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RESEARCH ARTICLE

CHARACTERIZATION OF SOIL UNDER CEREALS BASED LAND USE SYSTEM IN SIKANDARPUR SUB DIVISION OF BALLIA DISTRICT (U.P.)

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ABSTRACT

Properties of soils are influence the growth and development of all organisms. In this respect a depth wise soil study experiment was conducted in three villages of Sikandarpur subdivision of Ballia District to study the depth wise soil composition in cultivated land in different land use system *viz*. grass land areas, orchard land and rice grown land. For the analyses soil, samples were collected from different soil profile from different depth like 0-15, 15-30, and 30-45, 45-60 cm, brought to the laboratory for analysis of physico – chemical and chemical properties. The study is indicates as pH of cultivated alluvial soil increased with profile 1, 2, and 3 horizons depth with little variation but in surface horizons samples showes much more difference . p^H of the soils of different profile varied from 6.4 - 9.5, organic carbon in site- 1 was very high of 0-15 cm depth, as lower horizons compared to the site -2 profile and site-3 profile, organic carbon decreased with soil depth and have slight variation during the cropping period. The soil samples from profile 1 have highest available N indicated high organic matter accumulation during *kharif* season and soil of medium and low in soil profile 2, and 3. Similarly, optimum available P content was decrease with horizons depth and it was medium range in soil profile 1, 2 and 3.The available S content was seen in the different horizons and it have showed decreasing trend with depth. Among the different profile there where low available K of all soil profile due to recycling of organic residues. Exchangeable Ca^{++} and Mg^{++} content of cultivated soil of all soil profile was showed highest amount with no marked variation as per depth of horizons and as well profile wise. The available Fe, Cu, Zn, Mn content were found gradual increased from profile 1, 2 and 3 with 0-45 cm depth soiland decreasing with increase soil depth.

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INTRODUCTION

Ballia is a magnificent district located between two holy rivers *viz*. Ganga and Sarayu (*Ghaghra*) as natural resource. Similarly, soil is the most valuable natural resource. It is at the heart of terrestrial ecology, but it is finite and non- renewable (Mustafa *et al.* 2011 a, b). As we have to meet the challenges of this century, new understandings and new technologies will be needed to protect the environment and at the same time, produce food and biomass to support society (Brady and Weill 2004). Therefore systematic study of morphology and taxonomy of soils provides information on nature and type of soils, their constraints, potentials, capabilities and their suitability for different uses (Sehgal 1999; Samanta *et al*. 2011). The soil profile is one of the most important key to understanding the processes that have taken in soil development and is the means of determining the types of soil that occur and is the basis for their classification. Hence, soil constituents are the basic attributes that directly influence to any specified use. In fact the life supporting system of a country and socio- economic development of its people depends on soil resources. Agricultural intensification and massive infrastructure development in recent year without considering the variability of entire production system enhances the risk of soil erosion and fertility depletion (Singh *et al.* 2007). In order to adopt good management practices and remedial measures for various soils, a systematic study of the soils is highly essential. Hence; the present investigation was taken up to characterize the soil of Sikandarpur subdivision of Ballia.

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MATERIALS AND METHODS

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 128.93 meter above the sea level.

The mean annual rainfall ranges from 950 – 1150 mm. Study area Pandah block lies at 91^0 22' longitude and $21^0$11' with an altitude of 65 meters above the 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 (47.5^0C) and minimum (1.6^0C) temperature have been recorded in the months of June and January respectively. The relative humidity is generally high during the south west monsoon, being 70%.Soil samples were collected from rain fed area of Pandah block (Ballia District, U.P.) soils 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 trees and all other factors likely to affect the soil in comparison with the normal type. Soil samples were collected from three villages namely; Masoompur, Bachhapar and Firojpur away from Pandah block 2.00 km, 5.00 km, 4.00 km, respectively and from 31 km, 35 km and 29 km from Ballia district head quarter. Soil samples were collected in November 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 dig soil profile in the three village (Masoompur, Bachhapar and Firojpur) to collect the soil samples and 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 depth were taken in polythene bags separately. After well processed soil samples were ready to analysis of targeted possible parameters in laboratory of Department of Agricultural Chemistry and Soil Science, S.M.M. Town P.G. College, Ballia, only Fe, Cu, Zn, and Mn analysis were done in the Soil testing laboratory Mau (U.P.).

