INTERNATIONAL JOURNAL OF ADVANCED BIOLOGICAL RESEARCH

www.scienceandnature.org

STUDIES OF DEPTH WISE DISTRIBUTION OF PHYSICO-CHEMICAL PROPERTIES OF SOIL UNDER DIFFERENT CROPPING SYSTEMS

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ABS**TRACT**
An investigation was carried out during 2018-19 at Genetics and Plant Breeding farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (UP) to studies the depth wise physico-chemical properties of soil under different cropping systems. Results revealed that the bulk density ranged from 1.14-1.62 Mgm^{-3} , particle density ranged from 2.29-2.70 Mgm^{-3} ,porosity of the field ranged from 33.05 – 52.65% , soil pH was ranged from 7.6 -10.9 , EC is ranged from 0.21-0.78 dSm^{-1} while the organic carbon was ranged from 2.14- 6.04 gkg^{-1} and available nitrogen was low and ranged from 161-220 $kgha^{-1}$ .The available phosphorus and potassium were ranged from 7.31- 17.45 $kgha^{-1}$ and 168.32 – 218.53 $kgha^{-1}$, respectively .The significant positive correlation were observed among BD with PD, PD with EC, BD with K, PD with N, pH with K , P with K in whole GPB Farm.However the significant negative correlation were observed among OC and porosity and EC, EC with N, N with P in whole GPB Farm.

KEY WORDS: Physico- chemical properties, regression, pearsons correlation coefficient, macro nutrients, standard deviation.

INTRODUCTION

Soil productivity and sustainability depends on a dynamic equilibrium between its physical, chemical and biological properties. The study of soil use in its spatial context is essential to understand the area of optimum soil use and degraded areas. Therefore comprehensive account of our land use on sustainable basis is necessary. It is important to understand that the inherent potential and limitation of soil for managing it for sustainable production. The prevalent nutrient a deterioration.Prior to this management practices need to be refined under most, if not all farming situation is order to prevent the ever increasing problem of soil fertility basic requirement will be needed to monitor and document the extent of changes in soil fertility of the university, owing to farmers nutrient management approach. Keeping these facts in view, the present investigation was carried out at AND university Farm of Kumarganj, Ayodhya.

MATERIALS AND METHODS

An investigation was conducted during 2018-19 at Genetics and Plant Breeding farm of AND University of Agriculture and Technology, Kumarganj, Ayodhya. Random soil sampling was done on GPS basis in each plot of Genetics and Plant Breeding farm to evaluate the fertility status and effect of different cropping systems on soil physico-chemical characteristics and their correlation. The cropping systems were Black Gram – Pea – Green Gram, Black Gram – Lentil – Green gram, Kodo / Sawan – Rye – Fallow, Kodo/Kakun – Kidney Bean – Fallow, Kodo/Sawan – Mustard – Fallow, Rice – Wheat – Fallow, Rice – fodder Crops – Fallow, Rice – fodder Crops – Fallow, Green Gram – Lentil – Black Gram, Green Gram – Pea – Black Gram, Rice – Fodder Crop – Fallow, Rice Fodder Crop – Fallow, Rice – Fodder Crop – Fallow, Fodder Crop – Oat – Fallow, Fodder Crop – Berseem – Fallow, Fallow – Mustard – Fallow, Fallow – Barley – Fallow, Fallow – Barley – Fallow, Fallow, Fallow, Fallow, Fallow two hundred sixty four representative soil samples consisting of four depths viz., 0-15, 15-30, 30-60 and 60-90 cm from plots of GPB farm have been collected during March, 2019. The samples were collected from different spots for different physico-chemical studies were brought to the laboratory and dried under the shade. The entire samples were crusted and sieved through 20 mesh sieve and stored. The soil samples were analyzed with following standard procedures. The soils were sandy loam, loam and Silty loam. Correlations between different soil parameters were calculated and regression equations were worked out as per procedures described by Chandel (1984). The correlation coefficient, r is known as Pearsons correlation coefficient, since it was developed by Karl Pearson. The standard deviation is defined as the square root of the mean of the squared deviation of individual value from their mean.

