Short Communication

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Chemical Characterization of Ganga Basin Soils of Western Uttar Pradesh

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The indiscriminate use of fertilizers under intensive cropping system deteriorates the soil health and in turn productivity of crops and also pollutes the ecosystem (Prasad 2004 and 2015). Hence, it becomes necessary to study the changes in soil properties for efficient management of the soil for sustained production. Keeping this in view, the present study was undertaken to characterize the soils at two distances (1000 m and 3000 m) from a reference point (Upper Ganga Canal) in three districts namely, Muzaffarnagar, Meerut and Ghaziabad of Western Uttar Pradesh. The soil sampling (0-15 and 15-30 cm) was done on the right side (RS) of Ganga canal (as a base line) at the distance of 1000 and 3000 m from each alternate bridge between Purkazi and Muradnagar using GPS.

The soil samples (0-15 and 15-30 cm) from Muzaffarnagar (Purkazi, Belda, Jauli, and Tajpur), Meerut (Kaili Sakauti, Nanu and Bhole ki Jhaal) and Ghaziabad (Nanglai, Sonda and Aboopur) districts under different cropping pattern were collected and stored in polythene bags. Collected soil samples were air-dried, processed and stored in polythene bags for analysis. The soil samples were analyzed for pH and electrical conductivity (1:2 soil water suspensions), organic matter content, exchangeable cations (Ca^{++}, Mg^{++}, Na^{+}), anions (Cl^{-}, CO_3^{--}, HCO_3^{-}) and SAR following standard procedures.

The soil pH ranged from 7.10 to 8.18 and 7.23 to 8.33 at 1000 m distance and 7.12 to 7.93 and 7.07 to 8.33 at 3000 m distance in surface and sub-surface layers, respectively (Table 1). In general, soil pH decreased with distance and increased with depth owing to deposition of leached salt. Bhatt *et al.* (2017) reported similar findings in the soils of Gohana, Haryana. The electrical conductivity ranged from 0.11 to 0.98 dS m^{-1} and 0.20 to 1.52 dS m^{-1} at 1000 m distance and 0.13 to 0.87 dS m^{-1} and 0.21 to 1.05 dS m^{-1} at 3000 m distance in surface and sub-surface layers, respectively (Table 1), being higher at Bhole ki Jhaal due to higher upward movement of salts with evaporating water.

The organic carbon content at different locations ranged from 10.23 to 14.49 g kg^{-1} and 6.32 to 9.55 g kg^{-1} at 1000 m distance and 9.63 to 14.26 d g kg^{-1} and 7.21 to 10.13 g kg^{-1} at 3000 m distance in surface and sub-surface layers, respectively (Table 1), being higher in surface layer due to addition of plant residue and manure application. The change in organic matter content at two sites might be due to the cropping system and agro-management. Kumar *et al.* (2013) observed that the addition of farmyard manure and plant residue at the surface of the soils resulting in higher organic carbon.

Exchangeable Ca^{++} + Mg^{++} content in different locations soils ranged from 0.50 to 4.10 cmol (p+) kg^{-1} and 0.70 to 6.20 cmol (p+) kg^{-1} at 1000 m distance and 0.60 to 3.50 cmol (p+) kg^{-1} and 0.80 to 4.70 cmol (p+) kg^{-1} at 3000 m distance in surface and sub-surface layers, respectively (Table 1), being higher in subsurface layer

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Table 1. Chemical properties of soils at two depth and distance from Ganga canal

