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Characterization of rice growing soils of Reowti block of Ballia district U.P.

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Abstract

A depth wise soil study was carried out in three villages namely; Trikalpur, Bishunpura and Naina of Reoti Block of Ballia district Uttar Pradesh. Depth wise soilproperties of pedon 1 (Trikalpur), pedon 2 (Bishunpura) and pedon 3(Naina) land was suitable for possible crops cultivation. Soil pH of all pedons as depth wise seen increasing range towords alkaline from upper soil (0-15 cm) to the lower depth (120-150 cm) in all pedons, its range from 7.3 to 8.2. But their was not substantial difference in EC of soils, bulk density of pedon 1 was lower than other pedon, due to decreasing in organic carbon leads to increase the mineral contents. The grater amount of organic carbon, available N,P,K, and S was found in at 0-15 cm depth, there after decreasing with increasing depth of all pedon. Variation in other soil properties such as soil pH, EC, bulk density, water holding capacity, soil texture, calcium carbonate, exchangeable Ca^{++} and Mg^{++} and DTPA extractable Fe, Cu, Zn and Mn was also observec in scatterd pattern in all profile. Thus no clear horizons development in selected village pedon showed very shallow soil depth because all pedon have observed sand layer at 120-150 cm depth.

Introduction

The capability of land and soil to produce crops is limited and the limits to produce crops are set by soil, climate and landform. However, land capability and their limitation are depending on agro-ecological set-up which has managed to them (FAO, 1993a). Despite the significant growth in production, the sustainability of some cropping systems has been showing signs of fatigue. Therefore, comprehensive account of our land resource and ascertain its potential and problems towards optimizing land use on sustainable basis is necessary. In the recent past, productivity and fertility of agricultural soils are worldwide in general decline. A soil characteristic in relation to evaluation of soil fertility of area is important aspect in context to sustainable agriculture production. Because of imbalance and inadequate fertilizer use coupled with low efficiency of other inputs. The efficiency of chemical fertilizers for nutrients has decline tremendously in intensive agriculture in recent years. Soil quality mainly depends on the response of soil to different land use systems and management practices, which may often modify the soil properties and hence the soil productivity. Chemical properties viz., soil organic carbon content and cation exchange capacity have been reported to be comparatively more in the soils under grassland than under cultivated land use system (Singh and Agrawal, 2003). Effect of land use system on soil properties provides an opportunity to evaluate sustainability of land use system and thus the basic process of soil degradation in relation to land use, and hence the soil and crop management must be given high research priority (Walia *et al*. 1998). However, the information on effect of land use system on soil quality to given recommendations for optional and sustainable utilization of land resources is scanty. However information on distribution of soil properties in recent alluvium is meager and hence, the present investigation was undertaken in depth wise pedon study in three villages of Rewati Block of Ballia district.

Materials and methods

A depth wise soil study carried out in three villages namely; Trikalpur, Bishunpura and Naina of Reoti Block of Ballia district Uttar Pradesh. Depth wise soilproperties of pedon 1 (Trikalpur), pedon 2 (Bishunpura) and pedon 3 (Naina) land was suitable for possible crops cultivation.

Location and climatic condition-Ballia district lies between the parallel of $25^0$33' and $26^0$11' N latitude and 83^0 38'and 84^0.39'E longitude and 213.2 feet above the mean sea level. The mean annual rainfall ranges from 950 – 1150 mm. Reoti Block lies at 84^0 38' longitude and $25^0$85' latitude, with an elevation of 206.6 feet, above the mean sea level. The area truly represents the agronomical conditions of north east alluvial plains. The largest rainfall in 24 hours recorded at any station in the district was 32.0 mm. The average maximum (47.5^{0}C) and minimum (1.6^{0}C) temperature have been recorded in the months of June and January respectively. The relative humidity is generally high during the south west mansoon, being 70%. The relative humidity then starts decreasing the driest part of the afternoon is less than 30%. 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.