RESULT AND DISCUSSION

It is evident from the Table 1 that maximum bulk density1.62 Mgm^{-3} was recorded in kodo/kakun – kidney bean – fallow under the depth of 60-90 cm and the minimum bulk density of 1.14 Mgm^{-3} was record from green gram – pea - black gram at the depth of 0-15 cm. The maximum particle density of 2.70 Mgm^{-3} was found in rice- fodder crops – fallow Plot no. 8 (B9) under depth of 60-90 cm and the minimum particle density (2.29 Mgm^{-3}) was found in rice – fodder crop – fallow Plot no. 12 (C8) at the depth of 0-15 cm. As regarding the porosity, the maximum porosity 52.65% was found in fallow – mustard

– fallow at the depth of 0-15 cm .The minimum porosity (33.05%) was recorded in kodo/kakun - kidney bean – fallow cropping system under the depth of 60-90 cm. The range of Bulk density ranged from 1.14 -1.62 Mgm^{-3}, particle density 2.29 – 2.70 Mgm^{-3} and the porosity from 33.05 – 52.65%. The average bulk density of farm is 1.34 Mgm^{-3}, particle density is 2.48 Mgm^{-3} and porosity of the entire GPB farm was 45.97%. The standard deviation of bulk density was 0.089, particle density 0.087 and the porosity 3.96 on the GPB farm under 22 plots with 264 samples. Soil bulk density could be used as an indicator of soil quality parameter. The bulk density depends on several factor such as compaction, consolidation and amount of soil organic carbon present in the soil but it is highly corrected with organic carbon content of the soil. Higher sandy texture might be due to low organic matter content which solid particles lies close together and the Bulk density commonly higher than in fine textured soil particle density of soil did not vary much but with decrease in organic matter content of the soil, the particle density increases. The percent pore space varies indirectly with the bulk density of the soils and gives a good estimate of the porosity of soil. The results also corroborated with the finding of Muche et al (2015) and Shiva et al (2017).

Data showed in Table 1 that maximum pH 10.90 was recorded in fallow with depth 60-90 cm and minimum pH 7.60 in green gram – lentil – black gram cropping system with the depth of 0-15 cm. The maximum organic carbon (6.04 gkg^{-1}) was obtained in kodo/sawan – mustard – fallow with the depth of 0-15 cm whereas, minimum organic carbon 2.14 gkg^{-1} was found in fallow-barley-fallow cropping system at the depth of 60-90 cm. As the Electrical Conductivity is concerned, the maximum E.C (0.78 dSm^{-1})was recorded in green gram – pea – black gram at 30-60 cm and minimum E.C (0.21 dSm^{-1})was found in rice – wheat – fallow at 0-15 cm soil depth.It was found that pH value ranged from 7.6-10.9, organic carbon ranged from 2.14- 6.04 gkg^{-1} and Electrical conductivity (E.C) ranged from 0.21 – 0.78 dSm^{-1} .The increase in physico-chemical properties of soil varied with different soil depth and cropping systems have also been reported by several workers (Kumar *et al* 2017, Muche *et al* 2015, and Singh *et al* 2016) .

The data from the Table 1 evident that the maximum available nitrogen (220.0 kg ha^{-1}) was recorded in green gram – lentil – black gram at the depth of 0-15 cm and minimum available Nitrogen (161.0 kg ha^{-1}) was found in fallow at 60-90 cm soil depth. The maximum available phosphorus (17.45 kg ha^{-1}) was recorded in black gram – lentil – green gram at the depth of 0-15 cm whereas, minimum available phosphorus (7.31 kg ha^{-1}) was found in kodo/kakun- kidney bean – fallow cropping system at 15-30 cm soil depth. As far as Potassium is concern, the maximum available potassium (218.53 kg ha^{-1}) was recorded in fallow – barley – fallow at 0-15 cm and minimum available potassium (168.32 kg ha^{-1}) was found in rice – fodder crops- fallow at 60-90 cm soil depth.