The collected soil samples from different soil profile were analyses for soil pH, EC, Bulk density, WHC, (sand, silt, clay %), Soil Colour, CEC, Organic carbon, available N, P,K, and S, exchangeable Ca^{++} and Mg^{++} , $CaCO_3$, available Fe, Cu, Zn, Mn by using standard method described by different authors. Physico– chemical analysis of soils from the collected different site and depth of pedons were analyses for Bulk density (Mg m^{-3}) method described by Kanwar and Chopra (1998).Soil p^H was determined by glass electrode Buckman's p^H meter in 1:2:5 ratio of soil water suspension method described by Kanwar and Chopra (1998).Soil texture as per cent sand, silt and clay were determined by international pipette method described by Singh *et al.*(2006). Electrical Conductivity (EC) (dSm^{-1}) soil was determined by the supernatant liquid of the 1:2:5 ratio of soil – water suspension with conductivity meter method described by Kanwar and Chopra (1998). Cation Exchange Capacity of soil was determined by method described by (Jackson, 1973).The per cent Soil Organic carbon content was determined by Walkley's and Black's (1934) rapid titration method as described by Kanwar and Chopra (1998), Calcium carbonate was determine by rapid titration method (Puri,1930) method described by Singh *et al* (2005). Soil available nitrogen was determined by alkaline potassium permanganate method (Subiah and Asija, 1956). Available phosphorus (P) was estimated by using Olsen's *et al.* (1954) method and colour was developed by ascorbic acid. Available potassium (K) was determined by N neutral ammonium acetate method described by Muhr*et al.* (1965) was used. Available Sulpher (S)of soil was determined by Williams and Steinberg (1959), rapid extraction method.

The DTPA extractable micronutrients as Fe, Cu,Zn, Mn was determined by Lindsay and Norvell (1978) method. The exchangeable Ca and Mg in soil was determined by using 0.01 N EDAT solution method described by (Jackson, 1973).

RESULTS AND DISCUSSION

Soil pH: Data (Table –1) from three different soil profile on 0-15, 15-30, 30-45, 45-60 60-90, 90-120 and 120-150 cm of soils were ranged from 6.4 to 9.5. The increasing range of p^H was observed toward saline for upper soil (0-15 cm) to lower depth (120-150 cm) in all pedons. Soil profile 1 was showed 6.5 pH at 0-15 cm increased with depth up to 7.5 at 120-150 cm, profile 2 pH ranges was showed from 7.4 at 0-15 cm and it was increasing up to 120-150 cm of their value 7.6, profile 3 p^H value ranged from 8.7 at 0-15 cm to 9.5. The lower pH range was found at upper layer of cultivated soil than the 120-150 cm depth of soil due to presence of organic matter and possible higher activity of hydroxyl aluminum at higher pH eventually in higher P adsorption (Mokwanye, 1975). The higher biological activities might be responsible for decreased pH range on surface soil. The pH value showed in increase with increasing in the depth of soils which has attributed to the dominance of neutral soluble salts (Abrol*et. al.* 1988). It might be due to leaching of bases from upper layer to lower layer where they have retained by clay particles or as a result of chemical precipitation. Among the different profile, pedon one which was time being waterlogged body showed lower pH range than another pedon and there were maximum cultivation practice possible. The marked differences of pH value at profile 2 and 3 were due to both season crop rising and farmer's using imbalance fertilizers and pesticides.

Electrical conductivity of soil (dSm^{-1}): The data (Table- 1) reveal that EC of soil samples from all soil profile of cultivated land depending on soil depth. The EC of the soils under study ranged from 1.0 dSm^{-1} indicated not wide variation among the all different profile. A relative lower EC (1.0 dSm^{-1}) value in surface layer as compared to sub – surface (120-150 cm) soils 1.11 dsm^{-1} were observed no difference at profile two and others. Which was might be ascribed to the lateral movement of water from the construction of earthen bund on ground (Mehta *et.al.* 1996). Electrical conductivity varied between 0.990 and 1.009 dsm^{-1} characteristic of the normal black soils.

