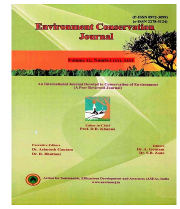
Environment Conservation Journal 24 (1):20-27, 2023

Journal homepage:https://www.environcj.in/

Environment Conservation Journal

ISSN 0972-3099 (Print) 2278-5124 (Online)



Evaluation of the fertility status of flooded soils in the Saharsa District, Bihar

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ARTICLE INFO

Received : 14 April 2022
Revised : 1 June 2022
Accepted : 16 July 2022

Available online: 08.01.2023

Key Words:
CEC's, Correlation
Fertility Status
Physico-Chemical Properties
Saharsa
Soil Degradation

ABSTRACT

The sampling location was Saharsa, which is one of Bihar's most flood-prone area Flooding is the leading source of soil degradation in the district. The current study was carried out in the Soil Science and Agricultural Chemistry laboratory at Sam Higginbottom University of Agriculture Technology and Sciences. 27 samples were collected from several farmer's fields, and composite sampling was carried out from three depths of 0-15, 15-30, and 30-45 cm. The results revealed that the texture was sandy loam to sandy clay, bulk density ranged from 1.11 to 1.59 Mg/m^3, particle density ranged from 2.22 to 2.85 Mg/m^3, pore space ranged from 52.60 to 66.50 % and water holding capacity ranged from 61.11 to 78.12 %. The pH ranged from 6.58 to 7.65, E.C. from 0.17 to 0.39 dS/m,(Due to Flooding) Soil Organic Carbon ranged from 0.74 to 1.20 %, Soil has acceptable Bd, Pd, pore space, and water holding capacity. As a result of the beneficial electrical conductivity for plants, the pH of the soil is neutral to alkaline. Sodium is low to medium in range. Low to medium levels of macronutrients are found in nitrogen, phosphorus, potassium, calcium, magnesium, and sulphur. By employing the proper management techniques and supplying the soil with enough nourishment for plant growth, farmers must maintain the health of their soil.

Introduction

One of the planet's most dynamic and intricate natural processes is referred to as "soil." Since it provides a medium for plant growth and fulfils the bulk of organisms' nutritional demands, it is essential for the existence of many sorts of life. On the surface of the planet, soil is a natural, living substance that sustains plant development (Zaware, 2014). Both good and bad things happen as soil is developed. Rock fragments that have been eroded and weathered by mechanical, chemical, and biological processes make up soil. Numerous tasks carried out by soil benefit both people and other living things. More than just a smattering of mineral granules make up soil. In addition, it has a few more elements and a biological system with living things. Soil testing tells farmers how much and what sort of fertiliser to be used to ensure that their efforts in other better practises pay off good yield and return for their produce (Joshi *et al.*, 2013. Due to geography, climate, physical weathering processes, vegetation cover, microbiological activity, and a variety of other biotic and abiotic variables, the physico-chemical characteristics of distinct soils vary in space and

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Doi:https://doi.org/10.36953/ECJ.12192326