Selection of site- Soil samples were collected from rainfed area of Reoti Block from the field of well cultivated area. Sampling sites were carefully chosen taking into consideration the ground cover, micro relief, degree of erosion, surface drainage, proximity to tress and all other factors likely to affect the soil in comparison with the normal type. Soil samples were collected from three villages namely; Trikalpur, Bishunpura and Naina away from Reoti Block 5.1 km, 2.2 km, 4.1 km, respectively from Reoti Block. It is located 23 km, 41 km and 26 km towards east from S.M.M. Town P.G. College, Ballia.

Collection of Soil Sample-Soil samples were collected in October 2016 when there were no crops standing in field and no rainfall occurred past 12- 24 hours. Before the collection of samples 3 suitable spot (landing station) were digger pedon in the three village (Trikalpur, Bishunpura and Naina) to collect the soil samples sampling made from 0-15, 15-30, 30-45,45-60, 60-90, 90-120 and 120-150 cm depths. About 2 kg of soil from each depths weretake in polythene bags separately. Soil samples were collected by the help of khurpi, scale and bucket. After well processed soil samples were ready to analysis of targeted possible parameters in laboratory.

Preparation of Soil samples -About 500 g per pedon and each depth of fresh soil samples were separately processed and air dried, powdered and sieved through 2 mm sieve and stored separately in plastic bag for physico–chemical analysis. The collected soil samples from all three pedon were analyses for soil pH, EC, Bulk density, WHC, (sand, silt, clay%), Organic carbon, available N, P, K, and S, exchangeable Ca^{++} and Mg^{++}, $CaCO_3$ %, available Fe, Cu, Zn, and Mn by using standard method described by different authors.

Physico–chemical analysis of samples - The collected soil samples were analyses for soil pH, EC, soil moisture content, bulk density and soil texture by method suggested by Kanwar and Chopra (2005),Calcium carbonate was determine by by rapid titration method (Puri,1930). Available nitrogen (N was determined by alkaline postassium permanganate method (Subbiah and Asija, 1956). Available phosphorus (P) was estimated by using Olsen's *et al.* (1954) method. Available potassium (K) Ammonium acetate exratable method described by Muhr *et al*. (1965) was used. Calcium and Magnesium (Ca^{++} and Mg^{++}). Preparation of HCl extract A.E.A. (1931) Titrate against 0.01N EDTA solution till the disappearance of the red colour and calculate the Ca^{++} + Mg^{++}. The amount of exchangeable Mg was found out substation from the value of exchangeable Ca^{++} + Mg^{++} described by Jackson (1973). Analysis of micronutrients Fe, Cu, Zn, Mn (mg/kg) by AAS (Atomic absorption spectrophotometer) Lindsay and Norwell (1978).

Results and discussions

Soil pH

The soil pH (table-1) was ranged from 7.0 to 8.2 of all pedons. The increasing range of pH towords alkaline from upper soil (0-15 cm) to the lower (120-150 cm) were found in all village pedon. Pedon 1 was showed 7.3 pH at 0-15 cm there after increasing 7.8 at 120-150 cm soil, pedon 2 was showed 7.3 pH at 0-15 cm there after increasing 8.0 at 120-150 cm soil and pedon 3 was showed increasing from 7.6 at 0-15 cm and it was increasing with depth 8.2 pH at 120-150 cm.

Fig.1 Soil pedon 1 of Village Trikalpur

Fig.2 Soil pedon 2 of village Bishunpura

Fig.3 soil pedon 3 of village Naina

Fig.4 Sand layer at 95 cm in pedon of village Naina

The lower pH range at upper layer of pedons due to presence of organic matter and their higher activity of hydroxyl aluminum at higher pH, eventually resulted in higher P adsorption (Tarfdar, 2008). The higher biological activities might be responsible for decreased pH range on surface soil, the value showed in increase with increasing in the depth of soil which is attributed to determine of neutral soluble salt (Abrol, 1998). The marked difference of pH value at pedon 2 and 3 was due to both season crop rising and using imbalance chemical fertilizer and pesticides.