Bulk density (Mg m^{-1}): The bulk density of soil was measured by the depth wise soil for all soil profile presented in Table –2. Bulk density was varied between the values of 1.21 to 1.58 Mg m^{-3} among the different soil profile respectively. The increased bulk density was observed at profile 1 at 15-30 cm depth 1.58 Mg m^{-3} and lower was a profile 2, 1.21 Mg m^{-3} in 90-120 cm depth. The bulk density value varied from 1.21 to 1.58 Mg $m^{-3}$with a little variation the soils profile and between the horizons. Increasing value of bulk density at different depth of among the pedon might be due to greater mineral content.

WHC (%): The WHC of soil was measured by the depth wise soil for all soil profile (Table – 2) varied between the values of 15.3 to 34.3% among the different soil profile respectively. The increased WHC was observed at profile 2 at 0-15 cm depth 34.3% and lower was a profile 3, 15.3% in 90-120 cm depth. The WHC value varied from 15.3 to 34.3 % with a little variation the different profile soils and between the horizons.

Table 1. Soil pH and EC (dSm-1) at different soil depths (cm) profile from different village

Profile Depth (cm)	Masoompur		Bachhapar		Firojpur	
	pH	EC	pH	EC	pH	EC
0 – 15	6.5	1.01	7.4	1.01	8.7	1.01
15 – 30	6.4	1.01	7.5	1.0	9.2	1.02
30 – 45	6.4	1.01	7.5	1.0	9.0	1.01
45 – 60	6.7	1.02	7.5	1.0	8.3	1.01
60 – 90	6.7	1.01	7.5	1.01	9.3	1.02
90 – 120	7.5	1.11	7.4	1.01	9.5	1.0
120 – 150	7.5	1.01	7.6	1.01	-	-

Table 2. Bulk density (Mg/m^3) and WHC (%) at different soil depths (cm) of different soil profile

Profile Depth (cm)	Masoompur		Bachhapar		Firojpur	
	Bd	WHC	Bd	WHC	Bd	WHC
0 – 15	1.31	26.52	1.33	34.3	1.42	22.8
15 – 30	1.33	23.13	1.38	34	1.58	21.5
30 – 45	1.33	22.32	1.29	32.53	1.42	17.6
45 – 60	1.4	19.35	1.35	28.64	1.42	17.5
60 – 90	1.42	19.23	1.37	17.53	1.33	15.3
90 – 120	1.29	17.75	1.21	17.24	1.37	15.3
120 -150	1.37	17.73	1.25	16.94		

Table-3. Sand, Silt, Clay (%) at different soil depths (cm) of different soil profile

Profile Depth (cm)	Masoompur			Bachapar			Firojpur		
	Sand	Silt	Clay	Sand	Silt	Clay	Sand	Silt	Clay
0-15	35	40	25	40	38	21	42	40	18
15-30	35	38	27	42	40	18	40	42	18
30-45	36	35	29	39	40.5	21.5	39	41	20
45-60	38	37	25	39	41	20	39	40	19
60-90	39	35	26	37	40	21	38	42	20
90-120	37.4	39.6	23	40	42	18	40	42.5	15
120-150	37	40	23	40	42.5	17	-	-	-

Table 4. Soil organic carbon (%) and $CaCO_3$ (%) at different soil depths (cm)

Profile Depth (cm)	Masoompur		Bachhapar		Firojpur	
	O.C.	$CaCO_3$	O.C.	$CaCO_3$	O.C.	$CaCO_3$
0 – 15	1.0	0.24	0.93	0.26	0.90	0.19
15 – 30	0.40	0.15	0.75	0.18	0.07	0.15
30 – 45	0.23	0.18	0.41	0.18	0.07	0.10
45 – 60	0.07	0.20	0.15	0.19	0.07	0.05
60 – 90	0.07	0.15	0.13	0.25	0.07	0.08
90 – 120	0.15	0.16	0.70	0.28	0.02	0.08
120 – 150	0.15	0.16	0.07	0.20	-	-

Table-5. Available nitrogen (Kgha^{-1}), phosphorus (kgha^{-1}) and potassium (Kgha^{-1}) at different soil depths (cm) of different soil profile

Depth (cm)	Masoompur			Bachhapar			Firojpur		
	N	P	K	N	P	K	N	P	K
0 – 15	348	16.8	504	332	20	358.4	269	18.6	369.6
15 – 30	269	16.57	392	252	18.5	369.6	237	18	347.2
30 – 45	253	11.2	324.8	221	15.3	330.5	192	15.3	414.4
45 – 60	221	10	336	193	11.2	332.4	192	11.3	380.8
60 – 90	158	10.3	347.2	173	8.6	324	158	7.6	280
90 – 120	158	9.0	369.6	158	8.8	302	149	5.5	268.8
120 -150	158	8.8	324.8	158	5.6	280			

