nutrients uptake from soils. Ultimately, soils have now become deficient in available nutrients. Low productivity of sugar cane and wheat is ascribed possibly due to deficiency of these nutrients. Proposed study area is agriculturally most important and cropping intensity is quite high. Farmers apply inadequate and imbalanced fertilizer due to which the inherent capacity of soil i.e. soil fertility is affected adversely. Many secondary (S, Ca, Mg) as well as micronutrients (Zn, Fe, B,Mo) deficiency are experienced and becoming limiting factor for crop production. In such condition, sustainability of crop production cannot be assured. Since the demand for food grain production is increasing continuously, the productivity of different crops is to be increased. For this purpose the information about the soil fertility status is most important and on the basis of soil fertility, fertilizer application is to be made for higher productivity. In the area so for no information on soil fertility in rice wheat system is available.

MATERIAL AND METHOD

Soil samples were collected from five locations of Daurala block Meerut district under Maize- Potato - Sugarcane Cropping Sequence. Soil samples at three depth of every location were collected with the help of auger and stored in polythene bags. Collected soil samples were air dried in shade, crushed gently with a wooden roller and then pass through 2.0 mm sieve to obtain a uniform representative sample. Samples were properly labelled with the aluminium 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 matter (Walkley and Black, 1934), available nitrogen (Subbiah and Asija, 1956), available phosphorus (Olsen et al., 1954), available potassium (Jackson, 1973) and cationic micronutrients (Fe, Mn , Cu and Zn) in soil samples with extracted with a Diethylene triamine pentaacetate (DTPA) solution (0.005 M) DTPA + 0.01 M CaCl2+ 0.1 M triethanolamine, pH 7.3 as outlined by Lindsay and Norvell (1978). The concentration of micronutrients was determined by atomic absorption spectrophotometer (GBC Avanta PM). All the analysis of soil samples was carried out in the laboratory of Department of Soil Science, SVPUA&Tech, Modipurm, Meerut (U.P), India.

General properties

Soil at various depths was usually found normal to alkaline in reaction (Table-1). It was observed that soil pH ranged from 7.0-8.30. The soil pH increased in subsurface inconsistently. Sangwan and Singh (1993) also reported the higher pH values in the lower horizon because of concentration of free carbonates. The soil EC ranged from 0.48 to 1.54 dSm^{-1} (Table-1), thereby indicating non saline nature of soils. The low EC may be due to free drainage condition which favored the removal of bases by percolating and drainage water Leelavathi *et al.* (2009).

The organic carbon varied from 0.20-1.01 % (Table 1). The organic carbon decreased with increasing depth in all the location. It could be attributed to differential additions of FYM and plant residues and

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crop management to surface horizon. The more organic carbon on surface soils may attribute to more addition of plant residue and FYM. Similar result was reported by Rajeswar *et al.* (2009) and Leelavathi *et al.* (2009).

Available macro nutrient

The available nitrogen content in all the soils was low ranging from 161 - 220 kg ha^{-1} throughout the depth. However, available N content was found to be maximum in surface horizons and decreased regularly with soil depth, which might possibly be due to the accumulation of plant residues, debris and rhizosphere. These observations are in accordance with the findings of Prasuna-Rani *et al. (1992).*

The available phosphorus content in the soils varied from 8.1-42.9 P_2O_5 kg ha-I. However, the highest available P was observed in the surface horizons and decreased regularly with depth. Higher P in the surface horizon might be due to the confinement of crop cultivation to this layer and supplementation of the depleted phosphorus through external sources *i.e.* fertilizers. Similar results were reported by Thangaswamy *et al. (2005).* It might be due to the confinement of added of P fertilizers being less mobile the rhizosphere. The lower P content in subsurface soil could be attributed to the fixation of phosphorus by clay minerals (Leelavathi et al., 2009) on surface soils.

Available K in all the soils varied from 144-379kg ha-^{1}. The highest available K content was noticed in the surface and showed decreasing trend with depth. This could be attributed to more intensive weathering, release of labile K from organic residues, application of K fertilizers and upward translocation of K from lower depths along with capillary rise of ground water (Pal and Mukhopadhyay 1992).

Available micro nutrient

The DTPA extractable Zn varied from 0.20-0.81 $mgKg^{-1}$ soil (Table 3). According to critical limit 0.6 $mgKg^{-1}$ as proposed by Lindsay and Norvell (1978) all the surface soil was insufficient in available Zn content with exception Daurala. In general surface horizon had higher concentration of DTPA extractable micronutrient due to higher organic carbon (Nayak *et al.* 2000) this may be ascribed to lower pH values and higher amounts of organic matter in surface.

The DTPA extractable Fe varied from 2.08-8.28 $mgKg^{-1}$ (Table 3). According to critical limit 4.5 $mgKg^{-1}$ as suggested by Lindsay and Norvell (1978) all the soils were sufficient in available Fe with exception of Surani and Machhari soils. A decreasing trend with depth was noticed inn all four locations. The availability of metal ions increases with increase in organic matter content because organic matter may supply chelating agents. Such relationship was also reported by Sharma *et al.* (2003).

