NUTRIENTS STATUS OF SUGARCANE-WHEAT GROWING SOILS OF DAURALA BLOCK OF MEERUT DISTRICT - UTTAR PRADESH

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Abstract The physico-chemical characteristics, available macro- and micronutrient status in the soil help in determining the soils potential to supply nutrients for crop growth. In order to provide a base line data and information the study was taken up under sugarcane - wheat cropping system of Daurala block Soil (district Meerut). The depth wise soils samples (0-15, 15-30 and 30-45 cm) in sugarcane - wheat cropping system at five different locations was analyzed for pH, EC, organic carbon, 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 0.12 to 1.06 % at surface and sub surface soil. The available N, P and K 141 to 223, 8.1 to 42.7 and 160 to 343 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: Available N, P, K, Micro nutrients, Soil fertility, Sugarcane

INTRODUCTION

Sugarcane – wheat is a leading cropping system of the western Uttar Pradesh. Sugarcane and wheat production has been stagnating, rather decreasing sometimes, during the last decade due to loss in soil fertility, and thus aggravated greatly with the increased cost of fuel, fertilizers etc. Uttar Pradesh alone accounts for 42.47 per cent of the total area and 41.31 per cent of the total production of sugarcane in the country. Sugarcane is cultivated throughout the state except some parts of the dry west, and south-west. Here Muzaffarnagar, Meerut, Saharanpur and Bijnor- the four leading producers of sugarcane in the country account for over 17 per cent of the country's (42% of Uttar Pradesh) production of sugarcane. Sugarcane is a long duration crop with luxuriant vegetative growth which requires more amount of nutrient. Sugarcane is grown under the exhaustive cropping systems involving mainly rice and wheat 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 sugarcane wheat system is available.

RESULT AND DISCUSSION

General Properties

Soil at various depths was usually found normal to alkaline in reaction (Table-1). It was observed that soil pH ranged from 7.20 - 8.41. 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 0.542 to 0.910 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 0.12 – 1.06 % (Table 1). The organic carbon decreased with increasing depth in all the location. Considering the soils having less than 0.5 % organic carbon as low, 0.5 % to 0.75 % as medium and more than 0.75 % as high in organic carbon status. It could be attributed to differential additions of FYM and plant residues and 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).

Nutrients status and soil fertility

Available macro nutrient

The available nitrogen ranged between 141 - 223 N kg ha^{-1} (Table 2) and indicated lower range of availability of nitrogen. Available nitrogen was found to be maximum in surface soil and decrease gradually with increasing depth. This is a decreasing trend of organic carbon with depth and because cultivation of crops is mainly confined to the surface soil and only at regular interval the depleted nitrogen in supplemented by external addition of fertilizer during crop cultivation (Prasuna rani et al., 1992).

The available phosphorus varied from 8.1-42.1 P_2O_5 kgha^{-1}(Table 2). The highest available phosphorus was observed in the surface soil and decrease with increasing depth. 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.

The available potassium varied from 160-343 K_2O kg ha^{-1}(Table 2). The available potassium was higher in surface soil and it declined with increasing soil 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). Similar results were reported by Leelavathi *et al.* (2009), Sharma *et al.* (2011).

Available Micronutrients

The DTPA extractable Zn varied from 0.19-1.07 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 (Prasad and Gajbhiye 1990) and Nayak *et al.* (2000). Similar distribution pattern of micro nutrient cation was also reported by Singh *et al.* (1990) this may be ascribed to lower pH values and higher amounts of organic matter in surface.

The DTPA extractable Fe varied from 1.15-6.52 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 at surface 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 Khera and Pradhan (1980), Sharma *et al.* (2003).

The DTPA extractable Cu varied from 0.71-1.26 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 Rai and Mishra (1967) and Sharma *et al.* (2003).

The extractable Mn in soil varied from 2.31-9.61 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 several workers (Sakal *et al.* 1986; Chatterji *et al.* 1999; and Sharma *et al*. 2003.)

CONCLUSION

The chemical properties of soil under rice-wheat cropping sequences of Daurala block in Meerut district, the soil was 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. Soils were sufficient in DTPA extractable micronutrient in surface soil

Table 1. Chemical properties of Daurala block soils of district Meerut under Sugarcane –Ratton **-**Wheat cropping sequence

Locations	Depth	EC(dSm-^{1})	pH	OC (%)
Surani	0-15	0.910	7.90	1.059
	15-30	0.612	7.80	0.616
	30-45	0.811	7.90	0.320
	Mean	0.777	7.87	0.665
Machri	0-15	0.820	8.25	1.034
	15-30	0.726	8.17	0.689
	30-45	0.551	8.00	0.344
	Mean	0.699	8.14	0.689
Bafawat	0-15	0.706	8.29	0.862
	15-30	0.589	8.41	0.616
	30-45	0.542	8.20	0.271
	Mean	0.612	8.30	0.583

Alipur	0-15	0.770	7.70	0.665
	15-30	0.565	7.30	0.320
	30-45	0.550	7.20	0.123
	Mean	0.628	7.40	0.369
Dauarala	0-15	0.891	8.20	0.985
	15-30	0.769	8.20	0.616
	30-45	0.820	8.00	0.394
	Mean	0.827	8.13	0.665

Table 2. Available N, P and K (kg ha^{-1}) of Daurala block soils of district Meerut under Sugarcane –Ratton - Wheat cropping sequence

Locations	Depth	Available macronutrients(kg ha^{-1})		
		N	P	K
Surani	0-15	223	33.7	305
	15-30	205	20.4	277
	30-45	184	10.9	265
	Mean	204	21.7	282
Machri	0-15	200	18.7	246
	15-30	185	11.2	241
	30-45	166	8.1	250
	Mean	184	12.6	246
Bafawat	0-15	199	42.7	169
	15-30	160	27.6	165
	30-45	141	14.9	187
	Mean	166	28.4	174
Alipur	0-15	199	33.9	185
	15-30	173	20.9	160
	30-45	160	11.4	280
	Mean	177	22.1	208
Dauarala	0-15	215	42.9	271
	15-30	163	29.4	289
	30-45	158	13.4	343
	Mean	179	28.6	301

Table 3. Available micronutrients (mg Kg^{-1}) of Daurala block soils of district Meerut under Sugarcane –Ratton - Wheat cropping sequence

Locations	Depth	Available micronutrients (mg Kg^{-1})			
		Zn	Fe	Cu	Mn
Surani	0-15	1.07	4.53	1.16	4.95
	15-30	0.42	6.28	1.09	4.53
	30-45	0.29	6.52	1.15	3.58
	Mean	0.59	5.78	1.13	4.35

Machri	0-15	0.42	4.66	1.26	3.06
	15-30	0.34	3.81	1.22	2.83
	30-45	0.26	4.45	1.14	2.31
	Mean	0.34	4.31	1.21	2.73
Bafawat	0-15	0.75	2.04	1.01	5.84
	15-30	0.62	1.79	0.99	4.45
	30-45	0.37	1.15	0.71	2.55
	Mean	0.58	1.66	0.90	4.28
Alipur	0-15	0.37	5.77	0.95	3.48
	15-30	0.25	5.21	0.82	5.93
	30-45	0.19	3.16	0.87	9.61
	Mean	0.27	4.72	0.88	6.34
Dauarala	0-15	0.94	5.16	1.29	3.46
	15-30	0.29	2.74	0.83	7.11
	30-45	0.29	4.72	0.87	8.81
	Mean	0.51	4.21	1.00	6.46

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