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RESEARCH ARTICLE

MICRONUTRIENT STATUS AND PHYSICAL PROPERTIES OF SOILS OF BAIRIA BLOCK OF DISTRICT BALLIA, UTTAR PRADESH

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ABSTRACT

An investigation was carried out for characterization of soils of Bairia Block of Ballia district, (U.P.) India. Depth wise soil samples were collected from two selected village and in this respect a soil profile was opened in each village. Soil samples were collected from 0-15, 15-30, 30-45, 45-60, 60-75, 75-90, 90-105, 105-120, 120-135 and 135-160 cm soil depth. Standard method was followed for analysis of physico-chemical parameter of soil. Results revealed that bulk density of soil found be1.26 to 1.48 Mg m^{-3} and water holding capacity contained 19.34 to 36.37 %. Micronutrients Fe, Cu, Zn and Mn content in soil from (0.93-7.09 mg kg^{-1}), (9.02-2.72 mg kg^{-1}), (0.80-0.03 mg kg^{-1}) and (0.80-0.30 mg kg^{-1}) rang respectively. Soil texture was found to be loamy sand to silty loam.

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INTRODUCTION

Micronutrients are essential elements that are used by plants in small quantities. Yield and quality of agricultural products increased with micronutrients application, therefore human and animal health is protected with feed of enrichment plant materials. Each essential element only when can perform its role in plant nutrition properly that other necessary elements are available in balanced ratios for plant. Divalent manganese ions (Mn^{2+}) is converted to Mn^{3+} or Mn^{4+} easily, therefore in the plant manganese plays an important role on oxidation and reduction processes, as electron transport in photosynthesis. Crops quality and quantity decreased due to manganese deficiency, and this is due to low fertility of pollen and low in carbohydrates during grain filling. Zinc uptake of soil solution in divalent cations form (Zn^{2+}) In calcareous soils with high pH zinc uptake may be a valence ion form. Iron in the soil is the fourth abundant element on earth, but its amount was low or not available for the plants and microorganisms needs, due to low solubility of minerals containing iron in many places the world, especially in arid region with alkaline soils (Tavakoli *et al.* 2014). Bulk density directly measures compaction, and generally does not vary with other soil properties because it is most often expressed on a dry soil basis.

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Soil strength measures soil compaction indirectly. Soil compaction may affect several physical and biological processes. Physical impedance of roots may limit plant access to water and nutrients by reducing the volume of soil exploited. Compaction may destroy soil structural units and change pore distribution, thereby slowing water infiltration and gaseous diffusion (Taylor and Brar 1991, Orr 1960). Water holding capacity can be defined as the amount of water the soil can hold for the use of plants root for certain period of time (Yusuf, 2011). Organic matter has a high affinity for moisture. The addition of organic matter to the soil usually increases the water holding capacity of soil due to addition of organic matter increases the number of micro-pores and macro-pores in the soil by gluing soil particles together or by creating favourable living conditions for soil organisms. Certain types of soil organic matter can hold up 20 times their weight in water (Reicosky, 2005).The relative proportion of different soil particles i.e. sand, clay and silt is known as soil texture. It affects the properties of soil including its water supplying power, rate of water infiltration, aeration, soil fertility, ease of tillage and susceptibility to erosion. Sandy soils are porous, have high infiltration rates, and retain little water, but clays have low infiltration rates, retain much water and may be poorly drained. Aeration is good in sandy soils but poor in clays. Roots penetrate sand more easily than clays. The fine and medium textural soils, such as the loam, clay loam, sandy clay loam, silt clay loam and sandy silt loams are generally more desirable because of their superior retention of nutrients and water (White, 1987, Singh *et.al.*2019).

MATERIALS AND METHODS

Location and climatic condition: Ballia district, the eastern part of the state of Uttar Pradesh is situated in central portion of the Ganges basin. The geographical extent of the district lies between latitude from 25°23" to 26°11" north and at longitudes from 83°38" to 84°39" east with elevation of about 27 to 115 meter above the sea level. The mean annual rainfall ranges from 950 to 1150 mm.

