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Delineation of soil fertility and nutrient index of Sohaon block soil of Ballia district, U.P.

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Abstract

A experiment was conducted by collected surface soil samples from 31 villages wise composite surface soil sample (0-15 cm) from 31 villages of Sohaon Block (Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur And Dularpur) of Ballia district. After analyses the soil pH was slightly alkaline, EC ranged from 1.032 to 1.044 dS/m, Bd values were varied from 1.5 to 1.6 Mgm^{-3}. The organic carbon content was ranged from 0.30 - to 0.8 %, WHC value was found that 44.5 to 46%, $CaCO_3$ values were from 1.6 to 1.7 % , available nitrogen content was ranged from 103.48 to 307.32 kg ha^{-1} of different village, available phosphorus content was 8.13 to 17.92 kg ha^{-1} of different village, available potassium content was 268.8 to 358.4 kg ha^{-1} of different village, available sulphur content was 7.00 to 8.87 mg kg^{-1}, nutrient index of available nitrogen was 1.064, available phosphorus was 1.77 and for available potassium was 2.54 have been appeared.

Introduction

Nature and properties of soil influence the whole ecosystem. Cultural practices and diversity of crop production practices also affect the particular areas. So that, Sohaon block of Ballia is situated in the western part of the district with riverbank area of Ganga. Total geographical area of the Sohaon block is 1.53 km with 42 number of development village in this block. As per 2011 census block has population 6276 of which 3249 males and 3027 females with 2000 population density. Sohaon block is located on the northern bank of the Ganges river. The productivity of this area is also affected adversely due to floods affection as agro-climate condition, some large area of the district is under wheat followed by barley, lentil, potato, pigeon, chick pea, sugarcane maize and rice, area is covered under oil seed and pulses also. The cropping intensity of the district is only 160.6 percent need affection to increase.

Materials and methods

Climate condition-Sohaon block lies between parallels of 25˚36'57'' N latitude and 84˚00'14'' E longitude. Sohaon is situated 70 meter at sea elevation having average temperature of 32˚C to where 35˚C at maximum and minimum up to 26˚C. About 70 percent of the total annual rainfall is received in the summer monsoon during the period of July to September that coincides with the Kharif cropping period.

Collection of soil samples- The 31 composite surface soil sample (0-15 cm) were collected from villages of Sohaon Block (Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur And Dularpur) of 31 villages of Sohaon Block, Ballia district. Soil sampling was done from five place of each village of 2 areas in five points of fellow crop, when no crop s in field, after collection of samples were made composite sample from five spot of each village.

Preparation of Soil samples -About 500 g per village fresh soil samples were separately processed and air dried, powdered and sieved through 2 mm brass sieve and stored separately in polythene bag for physical, chemical and physico-chemical analysis. The collected surface soil samples from different village were analyses for soil pH, EC, Bulk density, WHC, Organic carbon, Available N, P, K, S, and $CaCO_3$ by using standard method described by different authors. The nutrient index value was computed following the relationship given by Parker *et al.* (1951).

Results and discussion

Soil pH-The soil pH data (Table-1) was from different village of Sohaon block showed pH of all villages viz. Pipara Kala 7.88, Sohaon 7.32, Nasirpur Khan 7.58, Narahi 7.79 , Govindpur Khas 7.95, Sobantha 7.86, Sikandarpur 7.68, Senduriya 7.82, Basantpur Utari 7.83, Bairiya 7.78, Bharouli Khas 8.3, Ujiyar 8.2, Ramgarh Nasirpur Mutkal 8.47, Nasirpur Kalan 8.25, Narayanpur 7.77, Shrawanpur 7.93, Baghawana 8.9, Saryan 8.2, Salempur 8.2, Chaura 8.2, Kathariya 8.1, Amao 7.25, Kutubpur 7.2, Surahi 8.08, Lakhsmanpur 7.87, Saraykota 7.57, Medawrakala 6.77, Tutuwari 6.7, Daulatpur 6.5, Akhtiyarpur 7.7 and Dularpur 6.4. The pH range value was indicated alkaline to alkali of surface soil (0-15cm) was found in all uncroped area. It was also observed that the surface of normal soil had higher pH values as compared to black soil of Sohaon block. The marked differences of pH value of different village might be due to intensive cultivation and pedogenic causes leads to deposition of alkali salts on soil surface similar findings has been given by Durak *et al.* (2010).