Table.1 Status of soil pH and EC and water holding capacity (WHC) of soil at different depth of Reoti Block soil

Depth (cm)	Trikalpur (P1)			Bishunpura (P2)			Naina (P3)		
	pH	EC (dSm^{-1})	WHC (%)	pH	EC (dSm^{-1})	WHC (%)	pH	EC (dSm^{-1})	WHC (%)
0-15	7.3	1.011	38.25	7.6	1.016	36.33	7.6	1.015	31.10
15-30	7.6	1.011	34.33	7.9	1.014	35.12	7.9	1.014	30.00
30-45	7.0	1.014	29.96	8.1	1.015	34.83	7.8	1.016	28.17
45-60	7.8	1.011	22.41	8.1	1.016	34.01	8.0	1.016	26.77
60-90	7.8	1.012	22.01	8.0	1.016	28.12	8.2	1.016	21.30
90-120	7.8	1.112	20.47	8.0	1.017	25.13	8.2	1.017	19.11
120-150	7.8	1.011	19.20	8.0	1.016	24.00	8.2	1.017	19.00

Electrical conductivity - EC (table 1) of soil samples were ranged from 1.014 dSm^{-1} indicated not wide variation between the three pedons. Pedon 1 relative lower EC (1.011 dSm^{-1}) values in surface layer as compared to sub surface (30-45 cm) soil 1.014 dSm^{-1} and (120-150 cm) soil 1.011 were observed. Difference at pedon 2 and pedon 3 which may be ascribed to the lateral movement of water from the construction of earthen band on ground (Marti and Badia*,* 1995).

Bulk density - Bulk density (table-3) was varied between 1.05 to 1.50 Mg m^{-3} among the pedon 1, pedon 2 and pedon 3 respectively. The increased bulk density was observed at pedon 1 with 90-120 cm depth, 1.36 Mg m^{-3}, pedon 2 at with 0-15 cm depth, 1.42 Mg m^{-3} and pedon 3 at with 120-150 cm depth, 1.50 Mg m^{-3} and low value was at pedon 2 with 1.05 Mg m^{-3} in 45-60 cm depth. Values are varied from 1.05 to 1.50 Mg m^{-3} with a small variation among three pedons and horizons. The increase in bulk density from upper to lower horizons of all pedon due to translocation of clay and other minerals develop the compaction (Sharma *et al.* 1988) similar results have been reported by Sinha and Ghildyal (1982). Soil and water alteration interface to the soil physical conditions favourable for soil aeration pathway. The slight variation on increased bulk density of pedon 3 due to cultivation practices might be leads to soil compaction, use of imbalance fertilizer and very less use organic manure, the similar finding was given by Rao *et al.*1997.

Water Holding Capacity- Values ranged varied from 19 % on 120-150 cm depth to 38.25% (table-1) on surface horizon, decreased in horizon depth at all pedon. The pedon 1 was showed 19.20% on 0-15 cm depth to 38.25% on 120-150 cm lower horizon, pedon 2 was showed 24.0% on 0-15 cm to 36.33% and pedon 3 was showed 19% on 0-15 cm depth to 31.33% on 120-150 cm lower horizon. There was great difference of water holding capacity in Reoti Block soil among the all three pedon.

Soil Texture

Soil texture decreased with increase in horizons depth at all pedon. Soil properties with range and mean values are presented in table-2. The percentage of sand, silt and clay in different soil profile varied from pedon 1 was 35 to 45.8%, 32 to 40.2% and 15.2 to 28.5% pedon 2 38.4 to 43.3%, 40.2 to 42.3% and 15.2 to 21.4% and pedon 3 36 to 60.6%, 29.4 to 42.4% and 10 to 25% respectively, according to the textural class of these soils varied from loamy sand to clay 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 viz., clay illuviation.

Table.2 Status of mechanical composition ((%) pedon in different depth

Depth (cm)	Trikalpur (P1)			Bishunpura (P2)			Naina (P3)		
	Sand	Silt	Clay	Sand	Silt	Clay	Sand	Silt	Clay
0-15	35	32	27	38.4	40.2	21.4	35.8	42.4	21.8
15-30	35.8	40.2	24	40.8	40.2	19	36	42	22
30-45	36.5	35	28.5	40	41	19	39	41	20
45-60	38.4	37.2	24.4	42.6	41.3	16.1	39.1	41	19.9
60-90	42	35	23	43.3	38.7	18	40	35	25
90-120	40.1	39	20.9	40.8	42.3	18.9	52.6	37	10.4
120-150	45.8	39	15.2	44.1	40.7	15.2	60.6	29.4	10