Study area: The area truly represents the agronomical conditions of north east alluvial plains. The average temperature in Ballia is 26.0 °C. The largest rainfall in 24 hours recorded at any station in the district was 32.0 mm. The relative humidity is generally high during the south west monsoon, being 70%. The average annual wind speed is about 4.0 km. per hour, and maximum being 7.2 km. per hour in May and the minimum 1.6 km. per hour in November month.
Soil samples were air dried in shade and powdered gently with a wooden mallet and passed through 2 mm sieve. Moisture content was determined following Michael (1984). Bulk density was determined by....... .Soil texture (sand, silt and clay %) determined by Hydrometer method (Bouyoucos, 1962). Micronutrients namely Zn, Cu, Fe and Mn were determined on atomic absorption spectrophotometer as outlined by Lindsay and Norvell (1978).

RESULTS AND DISCUSSION

Bulk density: The bulk density data of both pedon of Bairia block presented in table-1 which ranged from 1.26 to 1.48 Mg m^{-3}. Pedon-1 showed 1.26 Mg m^{-3} at 0-15 cm whereas it was 1.48 at 135-160 cm soil depth. Bulk density of pedon -2 varied between 1.28 to 1.44 Mg m^{-3}. The increase in bulk density from upper to lower horizons of both pedon might be due to translocation of clay and other minerals develop the compaction (Mandal and Sharma, 2011). So that soil and water alteration interface to the soil physical condition favourable for soil aeration pathway.

Water Holding Capacity: Depth wise water holding capacity of soil was measured by the depth wise soil for both pedon presented in table-2 which ranged from 19.34 to 36.37 % of both pedon. The pedon-1recorded 34.14 % (0-15 cm) to 20.47 % (135-160 cm) and pedon-2 36.37 % (0-15 cm) to 19.34 % (135-160 cm). The valve of water holding capacity was decreased with increasing soil depth in both pedon might be due to organic matter content and some other physical factors in the both pedon.

Soil texture: The value of sand silt and clay percentage of both pedon presented in table-1. The percentage of sand, silt and clay varied pedon-1 sand 35 to 57 %, silt 23 to 36 % and clay 18 to 25 % and pedon-2 resulted sand 37 to 52 %, silt 38 to 30 % and clay 16 to 26 % respectively, according to textural class of these soils was found to be loamy sand to silty loam (Pandey and Girish, 2007). Irrespective of the land use systems soil texture was finer in the sub-surface horizons than in the surface horizons and this might be due to the pedogenic activities viz., clay illuviation.

Micronutrients status

DTPA extractable Fe: Data presented in table–2 revealed that DTPA extractable Fe in soil showed variation throughout the profile depth without any definite trend in both the pedons. However, available Fe content was found maximum 7.09 mg kg^{-1} in 30-45 cm and minimum 1.01 mg kg^{-1} in 120-135 cm irregularly with different soil depth at soil pedon-1 might be possible due to accumulation of natural vegetation residues and organic materials. Although the lowest Fe content was measured 0.91 mg kg^{-1} in 75-90 cm and 4.23 mg kg^{-1} in 135-160 cm soil depth (Lindsay and Norvell, 1978).