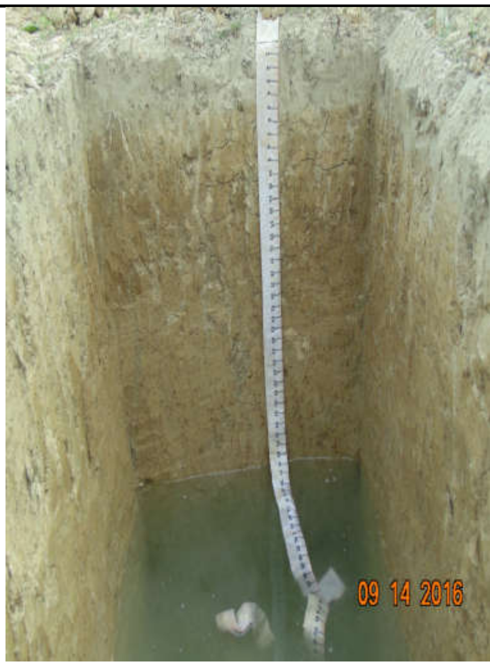
Table 6. Available Sulphur (mg/kg) and Exchangeable Ca^{++} and Mg^{++} content (cmol (p^+) kg^{-1}) in different depths (cm) of soil

Depth (cm)	Masoompur			Bachhapar			Firojpur		
	S	Ca	Mg	S	Ca	Mg	S	Ca	Mg
0 – 15	12.3	12.4	9.5	10.8	10.8	7.5	8.3	10.2	7.0
15 – 30	11.4	11.0	7.2	10.3	10.3	7.7	8.5	9.7	7.3
30 – 45	10.0	11.2	6.2	9.8	9.8	6.7	8.0	9.0	6.8
45 – 60	11.8	11.5	7.5	10.0	8.0	6.8	7.3	9.5	6.3
60 – 90	8.6	10.0	7.5	8.3	9.8	6.9	7.5	9.4	6.3
90 – 120	7.0	8.10	7.2	7.0	10	6.3	7.0	8.7	5.8
120 -150	7.5	8.0	7.0	7.0	9.9	6.0			

Table 7. DTPA extractable Fe, Cu, Zn, Mn (mg kg^{-1}) in different depth of soil

Depth (cm)	Masoompur				Bachhapar				Firojpur			
	Fe	Cu	Zn	Mn	Fe	Cu	Zn	Mn	Fe	Cu	Zn	Mn
0-15	22.73	18.21	0.77	4.44	12.4	20.43	0.63	3.99	5.62	10.24	0.84	8.84
15-30	14.57	7.43	0.86	2.88	2.79	2.67	0.55	3.97	2.61	1.31	0.51	5.21
30-45	6.06	1.94	0.72	3.27	1.82	1.31	0.51	2.67	2.20	0.12	0.49	4.29
45-60	5.8	1.52	0.02	3.42	1.6	1.08	0.35	2.52	2.24	0.34	0.40	4.04
60-90	3.9	1.37	0.39	3.74	1.3	1.0	0.82	2.42	2.31	0.72	0.40	4.0
90-120	3.4	0.51	0.16	4.28	1.1	0.5	0.54	2.04	2.42	0.70	0.32	3.92
120-150	2.01	0.04	0.14	4.40	1.04	0.01	0.13	1.20				

Bachhaparpedon (Pedon-2, Paddy growing area soil)



FirojpurPedon (Pedon 3, Paddy growing uplandsoil)

Masoompurpedon (Pedon 1, orchard land soil)

Figure Name of Village viz. Bachhapar pedon (Pedon-2, Paddy growing area soil) Firojpur Pedon (Pedon 3, Paddy growing upland soil) and Masoompur pedon Pedon-1 Orchard Soil)

The value of WHC was showed decreasing with increasing depth of pedon might be due to organic matter content and some other physical factor among all pedon.