Organic carbon

At different depth of soil (table 3) pedon decreasing with increasing soil depth. Reoti Block soil showed maximum organic carbon content 0.84% at 0-15 cm pedon 2 to 0.03% at 30-45 cm depth of horizons depth in pedon 1 (Singh and Agrawal, 2005), although the lowest organic carbon content was fairly greaten in all profile up to 0-30 cm horizons depth due to greater organic substances accumulation was observed on the surface of pedon 2 and it was gradual decreased with depth and elevation of pedon the similar findings was given by Sahu an Bala (1995). The pedon 1 located fallow cultivated land area and there surface accumulation, rapid decomposition (Swaby, 1966). The pedon 2 was crop land and growing to all types of crops with balance application of fertilizer and pedon 3 was all crop growing land. Its might be low microbial activities differences in organic carbon content of the soil and high rate of possible CO_2, evolution leads to low organic carbon, similar finding were given Sharma *et al.*(1996) and Singh *et al.* 2014. In pedon 1 and pedon 3 might be attributed to smaller amount of crop reisude than the high accumulation in pedon 2 removed of the surface soil containing high organic carbon due to erosion leads to responsible for the lower organic carbon content might be surface soil of pedon 1ogranic carbon content ranged between 0.44 to 0.20% and profile 3 organic carbon ranged between 0.38 to 0.29% with higher value in Reoti Block pedon followed by grassland and higher organic carbon than others irrespective of land uses on between the location.

Table.3 Status of organic carbon (%), $CaCO_3$ (%) and Bulk density (Mgm^{-1}) in different depths of Reoti Block soil

Depth (cm)	Trikalpur (P1)			Bishunpura (P2)			Naina (P3)		
	O.C.	$CaCO_3$	Bd	O.C.	$CaCO_3$	Bd	O.C.	$CaCO_3$	Bd
0-15	0.44	1.02	1.34	0.84	1.87	1.42	0.38	1.70	1.34
15-30	0.46	0.97	1.33	0.50	1.60	1.33	0.36	1.35	1.33
30-45	0.13	2.52	1.25	0.44	1.35	1.29	0.15	2.22	1.33
45-60	0.12	1.70	1.26	0.44	1.37	1.05	0.17	1.77	1.33
60-90	0.11	2.05	1.32	0.42	2.32	1.21	0.30	2.10	1.29
90-120	0.27	0.90	1.36	0.16	2.27	1.25	0.33	1.15	1.26
120-150	0.20	0.95	1.34	0.13	3.80	1.29	0.29	3.50	1.50

O.C.-Organic Carbon, Bd-Bulk density

Calcium carbonate

Irrespective of the land use system, the extent of calcium carbonate in horizons was measured at pedon 1, 2 and pedon 3. The small variation was found in amount $CaCO_3$ (table-3) in all pedon. Content in soil of all pedon depth were showed decreasing ranged from 3.80 to 0.95% throughout the depth. However, $CaCO_3$ content was found maximum (3.80 %) in lower horizon (120-150 cm) and decreased regularly with soil depth at pedon 2. Pedon 3 was showed 3.50% on 120-150 cm depth to 1.15% on sub-surface horizons (90-120 cm) and pedon 1 was 2.52% on 30-45 cm to 0.95% on lower surface horizons. There was great different of calcium carbonate in Reoti Block soil among the pedon.

Available nitrogen (N)

The three pedon depth were showed decreasing ranged from 335.5 to 128.6 kg/ha throughout the depth. However, content was found maximum (335.5 kg/ha) in surface horizons (0-15 cm) and decreased regularly with soil depth at pedon 2 possible due to the accumulation of natural vegetation residues and organic materials. It might be there where more microbial transformation due to moisture content similar finding was given by Prasuna Rani *et al*. (1992). The pedon 1 soil was ranged from 285.3 to 180.1 kg/ha of surface (0-15 cm) horizons to lower depth (120-150 cm). Pedon 3 was showed value 288.5 to 148.2 kg/ha from surface (0-15 cm) horizons to lower depth (120-150 cm) horizons. Its might be due to continuous application of imbalanced chemical fertilizer and cultural practices extent of increased available N status, partial decomposition of crop residues and similarly buildup of available N and P with combined use of inorganic and organice sources of fertilizer (Bhandari *et al*.,1992, Das *et al.* 1997). The pedon 1 was showed low extent of available nitrogen content become location of waterlogged body and summerged with 2-3 weeks. During that period it becomes huge surface accumulation of plant and animal residues, decomposition and transformation by microorganisms (Indoria *et al.* 2016).