Electrical conductivity of soil (EC)-The data in table-1 was reveal that EC of soil sample from all uncroped area of different village soil condition. The EC of the 31 surface soils samples from 31 village viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur under study ranged from 1.041 to 1.050 dSm^{-1} to all village but Ujiyar village was resulted 1.015 dSm^{-1} of the soil. The EC value indicated of all 31 villages were that not much more marked difference and appeared under the considerable range, similar finding has been given by Durak *et al.* (2010).

Bulk Density- Bulk Density data in table-1 of 31 surface soil samples represented of 31 villages viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur,

Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur from Sohaon block were ranged from 1.34 to 1.65 Mg m^{-3} among the village surface soil samples had no marked difference due to similar nature of mechanical proportion. Similar findings has been given by Lee *et al.* (2015).

Organic Carbon content -The organic carbon (%) content data present in table-1 of 31 surface soil samples from 31 villages viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur of Sohaon block were ranged from 0.3 to 0.80 %. The organic carbon content in Ramgarh Nasirpur Mutkal village was very low (0.3%) and Baghawana village was higher value (0.80%) resulted. The higher organic carbon content in few village might be due to root biomass of pulse cropping pattern leads to content of scale of SOC storage and nutrient availability (Jinquan *et al*. 2020). In contrast climate, crop productivity also plays the role in greater value of organic carbon.

$CaCO_3$ content-The calcium carbonate content presented in table-1 in surface soil of Sohaon block of 31 villages viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur were ranged from 0.55 to 5.125%. The $CaCO_3$ from Sarya village was 0.55% show the wide variation of Kutubpur village was 5.125%. The $CaCO_3$ content in the all village soils have might be due to alkaline nature and positive and significant correlation with exchangeable K (Behera *et al.* 2015) and another nutrient element.

Table-1: Status of soil pH, EC, BD, OC and $CaCO_3$ in different village surface soil of Sohaon block

S. No.	Village Name	pH	EC (dSm-1)	BD (Mgm-3)	Organic Carbon (%)	CaCO3 (%)
01.	Pipra Kala	7.88	1.044	1.46	0.538	1.4
02.	Sohaon	7.32	1.042	1.57	0.509	2.7
03.	Nasirpur Khan	7.58	1.043	1.46	0.64	1.35
04.	Narahi	7.79	1.044	1.615	0.39	1.77
05.	Govindpur Khas	7.95	1.043	1.47	0.48	1.55
06.	Sobantha	7.86	1.037	1.64	0.53	2.27
07.	Sikandarpur	7.68	1.041	1.6	0.43	1.57
08.	Senduria	7.82	1.043	1.49	0.71	2.52
09.	Basantpur Utari	7.83	1.043	1.6	0.34	1.95
10.	Bairia	7.78	1.041	1.54	0.74	1.85
11.	Bharauli Khas	8.3	1.047	1.47	0.58	1.475
12.	Ujiyar	8.2	1.015	1.57	0.61	1.3
13.	Ramgarh Nasirpur Mutkal	8.47	1.042	1.475	0.30	1.27
14.	Nasirpur Kalan	8.25	1.043	1.573	0.37	1.375
15.	Narayanpur	7.77	1.043	1.65	0.49	1.15
16.	Sharawanpur	7.93	1.042	1.34	0.68	1.45
17.	Baghawana	8.9	1.044	1.54	0.8	1.35
18.	Sarya	8.2	1.044	1.47	0.65	0.55
19.	Salempur	8.2	1.043	1.47	0.65	1.025

20.	Chaura	8.2	1.043	1.52	0.77	0.975
21.	Katharia	8.01	1.044	1.54	0.74	1.675
22.	Amao	7.25	1.04	1.51	0.62	0.725
23.	Kutubpur	7.2	1.045	1.55	0.58	5.125
24.	Surahi	8.08	1.05	1.53	0.69	1.375
25.	Lakshmanpur	7.87	1.047	1.61	0.466	2.025
26.	Saraykot	7.57	1.046	1.53	0.42	2.55
27.	Meravarakala	6.77	1.049	1.54	0.495	2.025
28.	Tutuwari	6.7	1.040	1.58	0.71	1.475
29.	Daulatpur	6.5	1.046	1.5	0.509	1.175
30.	Akhtiyarpur	7.7	1.049	1.56	0.699	1.6
31.	Dularpur	6.4	1.049	1.54	0.640	1.275

Water Holding Capacity (%)- Water holding capacity (table-2) form 31 surface soil samples from 31 villages viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur of village were ranged from 34.98% to 60.85%. The greater WHC value was observed in Govindpur Khas (64.85 %) village soil as compared to Bhagwana (34.98%) village soil. Greater content might be due to higher value of clay and organic carbon content.