Soil Texture: The value of sand, silt and clay percentage in profile 1, 2 and 3 at 0-15, 15-30, 30-45, 45-60, 60-90, 90-120 and 120-150 cm horizon profile depth (Table-3). The percentage of sand, silt and clay in different soil profile varied from profile 1 35 to 39%, 35 to 40% and 23 to 29%, profile 2, 37 to 42%, 38 to 42% and 17 to 21.5% and profile 3, 39 to 42%, 40 to 42.5% and 15 to 20% respectively, according the textural class of these soil varied from loamy sand to clay loam (Pandey and Girish, 2007). Irrespective of the land use system soil texture was finer in the sub-surface horizons than surface horizons and this might be due to the pedogenic *viz.* clay illuviation.

Organic Carbon (%): At different depths (Table–4) and soil profile, it was decreased with increasing soil depth. Cereals based cropping system soil was contained higher range of organic carbon content 1% at 0-15 cm to 0.07% at 60-90 cm of horizon in profile 1. Although, the lowest organic carbon content was measured 0.02% at village 3 with 90-120 cm depth. It was fairly high in all profile up to 0-15 cm depth of upper horizons, due to greater organic materials accumulation was observed on the surface of village (pedon 1) and it was gradual decreased with increasing depth and elevation of soil profile. The similar finding was given by Sahu and Bala (1995) differences in organic carbon content of the soil and high rate of possible CO_2 evolution leads to low organic carbon, similar findings were given by Sharma *et. al.* (1998) and Singh (1991). In profile 3rd might be attributed to lesser amount of crop residues than the higher accumulation in profile 1, removal of surface soil containing high organic carbon. Organic carbon content ranged between 0.02 to 1.0% from lower to upper horizon of all pedons. The surface horizons had higher organic carbon than others irrespective of land use in among the location.

Calcium carbonate (%): The Calcium carbonate of soil was (Table– 4) was varied between the values of 0.08 to 0.26% among the different soil profile respectively. The increased value calcium carbonate was observed in profile 2 at 0-15 cm depth 0.26% and lower value was in profile 3 0.08% in 90-120 cm depth in pedon 3. The calcium carbonate value varied from 0.08 to 0.26 % with a little variation the different profile soils and between the horizons. All pedon were situated in rice growing area there were water logging and moisture content in soil was observed in regular and might be much more chance to very minute formation of $CaCO_3$ in reduced soil condition among the different pedon of different village.

Available Nitrogen (kg ha^{-1}): Soils of all soil profile of their horizon depth were indicating decreasing range from 149 to 348 kg ha^{-1} (Table-5) throughout the depth. However, available N content was found maximum (348 kgha^{-1}) in surface horizons (0-15 cm) and decreased regularly with soil depth at Masoompur (pedon-1) possible due to the accumulation of natural vegetation residues and organic materials, similar finding was given by Prasuna Rani *et. al* (1992). Bachhapar (pedon 2) soil was showed similar trend of decreasing 332 kg ha^{-1} on surface (0-15 cm) horizon to 149 kg ha^{-1} subsurface (120-150 cm) horizon. The Firojpur (pedon 3) soil was showed similar trend of decreasing 269 kg/ha on surface (0-15) horizon to 149 kg/ha subsurface (90-120 cm) horizon. Continues application of similar type of imbalance chemical fertilizers and cultural practices, extent of increased available N status at soil profile 3 than 2 & 1 due to partial decomposition of crop residues and build of available N and P with combined use of inorganic and organic source of fertilizer (Bhandari *et.al.*1992); Hegde and Dwivedi (1992) and Devi (1993). The soil profile 3 was showed low extent of available nitrogen might be due to its higher removal by crop than annual addition. The soil profile 1 was showed highest available nitrogen content due to might be maximum surface accumulation of plant and animal residues, decomposition and transformation by microbes. Moreover, soil profile 1 have greater extent of available nitrogen then the 2 & 3, respectively at surface horizon as per elevation of cultivated soil due to surface accumulation of organic materials.