Available phosphorus (P)

Irrespective of the land use system the extent in horizons depth of available phosphorus was appeard small variation in amount of available phosphorus (table-4). The pedon 2 showed greater amount (19.45 kg/ha) in 0-15 cm depth and it was decreased with increasing horizon depth up to 120-150 cm of 9.45 kg/ha (Rajeswar and Khan, 2007). The similar pattern was found in pedon 1 of 15.58 kg/ha showed indifferent land use system. So, that in 0-15 cm horizons depth is no application of phosphorus might have increased the phosphorus fixation capacity of soil in current land use system (Das *et al*.1993) with respect of phosphorus fixation capacity of soil. The variation trend was similar of pedon 1, 2 and pedon 3, impact the pedon 2 horizons showed higher value of available phosphorus in all soil pedon and land use system. Because of pedon 1 and pedon 3 located fallow grass land there where water submergence of 2-3 weeks having decomposition of huge amount of organic materials to decomposition by microbes, it might be solubilise by phosphate sloubilizer. However, grater available phosphorus was observed in the surface horizons and decreased regularly with depth. Greater available phosphorus in the surface horizons might be due to supplementation of the depleted phosphorus through external sources and land use system i.e. fertilizers. (Thangaswamy *et al.* 2005).

Table.4 Status of available N (kg/ha), P (kg/ha) and K (kg/ha) in different depth of Reoti Block soil

Depth (cm)	Trikalpur (P1)			Bishunpura (P2)			Naina (P3)		
	N	P	K	N	P	K	N	P	K
0-15	285.3	15.58	347	335.5	19.45	369.6	288.5	18.80	257.6
15-30	266.5	15.44	347.2	279	17.26	313.6	272.8	18.20	280
30-45	219.5	14.20	336	163	15.32	291.2	203.8	16.50	324
45-60	219.5	14.01	324	150.1	13.46	280	163	14.60	280
60-90	181.8	13.89	268	136.8	10.89	257	235.2	13.23	369
90-120	213.2	10.81	258	134.2	9.89	224	169.4	10.40	291
120-150	180.1	10.31	360.	128.6	9.45	246	148.2	9.90	246.4

Available potassium (K)

The all profiles depths (table-4) was showed values of vailable K decreased with increase in horizons depth in all three pedons. The pedon 2 was measured 246 kg/ha on 120-150 cm depth to 369.6 kg/ha on surface horizon, pedon 3 was 246.4 kg/ha on 120-150 cm depth to 257.6 on surface horizons (0-15 cm) and pedon 1 was 250 kg/ha on 120-150 cm to 347 kg/ha on surface horizons. There was much more difference of content in Reoti Block soil between the all pedon. Applicatoin of potassium fertilizer in pedon 1 and pedon 3 land use system upward translocation of K from lower depth along capillary rise of ground water (Pal and Mukhopadhay, 1992). Available potassium content decreased from lower horizon to upper horizon in pedon 1 and pedon 3 land use system was 246.2 to 347 kg/ha than pedon 2 land use system it might be due to greater removal by crops than annual addition and pedogenic process such as alluvial of parent materials. The variation in amounts of available potassium was influenced by enrichment of organic substances on the soil during the submergence of water 2-3 week at pedon than the other pedon 1 and pedon 3 of land use system; it might be fixed in soil with increasing decomposable products.