time (Tale and Ingole 2015, Bhardwaj *et al.,* 2020). The most serious challenge facing Indian soil is soil degradation. Soil degradation can be both physical and chemical in nature. Natural factors and human activity both contribute to the degradation of soil. India is finally reaping the benefits of its decades of sowing (Supriya, 2021). The majority of soil erosion happens as a result of somewhat large and frequent rainfall events. Normal soil erosion in places with natural vegetation ranges from 0.1 to 0.2 kg/m^2 (Morgan, 1986). Because the Physico-chemical properties of soil determine food productivity and environmental quality, it is critical to have a fundamental understanding of these qualities, Soil characteristics (Tale *et al*., 2015; Ruhela *et al.,* 2022). Intensive farming can have detrimental effects on soil, including soil erosion, compaction, nitrification, acidity, desertification, loss of organic matter, contamination with heavy metals and agrochemicals, and desertification. Such degradation may be brought on by incorrect farming techniques such overfertilization, careless pesticide application, and the use of large machinery. Two significant soil attributes—nitrification and CaCO3 concentration—are employed in the current research as sub-criteria layers of the soil criterion hierarchy tree to analyse the influence on soil and the induced benefit from a switch to precision farming practises. Intensive cropping practises deplete N, P, and K in surface and subsurface soil, which can be replenished by applying manures and fertilisers together. The pH and electrical conductivity of soil are controlled by the application of manures and fertilisers (Dhaliwal *et al*., 2019). Incorporating a legume crop into a cropping system can improve soil physical and chemical qualities, especially in rice-growing regions (Kumar *et al*., 2020). Both soil nutrient availability, soil health, and crop growth may benefit from a balanced application of organic and inorganic fertilisers (Das *et al*., 2021). In order for crop and animal productivity to be sustained, environmental sustainability to be maintained or increased, and global human health to be improved, soil function must occur within ecosystem limits. Anthropogenic activities, such as favoured farming techniques and intensive land-use management, can alter the soil health in agro-ecosystems, which can further effect soil functions. The majority of previous evaluations of soil health in agriculture have been based on ecological functions of the soil that are linked with non-biological elements like soil nutrients and soil structures. Soil health is closely associated with sustainable agriculture, because soil microorganism diversity and activity are the main components of soil health. A agricultural system that "must be resource-conserving, socially supportive, commercially competitive, and environmentally sound" in order to "keep their productivity and usefulness to society for an infinite period of time."Sustainable development will require healthy soils, not only for increased agricultural production as a growing global population requires more food, but also to ensure sustainability of critical ecosystem services. (Sahu *et al*., 2021).

Material and Methods

The Gangetic Plain, the most fertile alluvial plain in the world, is where Bihar is situated. Latitude: 24°-20'-10" 27°-31'-15" N, Longitude: 83°-19'-50" 88°-17'-40" E. Soil samples were taken at depths of 0-15cm, 15-30cm, and 30-45cm from farms in nine villages using a soil auger, screw auger, and khurpi (Table 1 and Figure 1). The samples were air dried in the shade after composite sampling, and then processed for various physical and chemical analyses. The data collected throughout the inquiry was subjected to statistical analysis using the Completely Randomized Design (CRD) approach and by Opstat software. f-test, S.Ed (±) and C.D @ 5% were calculated in Mx Excel by Opstat software. In f-test Significant (S) and Non-Significant (NS) were determined by comparing the value of F(cal.) with F(tab.) at 5%. If F(cal) value is greater than F(tab.) at 5% then result is Significant and vice-versa. The Sampling site of Saharsa District are represented in Table. 1 in which all 9 villages are written and Site specification are shown in Fig 1. Method of Analysis and their Scientist name for different physical and chemical properties are respectively, Muthuaval *et al*., 1992 calculated the bulk density of soil and represented by (Mg/m^3), Muthuaval et al., 1992 calculated the particle density of soil and represented by (Mg/m^3), Jackson, 1973 used a digital pH metre to record the pH of the soil. Wilcox, 1950 used a digital conductivity metre to determine the electrical conductivity (dS/m) of the

Table 1: **Representing the Sampling site of Saharsa District**

SN	Block	Village	Latitude(^{0}N)	Longitude (^{0}E)
01	Kehra	S_1 – Kahra	25.8978	86.5866
		S_2 – Chainpur	25.8972	86.5873
		S_3 - Rohua mani	25.7246	86.6041
02	Mahishi	S_4 – Jajori	25.8395	86.4669
		S_5 – Bijwar	25.8679	86.4858
		S_6 – Gamrahu	25.8648	86.5009
03	Simri Bakhtiyarpur	S_7 – Teghra	25.4195	86.3526
		S_8 – Chapram	25.4259	86.3459
		S_9 – Baghwa	25.4208	86.3483

