

Characterization of Some Typical Alluvial Soils of Northern Madhya Pradesh

R. P. S. Tomar* and P. S. Tomar

ABSTRACT: Four typical pedons were studied for their morphological, physical and chemical properties in Morena district of Madhya Pradesh. The colour of surface horizon varied from yellowish brown to dark yellowish brown. Generally calcrets occurred in lower horizon whereas clay skins at the depth of 0.55 to 1.23 m. Texturally the soils were sandy loam on surface but sandy clay loam in subsurface. The pH of different horizons ranged from 7.5 to 8.3 and that of electrical conductivity from 0.11 to 0.25 dSm⁻¹. The organic carbon was low in surface soils and decreased with depth. Based on morphological, physical and chemical characteristics Badagaon and Dongarpur soils were classified as Typic Haplustalfs while that of Sirmiti and Matabasaiya as Typic Haplustepts.

INTRODUCTION

The soils of Morena district have developed in river alluvium and have no consistent relation between successive horizons. These soils are in a transitional stage starting with the hydromorphic conditions followed by an improvement in drainage conditions which give rise to normal soils when alluvium becomes stabilized. The old alluvial soils of Chambal command area are saline and calcareous (Gupta, 1985) and at places have argillic horizon and clay skins. The introduction of canal water for irrigation in Morena district resulted in the formation of saline and sodic soils (Gupta, *et al.* 1986). The present study was aimed to systematically characterize four typical soils of Morena tehsil, Morena (M.P.) and classify according to soil taxonomy for better interpretation.

MATERIAL AND METHODS

The study area forms a part of Morena district characterized by semi-arid climate with an average precipitation of 700 mm. The soil moisture regime is ustic. The hottest month is June with temperature up to 46°C and January is the coldest month having temperature as low as 2°C hence the soil temperature regime is hyperthermic. The natural vegetation are mango, neem, ber and babool trees. The dominant crops grown are pearl millet, sorghum, wheat, mustard and chickpea. Four soil profiles in Morena tehsil were dug up to the exposure of parent material

or two meters and were morphologically described. Soil samples collected from different horizons were analysed for various physical and chemical parameters following standard procedures. Soil textures were determined by the proposed technique (Gupta and Sinha, 1985) and taxonomically classified (Soil survey staff, 1998).

RESULTS AND DISCUSSION

The pedons under investigation occur on very gentle slopes to nearly flat land. The area is drained by tributaries of rivers like Kunwari and Chambal. The elevation of the area varies from 300 to 400 m MSL. The morphological and physical characteristics of all the soils studied are presented in table-1. The soil colour was yellowish brown (10YR 4/4) to brown (10YR 4/3) in Badagaon (P1) and Dongarpur (P3) soil profiles. Sirmiti (P2) and Matabasaiya (P4) had similar matrix colour in surface layers as of P1 and P3 but colour of subsurface horizons was brown to dark greyish brown (Gupta and Tembhare, 1985, Gupta and Tembhare, 1997).

The texture of surface horizon was sandy loam in the profiles. The subsurface texture of P1 was dominantly sandy clay loam, sandy loam to sandy clay loam in P3 and sandy clay loam to clay loam in P2 and P4. Patchy thin clay skins were noticed in pedon 1 and 3 within the depth from 0.55 to 1.23 m confirming the presence of argillic horizon. The soils

* RVSKVV, Special Agriculture Research Station, Bhind (M. P.), E-mail: rpstomar2007@rediffmail.com, sars.bhind@rediffmail.com

