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Physico-chemical Properties of Major Nutrients (N,P, K and S) and Micro nutrient (Zn) Status in Soil Profile of Mandapur Village, Badalapur Block of district Jaunpur (U.P.)

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Abstract

The representative soil profile in Mandapur village of district Jaunpur was selected for the study. At location 2-4 composite soil samples were taken from different horizons viz. 0-15 cm, 15-30 cm 30-45 and 60-90 cm segments. The soil texture ranged from sandy clay loam to loam. Amount of sand sill and clay in the soil profile varied from 49.2-32.6, 20.1-28.7 and 27.6-34.2 percent. Bulk density and particle density varied from 1.35-1.52 g cm-3 and 2.31-2.68 g.cm-3 respectively. Result revealed that soil samples were found low organic carbon, nitrogen, phosphorus sulphur and zinc and low to medium in potassium. Significant positive correlation were found to exist between organic carbon and available N,P,K,S and Zn status of soil under study. The pH, silt, clay, bulk density and particle density registered increasing trend with the depth while organic carbon and available nutrients such as N,P,K,S and Zn registered decreasing trend with the depth.

Key words: N, P, K, S, Zn, soil profile, physico-chemical properties.

Introduction

Soil is the most importance basic nutrient resource which determines the ultimate sustainability of any agricultural system [13]. Keeping all the above facts in mind the present study. No information is available on these aspects for soil profile of Mandapur block in Jaunpur district. The physic-chemical characteristics, available macro and micronutrients status in the soil profile help in determining the soil potential to supply nutrients for crop growth.

Materials and Methods The Composite Soil samples were collected from 0-15, 15-30, 30-45, and 60-90 cm depth after harvest of crop. Soil samples were prepared to determine the status of available N, P, K, S, and Zn. Soil pH and EC (electrical conductivity) in 1:2.5: Soil: water suspension. Organic carbon was estimated by standard method [15]. Available nitrogen was determined by alkaline potassium permanganate method [11]. Available phosphorus was extracted by Olsen's Method. Available potassium (Normal ammonium acetate extractable) was determined by the flame photometer and available sulphur was estimated by turbidimetrically as barium sulphate. Available zinc was estimated DTPA extracted using AAS method. The simple correlation analysis of data was computed in relation to available nutrient contents with different physico-chemical properties of the experimental soil.

Results and Discussion

Soil pH and electrical conductivity:

The data given in Table 1 related to physico - chemical characteristics and available nutriants status of soil profile exposed in Mandapur village of Badlapur block have been presented in Table1. It is evident from Table1 that soil pH of the investigated soil profile under variable depth (0-15, 15-30, 30-45, 45-60 and 60-90 cm) ranged from 7.8 – 9.1 with a mean value of 8.6. The maximum soil pH (9.1) was found at 60-90 cm depth and the minimum pH (7.8) was observed at 0-15 cm depth. Comparatively higher pH in the lower horizons may be ascribed to the high content of free calcium carbonate [1]. Table 1 shows the accumulation of soluble salts at lower depth. The electrical conductivity of soil profile ranged from 0.15-0.38dS m^{-1} with a mean value of 0.30 dS m^{-1}. The highest electrical conductivity (0.38 dS m^{-1}) was found at the depth of 0-15 cm and minimum (0.15 dSm^{-1}) in the layer of 60-90 cm depth. Table 1 shows the decreasing trend in electrical conductivity with soil depth. Most of the soil profile showed accumulation of soluble salts at lower depth [1, 2].