Available sulphur (SO_4) -Content in surface soil (0-15) to subsurface (120-150 cm) horizons depth (table 5) of pedon 1 was showed 12 to 8.60 mg/kg and soil pedon 2 of 13.05 to 7 mg/kg and pedon 3 was seen 12.21 to 9.45 mg/kg respectively. Greater amount of available sulphur was found in surface soil than in sub surface soil resulted from its recycling over the years by plant and subsequent organic matter accumulation (Bhatnagar *et al.* 2003). So, that available sulphur content declined with increase in depth at sub-surface in fact soil organic matter was regulates markedly variation on the content of suphate-S in alluvial soil. The similar finding was given by Trivedi *et al.* (1998). Negligible use of organic materials in these soils, several soil factors influence the availability of sulphur and hence the status of different forms of sulphur in soil varied widely with type (Balangoudar and Satyanarayana, 1990).

Table.5 Status ofavailable sulphur (mg/kg) and exchangeable Ca^{++} and Mg^{++} content [cmol (p^+) kg^{-1}] in different depth of Reoti Block soil

Depth (cm)	Trikalpur (P1)			Bishunpura (P2)			Naina (P3)		
	S	Ca	Mg	S	Ca	Mg	S	Ca	Mg
0-15	12.80	11.9	9.3	13.05	12.2	8.4	12.21	10.5	7.5
15-30	12.0	11.6	7.5	11.60	11.6	7.4	11.33	9.8	7.7
30-45	11.21	10.4	7.2	10.63	10.3	6.9	11.32	9.4	6.8
45-60	10.46	10.2	6.8	10.0	9.2	6.7	10.66	9.2	6.7
60-90	9.31	9.9	6.7	8.24	9.0	6.2	10.01	9.0	6.3
90-120	9.01	9.1	6.4	7.32	8.8	6.0	9.23	8.6	5.8
120-150	8.60	8.4	6.0	7.0	8.2	5.8	9.45	8.0	5.1

Exchangeable Ca^{++}- The lower horizons (table-5) of all pedon were observed increased exchangeable Ca^{++} than upper horizon. Values in surface soil of 0-15 to 120-150 cm horizons depth of at pedon 2 was 13.05 to 7.0 [cmol (p^+) kg^{-1}] similarly, pedon 1 was showed 12.8 to 8.6 [cmol (p^+) kg^{-1}] and pedon 3 of 12.21 to 9.4 [cmol (p^+) kg^{-1}] from 0-15 and 120-150 cm depth respectively. The magnitude of calcium levels of Reoti Block soil in pedon 3 of might be greater due to submerged soil have high clay content regarding their depth. In fact that pedon 2 value might be associated with clay, phosphorus and carbon to develop hardness and compactness of soil. (Diwakar and Singh, 1993). Soil showed higher proportion of Ca than relatively plain area might be due to eutrophication and run off from crop land area and excess flooding (Singh and Agrawal, 2005).

Exchangeable Mg^{++} - Exchangeable Mg^{++} [cmol (p^+) kg^{-1}] at different depth (table 5) of soil profile was appeared decreasing with increasing soil depth. Reoti Block soil showed maximum content exchangeable magnesium 9.3 [cmol (p^+) kg^{-1})] at 0-15 cm in pedon 1 to 5.0 at 120-150 cm depth of horizons depth in pedon 3. The pedon 1 was measured 9.3 [cmol (p^+) kg^{-1}] on 0-15 cm depth to 6.0 [cmol (p^+) kg^{-1}] on lower surface horizon, pedon 2 8.4 [cmol (p^+) kg^{-1}] at 0-15 cm depth to 5.8 (mg/kg) on 120-150 cm lower depth horizons and pedon 3 measured 7.5 to 5.1 [cmol (p^+) kg^{-1}]. Values in the waterlogged soil area were lesser than that of double cropping area such as pedon 1 due to recycling in rhizosphere (Tiwari and Mishra, 1990).

Micronutrients-DTPA extractable Fe- different soil depths (table-6) of pedons were showed decreasing ranged from 1.19 to 8.9 mg/kg throughout the all depth. However, available Fe content was found maximum (8.9 mg/kg) in surface horizons (0-15 cm) there after decreased regularly with soil depth at pedon 1. The lowest Fe content was measured 1.19 mg/kg at pedon 2 with 60-90 cm depth. Iron (Fe) content was fairly grater in pedon up to upper surface at 0-15 cm horizons depth due to greater Fe substances accumulation was observed on the surface of pedon 1 and it was gradual decreased with depth and elevation of pedon the similar finding was given by Tiwari and Mishra (1990).