The DTPA extractable Cu varied from 0.78-1.98 $mgKg^{-1}$ soil (Table 3). All the observed values were well above the critical limit of 0.20 $mgKg^{-1}$ soil as proposed by Lindsay and Norvell (1978). Increase in the finer fraction of the soil leads to increase in surface area for ion exchange and contribute to greater DTPA extractable forms of metal ions. This is in agreement with the findings of Sharma *et al.* (2003).

The extractable Mn in soil varied from 3.36-9.22 $mgKg^{-1}$ soil (Table 3). According to critical limit of 1.0 $mgKg^{-1}$ soil as proposed by Lindsay and Norvell (1978), all the soils were sufficient in available Mn. These finding are in close conformity by Sharma *et al.* 2003.

Table 1. Chemical properties of Daurala block soils of district Meerut under Maize- Potato -sugarcane cropping

Locations	Depth	EC(dSm^{-1})	pH	OC (%)
Surani	0-15	0.81	8.12	0.84
	15-30	0.68	8.10	0.39
	30-45	0.71	8.00	0.32
	Mean	0.73	8.07	0.52
Machri	0-15	1.54	7.90	1.01
	15-30	1.01	7.90	0.91
	30-45	0.53	8.00	0.37
	Mean	1.03	7.93	0.76
Bafawat	0-15	1.23	8.20	0.71
	15-30	1.01	8.30	0.44
	30-45	0.91	8.10	0.32
	Mean	1.05	8.20	0.49
Alipur	0-15	0.48	7.00	0.42
	15-30	0.51	7.20	0.30

	30-45	0.50	7.40	0.22
	Mean	0.50	7.20	0.31
Dauarala	0-15	1.04	8.20	0.62
	15-30	1.03	8.00	0.30
	30-45	0.98	7.70	0.20
	Mean	1.02	7.97	0.37
	Min	0.48	7.00	0.20
	Max	1.54	8.30	1.01

Table 2. Available N, P and K (kg ha^{-1}) of Daurala block soils of district Meerut under under Maize- Potato -sugarcane cropping

Locations	Depth	Available macronutrients(kg ha^{-1})		
		N	P	K
Surani	0-15	218	33.7	274
	15-30	181	20.4	227
	30-45	176	10.9	190
	Mean	192	21.7	230
Machri	0-15	212	18.7	258
	15-30	193	11.2	199
	30-45	176	8.1	212
	Mean	194	12.6	223
Bafawat	0-15	218	42.7	273
	15-30	187	27.6	194
	30-45	161	14.9	224
	Mean	189	28.4	230
Alipur	0-15	220	33.9	159
	15-30	195	20.9	144
	30-45	173	11.4	153
	Mean	196	22.1	152
Dauarala	0-15	220	42.9	331
	15-30	198	29.4	379
	30-45	172	13.4	317
	Mean	197	28.6	342
	Min	161	8.1	144
	Max	220	42.9	379

Table 3. Available micronutrients (mg kg^{-1}) of Daurala block soils of district Meerut under under Maize- Potato -sugarcane cropping

Locations	Depth	Available micronutrients (mg Kg^{-1})			
		Zn	Fe	Cu	Mn
Surani	0-15	**0.53**	**3.40**	**1.58**	**5.08**
	15-30	0.26	2.57	0.95	4.04
	30-45	0.26	2.37	0.93	3.92
	Mean	0.35	2.78	1.15	4.35
Machri	0-15	**0.63**	**2.08**	**1.32**	**4.49**
	15-30	0.46	2.30	1.46	3.36
	30-45	0.30	2.62	1.04	4.01
	Mean	0.47	2.33	1.27	3.95
Bafawat	0-15	**0.81**	**5.42**	**1.98**	**8.66**
	15-30	0.65	4.41	1.54	6.77

	30-45	0.43	3.36	0.85	4.41
	Mean	0.63	4.39	1.46	6.61
Alipur	0-15	**0.66**	**6.09**	**1.04**	**5.02**
	15-30	0.25	5.69	0.78	5.88
	30-45	0.28	4.52	0.84	6.41
	Mean	0.39	5.43	0.89	5.77
Dauarala	0-15	**0.67**	**8.28**	**1.84**	**5.28**
	15-30	0.26	6.36	1.56	9.22
	30-45	0.20	5.02	0.95	8.31
	Mean	0.38	6.55	1.45	7.61
	Min	0.20	2.08	0.78	3.36
	Max	0.81	8.28	1.98	9.22

CONCLUSION

Chemical characteristics and nutrient status of soils in maize-potato-sugarcane as discussed above indicated that soils were normal to alkaline in reactions, non saline and low to medium in organic carbon. As far as nutrient status is concern, the soils were low in available nitrogen, low to medium in available phosphorus and low to high available potassium. DTPA extractable micronutrient sufficient in surface soil except Fe soils of Surani.

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