

Characterization and classification of soils of Nagarjunasagar catchment in Shorapur taluk of Gulbarga district, Karnataka state

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Abstract : A detailed soil survey was carried out in the Ag5a, Ag5b, Ag5c, Ag5h and Ag5j sub-watersheds of Nagarjunasagar Catchment in Shorapur Taluk of Gulbarga district, Karnataka covering an area of 24604 ha. spread over 45 villages. The survey area is represented by five major physiographic units, namely, hill side, foot hills, pediments, pediplains and alluvial plains developed over alluvium, granite, limestone and shale. Nineteen soil series were identified, out of which, three series lie on hills and foot hills, four series on pediments, nine series on pediplains and remaining three into alluvial plains. The soils of hills, foot hills and pediments are shallow, well drained, rapidly permeable, light coloured, loamy-skeletal to fine-loamy, have low fertility and have developed over shale and granite and are classified as Lithic Ustorthents. These soils represent the forest, pasture, grazing, waste land and also rainfed cultivation at places. Soils of pediplains and alluvial plains are moderately deep to very deep, moderately well drained to well drained, slow to moderately permeable, light to dark coloured, fine-loamy to fine and have developed over alluvium, granite and limestone and classified as Typic Haplustepts, Vertic Haplustepts, Typic Haplustalfs, Typic Natrustalfs, Udic Haplustalfs, Leptic Haplusterts, Sodic Haplusterts, and Calcic Haplusterts. These soils are low to medium in fertility, cultivated as rainfed and irrigated.

Additional key words : Detailed soil survey, soil morphology, physico-chemical characteristics

Introduction

Soils are considered as the integral part of the landscape and their characteristics are largely governed by landforms on which they are developed. Detailed information on soils is necessary for agricultural

planning and management. The present paper highlights the detailed soil survey undertaken to characterize and classify the soils of Nagarjunasagar catchment in forty five villages of Shorapur Taluk in Gulbarga district of Karnataka state on 1:7920 scale.

Material and Methods

General description of the area

The study area comprising Ag5a, Ag5b, Ag5c, Ag5h and Ag5j subwatersheds of Nagarjunasagar catchment in Shorapur taluk of Gulbarga district, Karnataka lies between 16° 24' to 16° 33' N latitudes and 76° 30' to 76° 47' E longitudes with geographical area of 24604 ha. Alluvium, granite, limestone and shale are the main geologic formations in the survey area. The granite rocks are medium to coarse textured, dark coloured, possessing distinct petrological characters with rhombic pyroxene hypersthene and a high quality of the dark ferromagnesian compound which gives it dark colour. The climate is semi-arid type. The total annual rainfall is 731 mm, of which 90.3 percent occurs between June to October. The mean annual temperature is 27.6°C, and the mean summer soil temperature and mean winter soil temperature are 29.7°C and 23.9°C, respectively. The soil moisture regime is 'ustic' and soil temperature regime is 'isohyperthermic'.

Physiographically, the area has been divided into hill side, foot hills, pediments, pediplains and alluvial plains. The hills are moderately to steeply sloping (10-33% slope) and occur at an altitude between 400 to 503 m above MSL whereas most of the area surrounding the hills represents very gentle to gentle (1-5%) slopes of pediments, pediplains and alluvial plains and occur at an altitude between 360 to 400 m above MSL. The Ag5a and Ag5c sub-watersheds are drained from north to south and Ag5b, Ag5h and Ag5j sub-watersheds are drained from west to east through Devapur nala that joins the river Krishna directly at near or by Shellagi village in Shorapur taluk, Gulbarga district. The drainage pattern is sub-parallel to parallel with moderate to severe soil erosion.

Soil Survey Methodology

Detailed soil survey of the area was carried out using cadastral map of 1:7920 based on grid system (Soil Survey Staff 2000; AIS and LUS 1970). Soil pedons were studied in different physiographic units. Horizon-wise soil samples were collected from typical

pedons and analyzed for their physico-chemical characteristics with standard procedures (Black 1985; Jackson 1979). The soils were classified upto family level (Soil Survey Staff 1999).