Texture, bulk density, particale density and porosity:

Amount of sand, silt and clay in the soil profile varied from 32.6- 49.2, 20.1-28.7 and 27.6 – 34.2 per cent respectively. The highest amount of sand (49.2 %) was recorded in the depth of 0-15 cm. The average sand content was found 40.6 per cent. The maximum amount of silt (28.7%) was found at the depth of 60-90 cm and the minimum (20.1%) in the surface layer (0-15 cm). The mean value of silt of the soil profile under study was found 23.4 per cent. The clay content in soil profile was found highest (34.2%) at the depth of 60-90 cm and lowest in top layer (0-15 cm). The mean value of clay content was 31.44 %. It is evident from Table1 that the amount of sand showed decreasing trend while silt and clay showed increasing trend with the soil depth. The bulk density of soil profile varied from 1.35-1.52 g cm^{-3} with a mean value of 1.41 g cm^{-3} the maximum bulk density (1.52 g cm^{-3}) was found in the layer of 60-90 cm and the minimum (1.35 g cm^{-3}) at the 0-15 cm depth. Bulk density of soil increased with the increase in depth of soil [9]. The particle density of soil profile varied from 2.31-2.68 g cm^{-3} with a mean value of 2.46 g cm^{-3} and registered an increasing trend with the soil depth. The maximum value of particle density (2.68 g cm^{-3}) was found at the depth of 60-90 cm and the minimum (2.31 g cm^{-3}) was found at the depth of 0-15 cm. The porosity of the soil profile ranged from 41.56-43.29 % with an mean value of 42.61 per cent. The maximum value of porosity (43.29 %) was found in the 60-90 cm layer and the minimum (41.56 %) was found at the depth of 0-15 cm. Porosity in the soil profile increased with the depth of soil.

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Organic carbon:

The data given in Table 1 shows that the organic carbon status of the soil profile ranged from 0.11- 0.36 per cent with an average value of 0.23 %. The maximum organic carbon (0.36 per cent) was found in the layer of 0-15 cm and the minimum (0.11%) was found at the depth of 60-90 cm. It is evident that there was a decreasing trend in organic carbon content with the soil depth [6].

Available nitrogen:

It is evident from Table 1 that available nitrogen status of soil profile ranged between 121.6 -230.8 kg ha^{-1} with a mean value of 190.2 kg ha-1. The maximum amount of available nitrogen (230.8 kg ha^{-1}) was found in the surface layer (0-15cm) and minimum (121.6 kg ha^{-1}) at the depth of 60-90 cm. The nitrogen content showed

a declining trend with depth [10]. Correlation coefficients between available nutrients and important soil properties of soil profile were worked out and presented in Table 2. It is evident from Table 2 that available nitrogen was negatively and non significantly correlated with pH (r = - 0.809). This might be due to increased rate of denitrification at lower pH values [13]. A significant and positive correlation (r= 0.951) was found between available nitrogen and organic carbon. This relationship was found because most of the soil nitrogen is found in organic forms. Available nitrogen was non significantly and negatively correlated (r = - 0.867) with clay.

Available phosphorus:

It was seen from Table 1 that available phosphorus of the investigated soil profile ranged from 5.1- 14.8 kg ha^{-1} with a mean value of 9.7 kg ha^{-1}. The maximum amount of available phosphorus (14.8 kg ha^{-1}) was found in 0-15 cm surface layer and the minimum (5.1 kg ha^{-1}) in 60-90 cm layer. The highest available phosphorus was observed in the surface horizons and decreased regularly with depth. Higher P in the surface horizons might be due to the confinement of crop cultivation to this layer and supplementation of the depleted

Available sulphur:

It is evident from Table 1 that the available sulphur with in soil profile ranged from 9.2 -5.4 ppm with a mean value 7.8 ppm. The maximum amount of available sulphur (9.2 ppm) was found at the depth of 0-15 cm and minimum (5.4 ppm) in the 60-90 cm layer. Status of available sulphur decreased with the depth in the soil profile under study [10]. Available sulphur recorded non-significant negative correlation (r = - 0.809) with pH. This possibly due to the presence of H+ and OH- ions on the soil complex where sulphate ions are attracted to H+ ions [5]. A significant positive correlation (r = 0.902) was found between available sulpur and organic carbon because most of the sulphur was associated with organic matter [7]. A non-significant and negative correlation was found to exist between available sulphur and clay (r = -0.759).

phosphorus through external sources i.e. fertilizers [12]. Available phosphorus registered statistically significant but negative correlation (r = - 0.926) with pH. Available phosphorus and organic carbon were found to be positively and significantly correlated (r = 0.950). A significant and negative correlation (r = - 0.984) was found between available phosphorus and clay.