Available phosphorus (kg ha^{-1}): Inspite of land use systems, the extent of horizons depth (0-15, 15-30, 30-45, 45-60, 60-90, 90-120 & 120-150 cm, respectively) wise available phosphorus was observed at profile 1, 2, and 3. The small variation in amount of available phosphorus (Table–5) was found in all profile. The soil profile 1 was showed phosphorus 16.8 kgha^{-1} and it was decreased with increasing horizon depth up to 120-150 cm of 8.8 kg ha^{-1}. The similar pattern was found in another soil profile 2 and 3 also. Although grater amount of available phosphorus was found in profile 2 with 20 kg ha^{-1}, at soil profile 3rd 18.6 kg ha^{-1}, different lands use system. So, that low amount of application of phosphorus as chemical fertilizers might have increased the phosphorus fixation capacity of soil under mixed alleviated cultivated land, current follow land use system (Das *et al.*1993) with respect of phosphorus pool in soil. Therefore variation trend in all soil profile 1to 3 showed similar trend and not much more variation but soil profile 2 (Bachhapar) showed greater value than other spot. Because of soil profile 1 located orchard land, having deposition of huge amount of organic materials to decomposition by microbes, it might be solubilize by phosphate solubilizer.

Available potassium (kg ha^{-1}): It was decreased with increase in horizons depth at all profile. The soil profile 1 was measured 324.8 kg ha^{-1} in 120-150 cm depth to 504 kg ha^{-1} (table-5) on surface horizon, soil profile 2 showed 280 kg ha^{-1} in 120-150 cm depth to 358.4 kg ha^{-1} in surface horizon, soil profile 3, showed 268.8 kg ha^{-1} in 90-120 cm depth to 369.6 kg ha^{-1} in surface horizon, (0-15 cm) depth. There was great difference of available potassium content in cultivated land soil among all the three different soil profile of different village.

Available sulphur (mg kg^{-1}): Data (Table –6) revealed that on available sulphur varied with the depth wise distribution depending upon soil pH and organic materials of soil in among the different village soil pedon. Available sulphur in surface soil 0-15 to 120-150 cm horizon depths at profile 1 (I) was 12.3 to 7.0 mg kg^{-1}, profile 2 of 10.8 to 7.0 mg kg^{-1}, profile 3 of 8.3 to 7.0 mg kg^{-1}, respectively. Highest 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. It has down the depth in both the orders being lowest at 120-150 cm depth. So that, available sulphur content declined with increase in depth, at sub- surface the contents of sulphur was more or less similar, where as found in deeper layer was less than the critical limit (4.80 mg kg-1) soil organic matter regulates markedly the content of sulphur – S in alluvial soil. The similar finding was given by Trivedi *et.al.* (1998). Negligible amount use of organic manure and sulphur containing fertilizer has leads to low available sulphur content in all three village soils. Several soil factors influence the availability of sulphur and hence the status of different forms of sulpur in soil varied widely with soil type (Balangoudar and Satyanarayan,1990). Among the soil profile of land use system, soil profile 1 had greater available sulphur than other due to certain bacteria release H_2S gas, which can react with ferric phosphate to yield ferrous sulphide under soluble forms of sulphur and orthophosphate (Tarafdar, 2008).

Exchangeable Ca^{++} (cmol (p^+) kg^{-1}): The data of calcium in landing stations of cultivated land soil (Table–6) revealed that a greater value 12.4 to 8.0 cmol (p^+) kg^{-1} was found in Profile 1 and lowest value in profile 3 were measured. The lower horizons of all soil profile were observed increased exchangeable Ca than upper horizon. In fact that profile 1 the exchangeable Ca^{++} might be associated with day, phosphorus and carbon to develop hardness and compactness of soil. The deposition and less accumulation of Ca or the formation might be due to submerged condition of soil.

Exchangeable Mg^{++} (cmol (p^+) kg^{-1}): Data presented in Table – 6 for exchangeable Mg^{++} in different pedon wise depth of three different village of land use system. A very small variation was found in exchangeable Mg^{++} was found greater in lower horizon depth than surface horizon. It range from 9.5 to 6.2 cmol (p^+) kg^{-1} in profile 1, 7.5 to 6.0 in profile 2, and 7.0 to 5.8 in profile 3. Exchangeable Mg^{++} content in the arahr crop soil area was lesser than garden and rice cropping area.

DTPA extractable Fe (mg kg^{-1}): Data (Table–7) revealed that on DTPA extractable Fe at different soil depth were showed decreasing range from 22.73 to 1.04 mg kg^{-1} throughout the depth. However, available Fe content was found maximum (22.73 mg/kg) in surface horizons (0-15 cm) and decreased regularly with soil depth at soil profile 1 possible due to accumulation of natural vegetation residues and organic materials. Although the lowest Fe content was measured 1.04 mg/kg at soil profile 2 with (120-150 cm) depth. Iron (Fe) content was fairly greater in both soil profile up to 0-60 cm horizons depth due to greater Fe substances accumulation was observed on the surface of profile 2 and it was gradual decreased with depth and elevation of soil profile (Tiwari and Mishra 1990).