The available nitrogen was ranged from 161 -220 kg ha^{-1}, available phosphorus ranged from 7.31 -17.45 kg ha^{-1} and available potassium ranged from 168.32 -218.53 kg ha^{-1}. The increase in nitrogen and phosphorus availability might be due to the high organic matter in surface soil which favoured the decomposition and accumulation of organic matter, solubilisation of insoluble phosphorus and also supplementing the depleted phosphorus through external sources which releasing more quantity of nutrients. The results were also corroborated with the findings of Shiva *et al* (2017) and Singh *et al* (2016).

The results revealed that the B.D. v/s P.D. , P.D. v/s E.C. showed significantly and positively correlation at 1% level of significance , whereas the significant and negative correlation were found in porosity v/s organic carbon and E.C. v/s organic carbon at 1% level of significance. Table 2 the correlation between physico-chemical properties verses macro nutrients reveals that the E.C. v/s N , O.C. v/s K were significant and negative correlation at 1% level of significance whereas B.D. v/s K , P.D. v/s N , pH v/s K showed positive and significant correlation at 1% level of significance. Table 3 It was observed that the P v/s N and P v/s K showed significant and negative correlation at 1% level of significance. Table 4 Similar results were also reported by Sharma *et al* (2010) and Kumar *et al* (2010).

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TABLE 1: Physico- chemical properties of soil (Mean of different depth)

Cropping system.	Bulk Density (Mgm^{-3})	Particle density (Mgm^{-3})	Porosity (%)	pH	E.C. (dSm^{-1})	Organic Carbon (gkg^{-1})	Available Nutrients ($Kgha^{-1}$)		
							Nitrogen	Phosphorus	Potassium
B2	1.23-1.29	2.45-2.66	49.79-50.38	8.3 - 9.5	0.28-0.32	4.21-5.00	182.11-203.41	8.38-11.71	176.18-193.92
B3	1.36-1.45	2.54-2.65	45.28-46.89	8.4-9.2	0.25-0.38	3.64-5.87	188.56-208.88	8.68-17.65	203.21-215.0
B4	1.18-1.29	2.40-2.53	49.01-50.83	8.8-9.6	0.38-0.54	2.16-4.63	190.11-210.65	8.51-13.11	181.31-217.91
B5	1.40-1.62	2.30-2.42	33.05-39.12	9.8-10.8	0.41-0.57	2.16-5.04	183.24-206.48	7.31-9.36	196.38-217.38
B6	1.40-1.45	2.58-2.65	44.65-47.16	9.2-10.2	0.46-0.66	3.08-6.04	162.72-202.24	7.38-11.83	201.15-215.31
B7	1.17-1.30	2.40-2.52	47.96-52.50	9.9-10.5	0.21-0.41	2.44-5.05	164.80-198.52	8.32-11.71	191.31-203.71
B8	1.32-1.50	2.54-2.63	42.58-48.03	9.3-10.3	0.55-0.72	2.45-5.05	178.00-210.86	8.75-15.32	175.32-196.18
B9	1.32-1.50	2.60-2.70	44.44-49.23	9.5-10.6	0.37-0.66	3.34-4.76	173.67-200.08	7.32-9.32	183.78-205.38
C5	1.23-1.38	2.35-2.48	44.22-47.65	7.6-8.6	0.45-0.55	2.94-5.24	208.98-220.0	8.32-10.21	178.18-213.18
C6	1.14-1.40	2.32-2.41	41.90-49.56	9.8-10.4	0.54-0.78	4.06-4.96	181.85-208.34	8.11-10.83	185.83-195.32
C7	1.32-1.44	2.48-2.53	41.93-47.01	9.3-10.5	0.58-0.71	3.06-4.97	174.32-218.16	9.67-11.88	208.32-216.36
C8	1.28-1.52	2.29-2.40	36.66-44.34	8.9-10.1	0.61-0.70	2.25-4.06	182.46-201.32	8.08-9.68	172.40-209.36
C9	1.38-1.50	2.51-2.58	35.65-45.01	9.5-10.5	0.32-0.46	4.84-5.46	182.87-202.16	7.68-10.72	168.32-191.98
D3	1.23-1.38	2.40-2.52	45.23-48.75	9.2-10.1	0.27-0.34	2.36-4.85	170.60-190.81	7.62-12.82	180.37-206.98
D4	1.31-1.40	2.55-2.61	46.36-48.83	9.4-10.5	0.40-0.72	2.86-5.16	176.96-194.28	8.38-10.98	198.32-217.78
D5	1.16-1.27	2.45-2.54	49.20-52.65	8.2-8.8	0.41-0.64	3.68-4.98	178.89-195.10	8.68-9.92	178.78-190.91
D6	1.29-1.35	2.35-2.50	44.89-46.00	7.9-9.6	0.51-0.63	2.14-3.98	178.20-200.81	8.68-9.38	187.91-218.53
D7	1.50-1.59	2.40-2.54	36.65-38.97	9.3-10.1	0.41-0.72	2.26-5.16	181.33-210.00	8.68-9.46	176.33-192.96
E3	1.27-1.40	2.50-2.61	46.36-49.20	9.2-10.8	0.31-0.38	3.18-4.75	161.00-180.87	9.38-11.40	183.31-208.33
E4	1.25-1.40	2.48-2.58	47.67-49.59	9.3-10.3	0.23-0.35	3.15-5.73	165.17-194.81	8.59-10.38	173.81-209.31
E5	1.21-1.40	2.31-2.44	39.39-49.15	9.3-10.8	0.25-0.33	3.14-5.87	161.38-174.81	7.82-13.60	168.34-206.53
E6	1.18-1.23	2.40-2.52	49.59-51.58	10.2-10.9	0.32-0.38	3.65-5.65	171.35-182.95	9.38-12.51	172.38-213.96
AVERAGE	1.34	2.48	45.97	9.60	0.46	4.07	189.11	9.87	195.52
S.Deviation	0.089	0.087	3.96	0.67	0.12	2.98	10.11	0.959	9.18