Table 1
Morphological and physical properties of different pedons

Horizon	Depth (m)	Colour (Moist)	Structure Consistency	Sand (%)	Silt (%)	Clay (%)
P1 Badagaon						
Ap	0.00 – 0.20	10YR 4/4	gr, dl,mvfr,wss,wpo	70.4	14.8	14.8
Bw	0.20 – 0.55	10YR 4/4	m1sbk ds,mfr,wss,wps	55.6	21.2	23.2
Bt1	0.55 – 0.93	10YR 4/3	m1sbk dh,mfi,ws,wp	49.2	23.8	27.0
Bt2	0.93 – 1.45	10YR 5/4	m2sbk dh,mfi,ws,wp	46.8	23.4	29.8
C	1.45 – 1.85	10YR 4/3	massive dh,mfi,ws,wp	47.6	25.6	26.8
P2 Sirmiti						
Ap	0.00 – 0.14	10YR 4/3	gr, ds,mfr,wss,wps	50.4	33.2	16.4
Bw1	0.14 – 0.30	10YR 4/3	m1sbk dsh,mfr,wso,wpo	47.2	32.4	20.4
Bw2	0.30 – 0.66	10YR 3/3	m2sbk dh,mfi,ws,wp	44.6	29.7	25.7
Bw3	0.66 – 1.23	10YR 3/3	m2sbk dh,mfi,ws,wp	39.5	24.4	36.1
Bw4	1.23 – 1.65	10YR 4/3	m2sbk dh,mfi,ws,wp	45.8	26.2	28.0
C	1.65 – 1.80	10YR 3/4	m2sbk dsh,mfr,wss,wps	43.2	25.8	31.0
P3 Dongarpur						
Ap	0.00 – 0.24	10YR 4/4	gr, dl,mvfr,wso,wpo	63.4	20.2	16.4
Bw	0.24 – 0.49	10YR 4/4	f1sbk ds,mvfr,wss,wps	58.2	18.1	23.7
Bt1	0.49 – 0.81	10YR 4/3	m1sbk dsh,mfr,wss,wps	55.5	18.1	26.4
Bt2	0.81 – 1.35	10YR 4/4	m1sbk dsh,mfr,wss,wps	48.6	21.2	30.2
C1	1.35 – 1.66	10YR 4/4	f1sbk dsh,mfr,wss,wps	57.4	16.7	25.9
C2	1.66 – 1.85	10YR 4/3	f1sbk dsh,mfr,wss,wps	61.2	19.5	19.3
P4 Matabasaiya						
Ap	0.00 – 0.19	10YR 4/4	gr, dl,mfr,wso,wpo	66.7	20.2	13.1
Bw1	0.19 – 0.60	10YR 4/2	m1sbk dh,mfi,ws,wp	50.5	26.7	22.8
Bw2	0.60 – 0.95	10YR 4/3	m2abk dvh,mvfi,ws,wp	44.8	25.2	30.0
Bw3	0.95 – 1.30	10YR 4/2	m2abk dvh,mfi,ws,wp	41.6	26.8	32.2
Bc	1.30 – 1.75	10YR 4/2	m2abk dh,mfi,ws,wp	40.2	29.6	30.2
C	1.75 – 2.00	10YR 4/3	m2sbk ds,mfr,wss,wps	49.9	31.7	18.4