Available Cu (mg/kg): Data (Table–7) revealed that on available Cu (DTPA extractable) in different soil and different depth were found decreasing range from 20.43 to 0.01 mg/kg throughout all depth. However, available Cu content was found maximum (20.43 mg/kg) in surface horizon (0-15 cm) and decreased regularly with soil depth at profile 2 although the lowest Cu content was measured 0.01 mg/kg at profile 2 with 120-150 cm depth. So, Bachhapar soil pedon was showed greater available Cu than the Masoompur and Firojpur village.

Available Zn (mg/kg): The data (Table–7) revealed that on available Zn (DTPA extractable) in profile 1, 2 and 3 showed decreasing range from 0.14 to 0.88 mg/kg throughout the depth. The profile 1 was showed 0.14 mg/kg on (120-150 cm) depth to 0.87 mg/kg surface horizon. The profile 2 was showed 0.45 mg/kg on (15-30 cm) depth to 0.71 mg/kg on 120-150 (cm) and 0.63 mg/kg surface horizon, and profile 3 was showed 0.22 to 0.562 mg/kg. There is great difference of available Zn content in different profile. Available Zn in both profile varied from 0.14 to 0.88 mg/kg. The maximum available Zn content was observed in the surface horizon and showed decreasing trend horizon depth.

Available Mn (mg/kg): The amount Mn at different profile in 0-15, 15-30, 30-45, 45-60, 60-90,90-120 and 120-150 cm horizon depth; The value of Mn (Table-7) was appeared from 1.2 to 8.84 mg/kg throughout the all depth. The profile 1 was showed 1.4 mg/kg in (120-150 cm) depth to 8.77 mg/kg surface horizon. The profile 2 was showed 4.44 mg/kg on (0-15 cm) depth to 2.4 mg/kg on 30-45 (cm) and 4.4 mg/kg on (120-150 cm) depth, and profile 3 was showed 3.92 to 8.48 mg/kg. There are great difference of available Mn content in different profile, and Zn in both profile varied from 0.14 to 0.88 mg/kg decreased with increasing depth horizon at profile2 and 3. The profile 1 was showed 2.88 mg/kg on 30-45 cm depth to 4.4 mg/kg on 0-15 cm surface horizon.

Conclusion

The pH and EC of cultivated alluvial soil increased in profile 1, 2, and 3 with horizon depth with little variation but in surface horizons have much more difference were observed. pH of the soils of different profile varied from 6.4 - 9.5. The maximum amount of organic carbon in soil profile 1 was very high at 0-15 cm depth, as lower horizons compared to the profile 2 and 3. The amount of organic matter decreased with soil depth and slight variation observed accumulation of organic materials during the cropping period. The soil samples from profile 1 have highest available N indicated high organic matter accumulation during kharif season and soil of medium and lower soil profile 2, and 3. The soil samples of different horizons depth was showed optimum available P and K content but decreased with their subsequent depth. That was decrease with horizons depth. It was medium position of soil profile 1, 2 and 3.The available S content was noticed in the different horizons showed decreasing trend with depth. Low available K of all soil profile due to recycling of organic residues. Exchangeable Ca^{++} content of cultivated soil of all profile was showed highest amount of land use system of soil profile. Exchangeable Mg^{++} content of cultivated soil of all soil profile was showed highest amount but among the different profile have no marked variation as per depth of horizons and profile wise. The available Fe, Cu, Zn, Mn content was found gradual increased from profile 1, 2 and 3 with 0-45 cm depth soil and decreasing with increase soil depth. It has become clear from above findings that physico–chemical and chemical properties of cultivated land. Variation in bulk density, water holding capacity was seen in cultivated land than the orchard and grass land use system.

Application of Research- The information related to the particular subdivision/Block/village in respect to depth wise soil fertility status and soil composition will be use full to land use planning, crop suitability and natural resource management.

Research Category- Soil Fertility and pedology (Soil Science)

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Profile Study- Three soil profile was opened for the study of soil properties in three villages and depth wise samples were collected from the identified village of Sikanderpur subdivision of Ballia (UP) District (Already mentioned in the text of material and method).

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