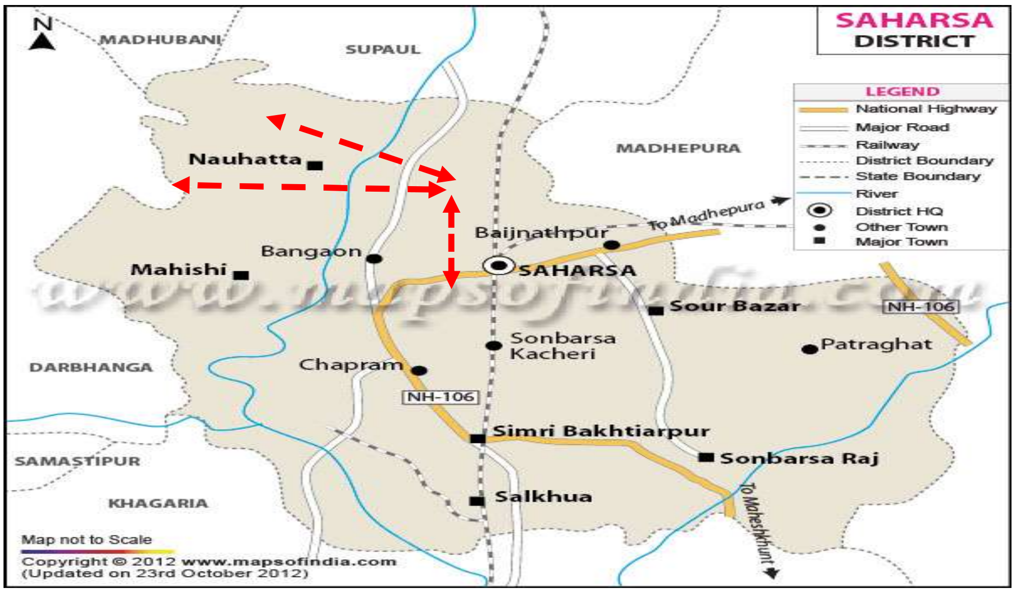

Fig.1 Saharsa map https://www.mapsofindia.com/maps/bihar/districts/saharsa.htm

soil. The organic carbon content (%) of the soil was determined using the wet oxidation method developed by Walkley and Black in 1947. Subbiah and Asija (1956) proposed a modified alkaline permanganate oxidation method for measuring available nitrogen (Kg/ha). The 0.5 M sodium bicarbonate method (Olsen's extractant) was used to assess available Phosphorus (Kg/ha) in soil. Available Potassium (Kg/ha) was determined using the neutral normal ammonium acetate (pH 7.0) method established by Jackson in 1958 with a flame photometer. Exchangeable Ca^{2+} and Mg^{2+}[cmol (p^+)/kg] was determined by EDTA method developed by Jackson, 1973. Available Sodium (mg/l) was determined using the method Flame photometer given by Richard *et al.*, 1954. Bardsley and Lancaster, 1960 used Turbidimetric method to measure the amount of Available Sulphur (ppm).

Results and Discussion

Variation in Physical Properties of Saharsa District at different depths.

In the Saharsa district, the texture ranges from sandy loam to sandy clay. The percentages of sand, silt, and clay range from 71.40-30.35 percent, 41.50-10.33 percent, and 34.08-17.20 percent, respectively observed during Experiment (Table 2), similar result was reported by (Marbaniang *et al.*, 2021). Table 3 represents physical properties of soils Saharsa district. Bulk Density varied from 1.11 and 1.59 Mg/m^3. The maximum value of 1.59 Mg/m^3 was found in S9 (30-45 cm depth) while the least value was found in S4 (0-15 cm depth) is 1.11 Mg/m^3. The Bulk Density increases with the increase in soil depth. The reason is soil compactness, which will be more at high depth, similar result was reported by (Singh *et al.*, 2020). Particle density ranged from 2.22 to 2.85 Mg/m^3. S5 has the highest value of 2.85 Mg/m^3 (30-45 cm depth). with the lowest

Table 2: Soil texture of Saharsa District. (observed during Experiment)

Farmer's site / Treatment	% Sand	% Silt	% Clay	Textural class
S_1: (Kahra)	70.00	12.8	17.2	Sandy Loam
S_2: (Chainpur)	44.5	21.6	33.6	Clay Loam
S_3: (Rohua mani)	67.2	10.4	22.40	Sandy Loam
S_4: (Jajori)	31.6	38.4	30.00	Sandy Clay
S_5: (Bijwar)	30.4	41.5	28.1	Sandy Clay
S_6: (Gamrahu)	56.6	15.4	28	Sandy Clay Loam
S_7: (Teghra)	68.2	12.6	19.2	Sandy Loam
S_8: (Chapram)	71.4	11.2	17.4	Sandy Loam
S_9: (Baghwa)	69.2	12.8	18	Sandy Loam