Available Nitrogen Content (kg ha^{-1})- Surface soil samples from 31 villages viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur from the Sohaon block surface (0-15cm) soil sample of uncroped area ranged from 103.48 to 307.32 kg ha^{-1}. Greater value available nitrogen content was observed in (kg/ha) from Sohaon (307.32 kg/ha) village as compared to lower value of Sharawanpur (103.48 kg/ha) village. The greater value of available nitrogen might be due mineralization of organic form of nitrogen by organic matter decomposition and short of microbial activity (Lee *et al*. 2015) in surface soil.

Available Phosphorus Content (kg ha^{-1})- Surface soil (table.2) samples from 31 villages viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur village of Sohaon block were ranged from 8.13 to 17.92 kg/ha. Greater value of available phosphorus was found in Basantpur Uttari (17.92 kg/ha) village as compared to leaser value of 8.21 in Daulatpur village soil. The greater value of $CaCO_3$ content leads to phosphorus fixation in soil. The similar findings have been given by Singh and Mishra (2012).

Available Potassium (kg ha^{-1}) Content- surface soil (table.2) samples from different village of Sohaon block viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur village were ranged

from 268.8 kg ha^{-1} to 358.4 kg ha^{-1}. The greater amount of available potassium content was formed in Surahi and Ujiyar village as compared to Daulatpur, Sikandarpur and Sohaon village. The greater of available K content in crop (Singh *et al.* 2023) land might be due to pedogenic process.

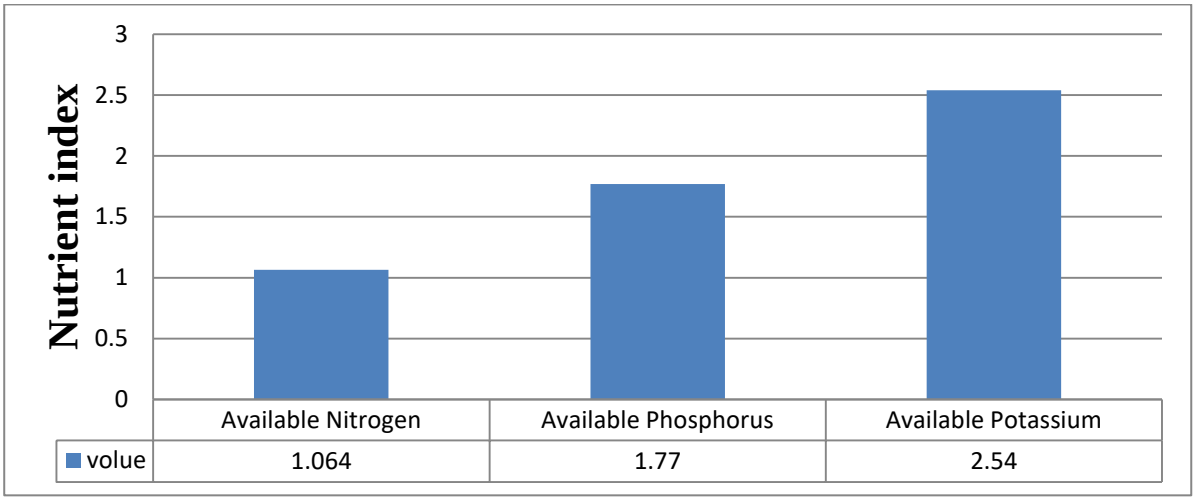
Available Sulphur (mg kg^{-1}) Content- Surface soil (table. 2) samples from 31 villages viz. Pipara Kala, Sohaon, Nasirpur Khan, Narahi, Govindpur Khas, Sobantha, Sikandarpur, Senduriya, Basantpur Utari, Bairiya, Bharouli Khas, Ujiyar, Ramgarh Nasirpur Mutkal, Nasirpur Kalan, Narayanpur, Saraykota, Shrawanpur, Baghawana, Sarya, Salempur, Chaura, Kathariya, Amao, Kutubpur, Surahi, Lakhsmanpur, Medawrakala, Tutuwari, Daulatpur, Akhtiyarpur and Dularpur village were ranged from 7.06 mg kg^{-1} to 8.87 mg kg^{-1}. The greater amount of available sulphur (8.87 mg kg^{-1}) was found in soil of Ramgarh Nasirpur Mutkal as compared to leaser amount (7.0 mg kg^{-1}) it might be due to pedogenetic process. Similar tinelings have been given by Reza *et al*. (2019).