TABLE 2: Mean Correlation among different physico- chemical properties of soils of all Plots of Genetics and Plant Breeding Farm of University Campus

Parameter	Bulk density (Mgm^{-3})	Particle density (Mgm^{-3})	Porosity (%)	pH	E.C. (dSm^{-1})	Organic Carbon (gkg^{-1})
Bulk density (Mgm^{-3})	1.000					
Particle density (Mgm^{-3})	+0.870**	1.000				
Porosity (%)	-0.436	+0.358	1.000			
Ph	+0.444	+0.369	+0.067	1.000		
E.C. (dSm^{-1})	+0.393	+0.405**	+0.087	+0.040	1.000	
Organic Carbon (gkg^{-1})	-0.058	+0.231	-0.163**	+0.024	-0.827**	1.000

** Significant at 1% levels of significance

TABLE 3: Mean Correlation between Physico - chemical properties Vs Macro Nutrient

Parameter	Bulk density (Mgm^{-3})	Particle density(Mgm^{-3})	Porosity (%)	pH	E.C. (dSm^{-1})	Organic Carbon (gkg^{-1})
Nitrogen	+0.518	+0.425**	+0.129	-0.214	-0.002**	-0.158
Phosphorus	+0.075	+0.092	+0.276	+0.258	+0.047	+0.233
Potassium	+0.796**	+0.701	-0.070	+0.369**	+0.394	-0.635**

** Significant at 1% levels of significance

TABLE 4: Mean Correlation among different soil properties (Macro nutrients) of Plots of Genetics and Plant Breeding Farm of University Campus

Parameter	Nitrogen	Phosphorus	Potassium
Nitrogen	1.000		
Phosphorus	-0.085**	1.000	
Potassium	+0.049	+0.295**	1.000

** Significant at 1% levels of significance