Table 3: Evaluation of Physical properties of soils Saharsa district

	P_b (Mg/m^3)		**D_p (Mg/m^3)**		**Pore Space (%)**		**WHC (%)**	
Treatment/ Farmer's site	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Range**
S_1: (Kahra)	1.31-1.42	1.37	2.22-2.78	2.53	66.51-61.5	63.55	65.15-61.11	63.29
S_2: (Chainpur)	1.32-1.45	1.39	2.35-2.82	2.60	61.15-57.25	58.90	65.15-64.66	64.97
S_3:(Rohua mani)	1.33-1.44	1.39	2.68-2.85	2.77	64.02-58.5	61.19	69.14-67.77	68.37
S_4: (Jajori)	1.11-1.28	1.21	2.41-2.78	2.57	54.12-52.6	53.34	78.12-72.09	75.16
S_5: (Bijwar)	1.17-1.22	1.19	2.60-2.85	2.76	54.80-53.2	53.86	76.66-64.61	70.61
S_6: (Gamrahu)	1.38-1.45	1.41	2.45-2.71	2.6	62.11-52.8	58.98	70.58-68.16	68.99
S_7: (Teghra)	1.31-1.39	1.35	2.31-2.80	2.58	56.41-55.05	55.78	64.45-63.08	63.62
S_8: (Chapram)	1.41-1.47	1.41	2.32-2.75	2.58	57.91-56.2	57.20	71.14-69.71	70.5
S_9: (Baghwa)	1.51-1.59	1.55	2.35-2.76	2.56	56.21-54.45	55.24	66.77-64.74	65.73
	Due to depth	Due to site	Due to depth	Due to site	Due to depth	Due to site	Due to depth	Due to site
F-test	S	NS	S	NS	S	NS	NS	NS
S.Ed (±)	0.019918	0.132554	0.1853	0.087704	1.326729	3.106753	2.186522	3.636299
C.D @5%	0.594333	0.000246	1.61006	0.051458	0.182575	0.016482	0.025598	0.006429

P_b= Bulk Density, D_p= Particle Density, WHC= Water Holding Capacity.

value of 2.22 Mg/m^3 reported in S1 (0-15 cm depth) Particle Density varies according to the mineral content of the soil particles similar result was reported by (Majhi *et al*., 2020). Pore Space (%) varied between 52.60 and 66.50. (%). S1 (0-15 cm depth) had the highest value of 66.50 %, while S4 (30-45 cm depth) had the lowest value of 52.60 percent (%) Pore Space was found to decrease with increase in depth attributed to increase in compaction in the sub surface. Surface soils are having high amount of macro and micro pores compared to sub surface soils due to presence of high organic matter similar result was reported by (Yuvarani *et al*., 2019). The water storage capacity (%) varied between 61.11 and 78.12 %. S4 (0-15 cm depth) had the highest value of 78.12 %, while S1 (30-45 cm depth) had the lowest value of 61.11. % WHC value decreases with the increasing depth because of soil compaction and reduction in pore space similar result was reported by (Tale *et al*., 2015).

Variation in Chemical Properties of Saharsa District at different depths (Table 4 and 5).

The pH was between 6.58 and 7.65. S1 (30-45 cm depth) had the highest value of 7.65 and S1 (0-15 cm depth) had the lowest value of 6.58, showing that the soils are moderately neutral to alkaline. pH value increases with the increasing depth because the upper horizons receive maximum leaching by rainfall and by dissolved carbonic acids and presence of high amount of exchangeable sodium ions, similar result was reported by (Marbaniang *et al*., 2021).