Table-2: Status of available nitrogen, phosphorus, potassium and sulphur in surface soil of Sohaon block

S. No.	Name of Village	W.H C.(%)	Available Nitrogen (kg ha^{-1})	Available Phosphorus (kg ha^{-1})	Available Potassium (kg ha^{-1})	Available Sulphur (mg kg^{-1})
01.	Pipra Kala	52.12	297.92	9.65	190.4	8.5
02.	Sohaon	45.38	307.32	12.16	246.4	7.125
03.	Nasirpur Khan	45.31	107.8	12.25	257.6	7.25
04.	Narahi	45.66	166.2	12.16	246.4	7.75
05.	Govindpur Khas	60.85	119.16	16.44	268.8	8.0
06.	Sobantha	52.08	153.66	9.74	257.6	8.0
07.	Sikandarpur	39.83	150.52	9.65	246.4	8.125
08.	Senduria	38.73	141.12	12.51	268.8	8.12
09.	Basantpur Utari	45.48	100.35	17.92	291.2	8.0
10.	Bairia	47.5	159.93	17.74	280.0	8.12
11.	Bharauli Khas	44.63	137.98	12.25	313.6	8.0
12.	Ujiyar	45.81	172.48	13.06	358.4	8.87
13.	Ramgarh Nasirpur Mutkal	42.45	156.8	13.96	324.8	8.87
14.	Nasirpur Kalan	46.35	122.3	13.06	313.6	8.62
15.	Narayanpur	47.79	137.98	9.30	268.8	8.25
16.	Sharawanpur	52.3	103.48	12.54	324.8	8.12
17.	Baghawana	34.98	104.76	14.33	302.4	7.75
18.	Sarya	51.62	225.79	13.44	313.6	7.5
19.	Salempur	39.58	107.21	15.23	313.6	7.87
20.	Chaura	50.58	106.62	11.27	302.4	7.5
21.	Katharia	53.8	156.8	8.31	336.0	7.62
22.	Amao	54.09	185.02	12.88	313.6	7.5
23.	Kutubpur	50.92	147.39	11.18	336.0	7.87
24.	Surahi	50.65	125.44	16.12	358.4	8.0

25.	Lakshmanpur	58.22	131.71	15.23	336.0	8.0
26.	Saraykot	55.07	106.44	16.12	302.4	7.625
27.	Meravarakala	44.1	108.4	14.33	257.6	7.0
28.	Tutuwari	51.52	119.16	9.21	302.4	7.75
29.	Daulatpur	55.0	116.03	8.13	268.8	8.0
30.	Akhtiyarpur	48.27	122.0	15.23	280.0	7.25
31.	Dularpur	44.77	112.89	10.02	246.4	8.12

Figure-1 Nutrient index of different village of Sohaon Block



Nutrient Index- Nutrient index for soil fertility in table-3 and figure-5 from different village of Sohaon block soil was low, medium and high. The NI ratings of <1.5, 1.5-2.5 and >2.5 to represent low, medium and high fertility of soils of given area, respectively. The nutrient index of available nitrogen showed that the 29 village was low and 2 village nutrient index was medium. The results of available nitrogen was 1.064 falls in medium fertility levels. The nutrient index of available phosphorus showed that the 7 villages of available phosphorus is low and 24 village nutrient index was medium. The result of available phosphorus was 1.77 falls in medium fertility level. The nutrient index available potassium showed that the 14 village was medium and 17 village nutrient index was high (Singh *et al*. 2023). The result of available potassium was 2.54 medium fertility level appeared.

Conclusion

The soil pH surface soil it becomes varied with village to village of slightly akaline, EC, WHC, $CaCO_3$ and Bd values were not much more difference of surface soil in all villages, organic carbon was observed in varied fluctuation as per village. The available nitrogen and available phosphorus content was noticed in the surface soil showed in medium ranges, available potassium content was noticed in the surface soil from medium to higher range, available sulphur content was also in lower range of different village of Sohaon block. The nutrient index of available nitrogen was fallen in medium fertility levels, available phosphorus and available potassium were falls medium fertility level.

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