Table.6 Status of DTPA extractable Fe, Cu, Zn and Mn (mg/kg) in different depth of Reoti Block soil

Depth (cm)	Trikalpur (P1)				Bishunpura (P2)				Naina (P3)			
	Fe	Cu	Zn	Mn	Fe	Cu	Zn	Mn	Fe	Cu	Zn	Mn
0-15	8.91	0.481	0.79	2.91	8.7	0.39	0.83	4.5	7.8	0.36	0.80	4.47
15-30	4.86	0.340	0.74	1.37	3.6	0.38	0.74	4.2	4.3	0.35	0.72	3.80
30-45	4.54	0.323	0.64	3.06	1.6	0.38	0.64	4.1	2.8	0.28	0.70	3.58
45-60	4.33	0.290	0.54	3.16	1.9	0.35	0.58	3.3	2.6	0.27	0.64	3.49
60-90	4.16	0.201	0.50	4.40	1.1	0.28	0.50	3.0	2.1	0.25	0.54	2.80
90-120	3.21	0.195	0.48	4.01	2.7	0.24	0.49	2.8	2.1	0.19	0.51	1.86
120-150	2.66	0.172	0.46	5.40	2.6	0.17	0.44	2.4	2.1	0.11	0.43	1.65

DTPA extractable Cu- Different soil depth were showed decreasing range (table-6) from 0.119 to 0.481 mg/kg throughout the depth, However, value was found maximum (0.481 mg/kg) in surface horizons (0-15 cm) and decreased regularly with soil depth at pedon 1, although the lowest value was measured 0.119 mg/kg at pedon 3 with 120-150 cm. The pedon 2 was measured 0.179 mg/kg on 120-150 cm depth to 0.392 mg/kg on surface horizon and pedon 3 was 0.119 mg/kg to 0.361 mg/kg on surface horizon.

DTPA extractable Zn-The available Zn at different soil depth (table-6) were showed decreasing range from 0.435 to 0.837 mg/kg throughout the depth. The pedon 1 was showed 0.469 mg/kg on 120-150 cm depth to 0.798 mg/kg on surface horizon, pedon 2 was showed 0.448 mg/kg on 120-150 cm depth to 0.837 mg/kg on surface horizon and pedon 3 was 0.435 mg/kg on 120-150 cm depth to 0.802 mg/kg on surface (0-15 cm) horizon. The maximum available Zn was observed in the surface horizon and showed decreasing trend with horizon depth.

DTPA extractable Mn -The amount of available Mn (table-6) decreased with increasing horizon depth at all pedon only pedon1 was appeared to inverse trend of their values. Pedon 2 was showed 4.51 mg/kg on 0-15 cm to 2.49 mg/kg on lower surface horizon and pedon 3 was showed 4.47 mg/kg on 0-15 cm depth to 1.65 mg/kg on 120-150 cm lower horizon. There was great different of available Mn in Reoti Block soil among the three pedon (Singh *et al.* 2014).

Conclusion

Depth wise soil properties of pedon 1 (Trikalpur), pedon 2 (Bishunpura) and pedon 3(Naina) land was suitable for possible crops cultivation. Soil pH of all pedons as depth wise seen increasing range towords alkaline from upper soil (0-15 cm) to the lower depth (120-150 cm) in all pedons, its range from 7.3 to 8.2. While their was not substantial difference in EC of soils, bulk density of pedon 1 was lower than other pedon, due to decreasing in organic carbon leads to increase the mineral contents. The grater amount of organic carbon, available N,P,K, and S was found in at 0-15 cm depth, there after decreasing with increasing depth of all pedon. Variation in other soil properties such as soil pH, EC, bulk density, water holding capacity, soil texture, calcium carbonate, exchangeable Ca^{++} and Mg^{++} and DTPA extractable Fe, Cu, Zn and Mn was also observec in scatterd pattern in all profile. Thus no clear horizons development in selected village pedon showed very shallow soil depth because all pedon have observed sand layer at 120-150 cm depth.

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