Table 4: Evaluation of Chemical properties of soils of Saharsa District

	pH		EC (dS/m)		O.C(%)		CEC (cmol (p+)/kg)	
Treatment/ Farmer's site	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Range**
S_1: (Kahra)	6.58-7.65	7.01	0.19-0.27	0.22	1.14-0.72	0.96	10.28-13.08	11.64
S_2: (Chainpur)	6.66-7.24	6.91	0.29-0.39	0.34	0.98-0.67	0.85	15.37-15.74	15.55
S_3:(Rohua mani)	6.82-7.41	7.12	0.17-0.28	0.22	1.10-0.59	0.86	11.49-11.96	11.77
S_4: (Jajori)	6.66-7.38	6.98	0.25-0.39	0.32	1.19-0.73	1.00	13.85-14.18	14.06
S_5: (Bijwar)	6.96-7.32	7.15	0.18-0.19	0.18	0.95-0.58	0.81	14.08-14.74	14.40
S_6: (Gamrahu)	7.12-7.58	7.32	0.24-0.35	0.29	0.89-0.61	0.77	14.23-14.68	14.51
S_7: (Teghra)	6.67-7.38	7.00	0.26-0.39	0.33	1.12-0.57	0.91	11.23-11.83	11.54
S_8: (Chapram)	7.08-7.48	7.29	0.21-0.24	0.23	1.17-0.77	1.02	12.34-13.12	12.74
S_9: (Baghwa)	7.14-7.62	7.10	0.28-0.37	0.33	1.20-0.74	1.02	11.33-12.88	12.16
	Due to depth	Due to site	Due to depth	Due to site	Due to depth	Due to site	Due to depth	Due to site
F-test	S	NS	S	S	S	S	S	S
S.Ed (±)	0.300605	0.139682	0.1853	0.087704	0.094086	0.059933	0.445796	1.49194
C.D @5%	0.594333	0.000246	1.61006	0.051458	6.64	3.14	0.003134	4.23628
pH-potential of hydrogen, EC- Electrical Conductivity, O.C-Organic Carbon and CEC- Cation Exchange Capacity.								

Table 5: Evaluation of Macronutrients of soils of Saharsa District.

	Avl N (Kg/ha)		Avl P (Kg/ha)		Avl K (Kg/ha)		Avl S (ppm)	
Treatment/ Farmer's site	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**
S_1: (Kahra)	411.12--354.28	381.52	10.79-8.74	9.70	88.41-76.39	82.08	11.39--8.31	9.82
S_2: (Chainpur)	288.35--271.69	298.80	19.21-15.58	17.55	172.7-141.52	151.61	16.18-14.74	15.52
S_3:(Rohua mani)	338.24--274.66	304.78	9.97-8.89	9.42	78.3-81.44	81.95	12.08--10.96	11.59
S_4: (Jajori)	264.92--243.68	268.92	17.68--14.76	16.30	153.72-128.68	141.63	14.68--13.76	14.22
S_5: (Bijwar)	274.77--253.29	284.87	17.48--14.39	15.98	148.76-126.38	138.34	14.77--13.82	14.29
S_6: (Gamrahu)	278.66--244.77	270.33	15.45-12.14	14.09	85.23-81.49	87.00	13.88--12.59	13.17
S_7: (Teghra)	406.54--352.79	379.18	10.88-8.39	9.61	83.62-74.24	77.39	10.89--8.77	9.83
S_8: (Chapram)	384.93--323.66	354.59	9.44-7.28	8.46	76.42-64.12	71.14	9.86--6.83	8.11
S_9: (Baghwa)	424.27--356.24	380.8367	9.55-7.40	8.55	92.26-77.67	85.57	10.45--8.39	9.52
	Due to depth	Due to site	Due to depth	Due to site	Due to depth	Due to site	Due to depth	Due to site
F-test	S	S	S	S	S	S	S	S
S.Ed (±)	30.0328	87.7572	1.27816	1.2691	6.361463	32.63397	2.186522	3.636299
C.D @5%	2.081008	0.00642	5.35	6.34	0.00351	4.35011	0.025598	0.006429
Avl N = Available Nitrogen, Avl P = Available Phosphorus, Avl K = Available Potassium, Avl S= Available Sulphur.								