Results and Discussion

Nineteen soil series, namely, Ammapur, Birnur, Chennampalli, Chennur, Devapur, Fatepur, Gabbur, Holiguda, Hosur, Kaladevanahalli, Kambalapalli, Kawadimutti, Kondapur, Kurvihall, Shellagi, Talawargera, Tumkur, Venkatapur and Wadagera were identified and mapped based on their morphological and physico-chemical properties and classified at family level.

Soil Morphology

The soils of Chennampalli series occurring on hills are shallow, well drained and rapidly permeable. They are brown (7.5 YR 4/4) to dark brown (7.5 YR 3/3) in colour and have gravelly sandy clay loam texture with fine, weak subangular blocky structure with 34 to 40% gravels developed from granite (Table 1). These soils are mostly under forest and occupy an area of 10.9% of the total surveyed area. Lithic contact is within 50 cm from the surface. Ammapur and Kambalapalli soils of foot hills are shallow, well drained, rapidly permeable, reddish brown (2.5 YR 4/4) to dark reddish brown (5 YR 3/4) in colour and developed from granite and shale. These soils represent the forest land and occur on moderately sloping (3-10%) foot hills and cover an area of 3.3%. The soils of Birnur, Devapur, Hosur and Kondapur series of pediments are shallow, well drained, rapidly permeable and reddish brown (2.5 YR 3/4) to dark reddish brown (5 YR 3/4) and very dark grayish brown (10 YR 3/2) colour developed from granite and shale. These soils represent the forest and waste lands on moderately (3-10%) sloping pediments and cover an area of 5.2%. Soils belonging to Chennur, Fatepur, Gabbur, Holiguda, Kaladevanahalli, Kawadimutti, Talawargera, Tumkur and Wadagera series occurring on pediplains while those of Kurvihall, Shellagi and Venkatapur series occurring on alluvial plains are moderately deep to very deep, moderately

Table 1. Morphological characteristics of soils*

Horizon	Depth (cm)	Colour (moist)	Texture	Structure	Gravel (%)	Consistence			Cutans/ Slikensides/ Cracks (cm)	Boundary	Pores	Roots	Effervescence
						(dry)	(moist)	(wet)					
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hill side slope (10-33% slope) Granitic landscape													
1. Chennampalli: Loamy- skeletal, mixed, isohyperthermic Lithic Ustorthents													
A	0-9	7.5 YR 3/3	scl	f1sbk	34	dsh	mfr	wss wps	-	cs	f-f	f-f	-
AC	9-23	7.5 YR 3/3	scl	m2sbk	40	ds	mfr	wss wps	-	gs	f-f	vf-f	-
R	23 +												
Hard rock													
Foot hill slope (3-10% slope) Granitic landscape													
2. Kambalapalli: Loamy- skeletal, mixed, isohyperthermic Lithic Ustorthents													
Ap	0-10	5 YR 3/4	sl	f1sbk	25	dl	mvfr	wso wpo	-	cs	f-m	vf-f	-
A12	10-22	5 YR 3/4	scl	f1sbk	33	dsh	mfr	wss wps	-	gw	f-m	vf-f	-
R	22 +												
Hard rock													
Foot hill slope (3-10% slope) Shale landscape													
3. Ammapur: Loamy, mixed, isohyperthermic Lithic Ustorthents													
A	0-8	2.5 YR 4/4	scl	f1sbk	15	ds	mfr	wss wps	-	gs	f-f	f-f	e
AC	8-12	2.5 YR 4/4	scl	f1sbk	17	ds	mfr	wss wps	-	gs	f-f	f-f	e
R	12 +												
Hard rock													
Pediments (3-10% slope) Granitic landscape													
4. Birnur: Loamy, mixed, isohyperthermic Lithic Ustorthents													
Ap	0-7	2.5 YR 3/4	scl	m1sbk	15	dh	mfr	wss wps	-	cs	f-vf	f-f	-
A12	7-19	2.5 YR 3/4	scl	m2sbk	18	dh	mfr	ws wp	-	cs	f-vf	vf-f	-
R	19 +												
Hard rock													