Available potassium:

Table 1 shows that the available potassium of the soil profile ranged from 114.0 -10.6kg ha^{-1} . The maximum amount of available potassium (210.6 kg ha^{-1}) was found in surface layer (0-15 cm) and minimum (114.0 kg ha^{-1}) was found at the layer of 60-90 cm depth. Available potassium showed decreasing trend with the soil depth [1]. A non significant and negative correlation (r = -0.802) was found between available potassium and pH. Table 2 shows that the available potassium was significantly and positively (r = 0.930) correlated with organic carbon. This suggested the creation of favourable soil environment with presence of high organic matter [8]. A non-significant and negative correlation (r = -0.675) was found between available potassium and clay.

Available zinc:

Data related to study of soil profile presented in table 1 shows that the available zinc in different layers varied from 0.12- 0.52ppm with a mean value of 0.36 ppm. The maximum status of available zinc (0.52 ppm) was found in 0-15 cm layer and the minimum status (0.12 ppm) was found in the layer of 60-90 cm. Table 1 shows that the available zinc had a decreasing trend with the depth [14]. The relatively high available zinc in surface layer may be due to variable intensity of pedogenic process and more complexing with organic matter that provide chelating agents for complex ions of added zinc and reduces adsorption and precipitation [3] . Table 2 indicates that available zinc and pH shows non-significant negative correlation (r = - 0.863). Available zinc was significantly and positively correlated (r = 0.946) with organic carbon in investigated soil profile [4, 14].

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Table 1 Physico-chemical properties and N,P,K,S,Zn status of soil profile (Village - Mandapur, Block - Badlapur)

S. No.	Depth (cm)	pH	EC ($dS\ m^{-1}$)	Sand (%)	Silt (%)	Clay (%)	BD $g\ cm^{-3}$	PD $g\ cm^{-3}$	Porosity (%)	Organic carbon (%)	Available nutrient (kg ha^{-1})			Available nutrient (ppm)	
											N	P	K	S	Zn
1	0-15	7.8	0.38	49.2	20.1	27.6	1.35	2.31	41.56	0.36	230.8	14.8	210.6	9.2	0.52
2	15-30	8.6	0.35	42.6	21.8	30.4	1.37	2.38	42.44	0.28	218.5	12.2	198.5	8.4	0.46
3	30-45	8.7	0.34	40.2	22.3	32.2	1.40	2.44	42.63	0.24	204.0	8.2	185.0	8.1	0.36
4	45-60	8.8	0.28	38.6	24.3	32.8	1.41	2.48	43.15	0.18	176.5	8.1	172.6	8.0	0.35
5	60-90	9.1	0.15	32.6	28.7	34.2	1.52	2.68	43.29	0.11	121.6	5.1	114.0	5.4	0.12
Range		7.8 - 9.1	0.15-0.38	32.6-49.2	20.1 - 28.7	27.6-34.2	1.35-1.52	2.31-2.68	41.56-43.29	0.11-0.36	121.6-230.8	5.1-14.8	114.0-210.6	5.4-9.2	0.12-0.52
Mean		8.6	0.30	40.6	23.4	31.44	1.41	2.46	42.61	0.23	190.28	9.7	176.14	7.8	0.36

Table 2 Correlation coefficient (r values) of pH, organic carbon and clay with available nutrients (Soil profile)

Soil properties	Available nutrients				
	N	P	K	S	Zn
pH	-0.809	-0.926*	-0.802	-0.809	-0.863
Organic carbon	0.951*	0.950*	0.930*	0.902*	0.946*
Clay	-0.867	-0.984**	-0.675	-0.759	-0.818

Available zinc recorded non-significant and negative correlation with clay (r = - 0.818).

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