The electrical conductivity was measured in dS/ m and ranged from 0.17 to 0.39. S2 (30-45 cm depth) had the highest value of 0.39 dS/m, whereas S3 (0-15 cm depth) had the lowest value of 0.17 dS/m. electrical conductivity increases with depth due salt accumulation in lower depth, similar result was reported by (Mohanta *et al*., 2021). The percentage of soil organic carbon ranged from 0.74 to 1.20 %. S9 (0-15 cm depth) had the highest value of 1.20 %, while S3 (30-45 cm depth) had the lowest value of 0.74 %. The organic carbon decreases with increasing depth due to the fact that surface soil contains undecomposed and partial decomposed organic matter while subsoil contains decomposed organic matter which has undergone chemical and biological changes, similar result was reported by (Majhi *et al*., 2020). Nitrogen availability (Kg/ha) varied between 243.68 and 424.27 Kg/ha. S9 (0-15 cm depth) had the highest value of 424.27 Kg/ha, whereas S4 (30-45 cm depth) had the lowest value of 243.68 Kg/ha. The available Nitrogen decreases with the increasing depth due to the fact it is positively correlated with organic matter content which decreases with depth and might be due to higher pH to the depth, similar result was reported by (Kumar *et al*., 2020). Phosphorus availability (Kg/ha) ranged from 7.28 to 19.21 Kg/ha. S2 (0-15 cm depth) had the highest value of 19.21 Kg/ha, whereas S8 (30-45 cm depth) had the lowest value of 7.28 Kg/ha. The available Phosphorous decreases with the increasing depth. Higher level of available Phosphorous in surface soil could be attribute of favourable soil pH and organic matter content, similar result was reported by (Sarma and colleagues 2019). Potassium availability Kg/ha varied from 64.12 to 172.70 Kg/ha. S2 (0-15 cm depth) had the highest value of 172.70 Kg/ha, whereas S2 (30-45 cm depth) had the lowest value of 64.12 Kg/ha. The available Potassium decreases with the increasing depth. The high content of available Potassium on surface soil may be attributed to the release of labile K from organic residues and application of potassium fertilizers, similar result was reported by (Singh *et al*., 2020). Calcium (cmol (p+)/kg) exchangeable ranged from 1.25 to 4.14 cmol (p+)/kg. S2 (0-15 cm depth) had the highest value of 4.14 cmol (p+)/kg, whereas S8 (30-45 cm depth) had the lowest value of 1.25 cmol (p+)/kg. The exchangeable Calcium decreases with the increasing depth due to the attribute of high pH towards the depth, similar result was reported by (Mohanta *et al.,* 2021). Magnesium (cmol (p+)/kg) exchangeable ranged from 0.53 to 3.48 cmol (p+)/kg. S2 (0-15 cm depth) had the highest value of 3.48 cmol (p+)/kg, whereas S7 had the lowest value (30-45 cm depth), 0.53 cmol (p+)/kg. The exchangeable Magnesium decreases with the increasing depth due to the attribute of high pH towards the depth, similar result was reported by (Marbaniang *et al*., 2021). The sodium concentration in the soil (mg/kg) ranged from 160.5 9 to 267.53 mg/kg. S9 (30-45 cm depth) had the highest value of 267.53 mg/kg, whereas S1 (30-45 cm depth) had the lowest value of 160.59 64.12 mg/kg. Sodium decreases with the increasing depth due to the attribute of high pH towards the depth, similar result was reported by (Okolo *et al*., 2016). Sulphur concentrations (ppm) ranged from 6.83 to 16.18 ppm. S2 (0-15 cm depth) had the highest value of 16.18 ppm, while S8 (30-45 cm depth) had the lowest value of 6.83 ppm. The available Sulphur decreases with the increasing depth might be due to greater plant and microbial activities and mineralization of organic matter in surface layer, similar result was reported by (Ghodke *et al*., 2016).

Correlation Matrix between soil Physico-Chemical Properties of Saharsa District at different depths.

Table 6 shows the data on the correlation matrix between physico-chemical parameters of soil in different villages in Saharsa district. WHC (r = -0.5487), phosphorus (r = -0.60629), potassium (r = -0.58248), negatively non significantly correlated particle density (r = -0.36082), CEC (r = -0.35547), and positively significantly correlated pH (r= 0.20659), EC (r= 0.332951), organic carbon (r = 0.245996), positively non-significantly correlated nitrogen (r = 0.54888). The particle density of soil is negatively significant connected with EC (r = -0.57329), organic carbon (r = -0.57516), nitrogen (r = -0.47419), and positively significant correlated with WHC (r= 0.272781), pH (r = 0.20469), phosphorus (r= 0.177385), CEC (r = 0.125322) and potassium (r = 0.197969) have a correlation of 0.197969.