Location	Depth (cm)	Distance (m) from Ganga canal									
		Soil pH		Soil EC (dSm^{-1})		Organic matter ($g\ kg^{-1}$)		Exchangeable $Ca^{++}+Mg^{++}$ ($cmol\ (p+)\ kg^{-1}$)		Exchangeable Na^{+} ($cmol\ (p+)\ kg^{-1}$)	
		1000 m	3000 m	1000 m	3000 m	1000 m	3000 m	1000 m	3000 m	1000 m	3000 m
Purkazi	0-15	7.45	7.25	0.25	0.13	11.56	14.26	1.2	0.6	1.4	0.9
	15-30	7.64	7.44	0.23	0.29	9.55	10.13	1.1	1.3	1.6	1.7
Belda	0-15	7.56	7.65	0.39	0.24	13.18	12.23	1.4	0.8	2.5	1.4
	15-30	7.98	7.84	0.21	0.21	8.24	8.12	0.7	0.9	1.2	1.1
Jauli	0-15	7.35	7.36	0.11	0.33	12.14	12.23	0.5	1.3	1.1	2.9
	15-30	7.87	8.11	0.28	0.23	9.34	9.12	1.0	0.8	1.7	1.2
Tajpur	0-15	7.20	7.55	0.98	0.79	14.34	10.23	4.1	3.4	5.2	4.3
	15-30	7.68	7.85	0.32	0.21	8.43	7.82	1.2	0.9	1.8	1.4
Kaili (Sakoti)	0-15	7.55	7.20	0.28	0.21	10.23	9.63	1.0	0.8	1.8	1.3
	15-30	7.92	7.07	0.20	0.26	9.21	7.24	1.0	1.1	1.4	1.5
Nanu	0-15	7.10	7.37	0.62	0.37	13.45	12.11	2.4	1.6	4.3	2.1
	15-30	7.23	7.22	0.49	0.64	8.21	9.11	1.4	2.7	3.1	3.9
Bhole ki Jhaal	0-15	7.47	7.93	0.48	0.21	14.49	13.21	1.7	1.0	2.8	1.8
	15-30	7.74	8.11	1.52	1.05	8.13	7.23	6.2	4.7	9.4	5.9
Nanglai	0-15	8.18	7.12	0.32	0.73	14.26	11.11	1.2	2.8	2.1	4.3
	15-30	8.33	7.36	1.23	0.56	8.13	8.24	5.1	2.3	7.5	3.5
Sonda	0-15	7.31	7.25	0.22	0.87	13.18	14.13	0.7	3.5	1.6	5.4
	15-30	7.45	7.30	0.21	0.45	5.92	7.42	0.9	1.2	1.7	2.7
Abupur	0-15	7.85	7.75	0.22	0.38	12.14	10.12	1.1	1.4	1.8	2.4
	15-30	7.95	7.88	0.27	0.84	6.32	7.21	1.2	3.3	1.9	5.3

and it decreased with increasing distance. Exchangeable sodium in different locations soils ranged from 1.10 to 5.20 cmol (p+) kg^{-1} and 1.20 to 9.40 cmol (p+) kg^{-1} at 1000 m distance and 0.90 to 5.40 cmol (p+) kg^{-1} and 1.10 to 5.90 cmol (p+) kg^{-1} at 3000 m distance in surface and sub-surface layers, respectively (Table 1), being higher in subsurface layer. High Na^{+} at Bhole ki Jhaal site might be due to the presence of brackish water. A similar finding was also observed by Chaudhary (2015). The SAR value in different locations soils ranged from 1.81 to 3.94 and 2.0 to 5.34 at 1000 m distance and 1.66 to 4.09 and 1.64 to 4.14 at 3000 m distance in surface and sub-surface layers, respectively (Table 2), being higher in the subsurface layer. Chaudhary (2015) also reported similar findings in the soils of Saharsa district of Bihar.

Chloride content ranged from 1.10 to 5.40 mg l^{-1} and 0.28 to 8.60 mg l^{-1} at 1000 m distance and 0.80 to 5.20 mg l^{-1} and 1.40 to 6.20 mg l^{-1} at 3000 m distance in surface and sub-surface layers, respectively (Table 2), being higher in subsurface layer and decreased with increasing distance. The carbonate was absent in most of the soil samples. Bicarbonate content ranged from 0.80 to 4.30 mg l^{-1} and 0.90 to 7.10 mg l^{-1} at 1000 m distance and 0.60 to 4.60 mg l^{-1} and 1.10 to 4.60 mg l^{-1} at 3000 m distance in surface and sub-surface layers, respectively (Table 2), being higher in subsurface layer and it decreased with increasing distance. Distribution of HCO_3^- did not follow any specific trends with depth.

The soils of the different locations around Ganga Canal in Meerut, Muzaffarnagar and Ghaziabad were normal to alkaline, non-saline and low to high in organic matter content. These soils were low in cations of Na^{+}, $Ca^{++} + Mg^{++}$ but sufficient in Cl^-, CO_3^{--} and HCO_3^-.

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