Table.1 Status of Bulk Density, soil Water Holding Capacity (WHC) and soil texture (sand, silt and clay) of soil in different depth in two village of Bairia Block soil

Depth (cm)	Sripalpura					Tiwarike Milkee				
	B.D. (Mg m^{-3})	WHC (%)	Sand (%)	Silt (%)	Clay (%)	B.D. (Mg m^{-3})	WHC (%)	Sand (%)	Silt (%)	Clay (%)
0-15	1.26	34.14	35	36	25	1.28	36.37	37	33	26
15-30	1.29	35.02	36	37	24	1.29	35.79	38	36	23
30-45	1.31	31.95	36	35	25	1.31	34.54	39	35	24
45-60	1.33	29.96	38	36	25	1.34	33.02	39	37	24
60-75	1.35	26.78	40	33	25	1.37	29.75	42	36	21
75-90	1.38	22.43	43	32	23	1.38	24.12	43	38	16
90-105	1.39	22.01	45	30	22	1.40	22.26	44	37	18
105-120	1.42	21.30	51	28	19	1.42	20.29	46	33	19
120-135	1.47	19.69	53	26	19	1.44	19.38	51	30	16
135-160	1.48	20.47	57	23	18	1.44	19.34	52	30	16

Table 2. Status of available (DTPA Extractable) Fe, Cu, Zn and Mn (mg kg^{-1}) in soil at different soils depth

Depth(cm)	Sripalpur				TiwarikeMilki			
	Fe	Cu	Zn	Mn	Fe	Cu	Zn	Mn
0-15	1.31	5.12	0.75	7.05	2.57	6.46	0.80	7.15
15-30	1.95	4.16	0.61	5.96	3.03	5.23	0.53	7.01
30-45	7.09	3.10	0.53	5.61	1.89	5.39	0.49	5.84
45-60	4.51	9.02	0.49	5.34	1.71	7.69	0.47	4.86
60-75	2.63	7.69	0.42	4.83	1.03	8.97	0.45	4.41
75-90	2.29	3.20	0.39	4.26	0.91	6.62	0.44	3.45
90-105	1.09	2.88	0.35	3.64	1.03	4.06	0.41	3.33
105-120	1.49	2.72	0.33	3.51	1.71	5.82	0.39	3.22
120-135	1.01	3.15	0.31	2.66	1.14	7.85	0.35	3.16
135-160	1.43	3.17	0.30	2.35	4.23	3.84	0.31	2.88

DTPA extractable Cu: The amount of DTPA extractable Cu data presented in table-2. The amount of DTPA extractable Cu in different soil depth showed 9.02 to2.72 mg kg^{-1} both pedon. Pedon-1 maximum 9.02 mg kg^{-1} in the 45-60 cm depth and minimum 2.72 mg kg^{-1} in 105-120 cm depth and pedon-2 showed maximum 8.97 mg kg^{-1} in 60-75 cm and minimum 3.84 mg kg^{-1} in 135-160 cm depth. The amount of DTPA extractable Cu was not followed any definite trend with depth in the both pedons (Bhaskar *et al*. 2004).

DTPA extractable Zn: The data regarding DTPA extractable Zn in table-2. The DTPA extractable Zn in different soil depth showed vairation 0.80 to 0.30 mg kg^{-1} throughout the both depth. Pedon-1 maximum 0.75 mg kg^{-1} at 0-15 cm and minimum 0.30 mg kg^{-1} at 135-160 cm depth and pedon-2 showed maximum 0.80 mg kg^{-1} at 0-15 cm and minimum 0.31 mg kg^{-1} at 135-160 cm depth. The amount of DTPA extractable Zn was increased with increasing depth in the both pedons. The similar results were given by Kannan and Mathan (1994).

DTPA extractable Mn: The data presented (table-2) revealed that DTPA extractable Mn at different soil depth showed variation 7.15 to 2.35 mg kg^{-1} throughout the depth. The DTPA extractable Mn in pedon-1 exhibited maximum 7.05 mg kg^{-1} at 0-15 cm and minimum 2.35 mg kg^{-1} at 135-160 cm depth and pedon-2 showed maximum 7.15 mg kg^{-1} at 0-15 cm and minimum 2.88 mg kg^{-1} at 135-160 cm depth. The amount of DTPA extractable Mn was decreased with increasing soil depth in the both pedons. Similar finding are given by singh*et al.* (2014).

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