The WHC had a negative significant correlation with nitrogen (r = -0.68959), a non-significant correlation with EC (r= 0.18417), and a positive significant correlation with PH (r= 0.323876), organic carbon (r= 0.068029), phosphorus (r= 0.395382), potassium (r= 0.368893), and CEC (r = 0.403404). EC (r = -0.4332), organic carbon (r = -0.18863), nitrogen (r= -0.1401), phosphorus (r = -0.28473), and potassium (r = -0.49422) are all negatively non-significantly linked with soil pH. CEC was shown to be positively associated (r = 0.001299). The potassium (r = 0.197969) and CEC (r = 0.125322) have a correlation of 0.197969. The WHC had a negative significant correlation with nitrogen (r = -0.68959), a non-significant correlation with EC (r= 0.18417), and a positive significant correlation with PH (r= 0.323876), organic carbon (r= 0.068029), phosphorus (r= 0.395382), potassium (r= 0.368893), and CEC (r = 0.403404). The pH of the soil has a non-significant negative relationship with EC (r = -0.4332), -0.18863 for organic carbon, -0.1401 for nitrogen, -0.28473 for phosphorus, and -0.49422 for potassium. CEC was shown to be positively associated (r = 0.001299). Organic carbon (r = 0.189734), nitrogen (r = 0.062754), phosphorus (r = 0.17453), potassium (r = 0.170595), and CEC (r = 0.174683) are all positively linked with soil EC. Phosphorus (r = -0.49748), potassium (r = -0.26052), CEC (r = -0.48639), and nitrogen (r = 0.586055) are all negatively not significantly connected with soil organic carbon.

Table 6: Correlation between Different Properties of Soil

	Bd	**Pd**	**WHC**	***pH***	**EC**	**OC**	**N**	**P**	**K**	***CEC***
Bd	1									
Pd	-0.36082	1								
WHC	-0.5487	0.272781	1							
pH	0.20659	0.20469	0.323876	1						
EC	0.332951	-0.57329	-0.18417	-0.4332	1					
OC	0.245996	-0.57516	0.068029	-0.18863	0.189734	1				
N	0.548887	-0.47419	-0.68957	-0.14005	0.062734	0.586061	1			
P	-0.60629	0.177385	0.395382	-0.28473	0.17453	-0.49748	-0.80197	1		
K	-0.59647	0.197969	0.368893	-0.49422	0.170595	-0.25524	-0.64502	0.92261	1	
CEC	-0.35547	0.125322	0.403404	0.001299	0.174683	-0.48639	-0.77527	0.913253	0.79647	1

Phosphorus (r = 0.80195), potassium (r = 0.64502), and CEC (r = 0.77527) are all positively non-significantly linked with soil nitrogen. The soil phosphorus has a non-significant positive relationship with potassium (r = 0.922084) and CEC (r = 0.79647).

Conclusion

It is concluded from the trial that the soils of district Saharsa are sandy loam to sandy clay with adequate BD, PD, pore space and water holding capacity. Soil pH is neutral to alkaline as favourable electrical conductivity for plant growth, fertile with high organic content. Some sites showed a deficiency in secondary nutrients calcium, magnesium. Sodium is low to medium in micronutrient and low to medium of macronutrients viz. Nitrogen, Phosphorous, Potassium and Sulphur. Proper integrated soil management should be practised to increase soil health and reduce cultivation costs. Soil health can be improved by using organic fertiliser and following suitable agronomic procedures. The correlation revealed that the soil parameters differ negatively significantly, non-significantly, and favourably significantly, non-significantly.

Acknowledgement

The author expresses his gratitude to the HOD Sir, Advisor, Co-advisor, Co-author, seniors, and juniors of the Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India, as well as the NAI, SHUATS for providing the opportunity to pursue a Master's degree.

Conflict of interest

The authors declare that they have no conflict of interest.

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