Table 2
Chemical properties of soils

Horizon	pH (1:2)	EC (dSm ⁻¹)	Org.C (g kg ⁻¹)	CaCo ₃ (g kg ⁻¹)	CEC	Ca	Mg [Cmol (p+) kg ⁻¹]	K	Na
P1 Badagaon									
Ap	7.9	0.18	2.9	11.5	12.1	8.4	0.8	0.66	0.21
Bw	7.5	0.17	2.7	15.0	17.2	13.6	1.7	0.51	0.25
Bt1	7.8	0.19	2.8	20.0	20.5	15.8	1.8	0.56	0.80
Bt2	8.0	0.22	2.4	26.0	23.4	19.0	2.4	0.56	0.71
C	8.1	0.25	1.6	75.0	23.4	20.0	1.6	0.52	0.56
P2 Sirmiti									
Ap	8.0	0.20	4.3	13.5	15.2	11.2	1.3	0.58	0.53
Bw1	7.8	0.15	3.7	13.0	16.4	11.4	1.7	0.57	0.88
Bw2	7.9	0.09	3.0	13.0	22.0	17.0	2.3	0.57	0.86
Bw3	7.6	0.15	2.4	13.5	23.3	18.2	2.4	0.51	0.86
Bw4	7.6	0.14	1.6	13.0	24.9	20.0	2.8	0.52	0.46
C	7.9	0.17	1.2	95.0	25.4	20.4	4.1	0.55	0.65
P3 Dongarpur									
Ap	8.0	0.16	3.8	8.5	14.1	11.4	0.9	0.42	0.41
Bw	8.0	0.17	3.6	8.3	17.4	13.2	1.7	0.44	0.67
Bt1	7.9	0.15	1.8	16.1	22.5	17.4	2.8	0.46	0.70
Bt2	8.2	0.21	1.5	16.0	23.8	18.0	3.1	0.49	0.70
C1	8.1	0.22	1.4	11.4	20.1	15.4	2.7	0.50	0.91
C2	8.3	0.18	1.3	70.0	16.4	12.0	2.3	0.49	0.82
P 4 Matabasaiya									
Ap	8.0	0.14	2.5	13.0	14.2	10.5	2.0	0.79	0.31
Bw1	8.1	0.14	2.0	14.0	17.3	13.0	1.7	0.87	0.52
Bw2	8.0	0.15	1.2	14.5	19.2	15.0	1.6	0.76	0.42
Bw3	8.0	0.17	1.2	14.5	19.5	14.7	2.1	0.71	0.24
BC	8.1	0.11	0.5	17.0	18.7	14.5	2.4	0.72	0.25
C	8.2	0.13	0.4	19.0	16.8	12.4	2.1	0.83	0.44

were slightly alkaline to strongly alkaline in reaction and calcareous with CaCO_3 (Table-2) content ranging from 8.3 to 95.0 g kg^{-1} through depth. The organic carbon content was low (0.4 to 4.3 g kg^{-1}) in different layers. Cation exchange capacity of these soils ranged from 12 to 25.6 Cmol (p+) kg^{-1} with calcium as dominating cation on the exchange complex. The CEC and exchangeable Ca increased with increasing clay content in the profiles as reported by Gupta and Tembhare, 1997.

Soil classification : The Badagaon and Dongarpur soils were classified as under Typic Haplustalf, a subgroup category of the order Alfisol. In the fine earth fraction, arigillic horizon, ustic soil moisture regime, mixed mineralogy exist and therefore, these pedons were classified as fine loamy, mixed hyperthermic, Typic Halplustalfs at family level. However, Sirmiti and Matabasaiya soils were classified as fine loamy, mixed, hyperthermic, Typic Haplusteps at family level due to the presence of

ochric epipedon, cambic horizon, ustic moisture and hyperthermic temperature regime and fine loamy particle size class (Soil survey staff, 1998).

REFERENCES

- Gupta, G. P. (1985), New triangle diagrams for the determination of soil texture. *JNKVV Res. J.* 19:50.
- Gupta, G. P. and Sinha, S. B. (1985), Some improvements over old methods of soil texture determination. *Abstract 50th Annual Con. ISSS Anand, Gujrat*, Nov. 4-7, 1985, PP 34.
- Gupta, G.P., Tembhare, B.R., Seth, K.K. and Sinha, S. B. (1986), Some newly proposed soil series of Chambal region, Madhya Pradesh, *JNKVV Res. J.* 20:117.
- Gupta, G.P. and Tembhare, B.R. (1997), Characterization of some typical alluvial soils of northern Madhya Pradesh. *JNKVC Res. J.* 31 (1&2): 27-32.
- Soil Survey Staff (1988), *Keys to soil Taxonomy 8th Edition*. Soil conservation service, SMSS, United States Department of Agriculture, Washington, USA.