contd.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
5. Kondapur: Sandy- skeletal, mixed, isohyperthermic Typic Ustorthents													
Ap	0-9	7.5 YR 4/4	ls	flgr	60	dl	mvfr	wso wpo	-	cs	f-f	f-p	-
AC1	9-24	7.5 YR 4/4	ls	flgr	67	dl	mvfr	wso wpo	-	cs	f-f	f-p	-
AC2	24-35	7.5 YR 4/4	ls	flgr	80	dl	mvfr	wso wpo	-	cs	f-f	f-p	-
Cr	35-60												
Weathered granite													
Pediments (3-10% slope) Shale landscape													
6. Devapur: Loamy, mixed, isohyperthermic Lithic Ustorthents													
Ap	0-10	10 YR 3/2	cl	m2sbk	8	dh	mfi	ws wp	-	cs	c-f	vf-p	e
A12	10-16	10 YR 3/2	cl	m2sbk	12	dh	mfi	ws wp	-	gs	c-f	vf-f	es
R	16+												
Hard Rock													
7. Hosur: Loamy, mixed, isohyperthermic Lithic Ustorthents													
Ap	0-12	5 YR 3/4	sl	flgr	10	dsh	mfr	wss wps	-	cs	f-f	f-f	
A12	12-24	5 YR 3/4	scl	m2sbk	12	dh	mfi	ws wp	-	-	f-f	f-f	
R	24+												
Hard rock													
Pediplains (1-5% slope) Granitic landscape													
8. Fatepur: Clayey, smectitic, isohyperthermic Vertic Haplustepts													
Ap	0-8	10 YR 3/2	c	flsbk	-	dh	mfi	ws wp	2-3	cs	f-f	f-f	ev
Bw1	8-21	10 YR 3/2	c	m2sbk	-	dh	mfi	ws wp	pf	cs	f-f	f-f	ev
Bw2	21-46	10 YR 3/2	c	m2sbk	-	dh	mfi	ws wp	ss	cs	f-f	f-f	ev
Cr	46+												
Weathered granite													
9. Gabbur: Fine, smectitic, isohyperthermic Leptic Haplusterts													
Ap	0-10	10 YR 3/2	sic	m2sbk	-	dsh	mfi	ws wp	2-3	cs	f-vf	vf-f	e
Bw	10-37	10 YR 3/2	sic	m2sbk	-	dh	mfi	wvs wvp	pf	gs	f-vf	vf-f	es
Bss	37-60	10 YR 3/2	sic	m2abk	-	dvh	mvfi	wvs wvp	ss	gs	f-f	vf-f	es
Cr	60+												
Weathered granite													

contd.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
10. Hologuda: Fine, smectitic, isohyperthermic Sodic Haplusterts													
Ap1	0-13	10 YR 3/1	c	m2sbk	-	dh	mfi	ws wp	2-3	cs	f-vf	vf-f	e
Ap2	13-30	10 YR 3/1	c	m2sbk	-	dh	mfi	ws wp	pf	gs	f-vf	vf-f	e
Bss1	30-63	10 YR 3/1	c	m2abk	-	dh	mfi	ws wp	ss	gs	f-vf	vf-f	e
Bss2	63-85	10 YR 3/1	c	f3abk	-	dvh	mvfi	wvs wvp	ss	gs	f-vf	-	e
Bss3	85-110	10 YR 3/1	c	f3abk	-	dvh	mvfi	wvs wvp	ss	-	f-vf	-	e
11. Kawadimutti: Coarse-loamy, mixed, isohyperthermic Typic Haplustepts													
Ap1	0-9	7.5 YR 4/4	ls	f-1-gr	-	dl	mvfr	wso wpo	-	cs	f-f	f-f	-
Ap2	9-17	7.5 YR 4/4	ls	f-1-gr	-	dl	mvfr	wso wpo	-	gs	f-f	f-f	-
Bw1	17-32	7.5 YR 4/4	sl	f-1-sbk	-	dsh	mfr	wss wps	-	cs	f-f	f-f	-
Bw2	32-51	7.5 YR 4/6	sl	f-1-sbk	-	dsh	mfr	wss wps	-	cs	f-f	-	-
Bw3	51-69	7.5 YR 4/4	sl	f-1-sbk	-	dsh	mfr	wss wps	-	cs	f-f	-	-
Bw4	69-105	7.5 YR 4/4	sl	f-1-sbk	-	dsh	mfr	wss wps	-	-	f-f	-	-
12. Talawargera: Fine-loamy, mixed, isohyperthermic Typic Haplustalfs													
Ap1	0-12	7.5 YR 4/4	scl	m2sbk	-	dh	mfi	ws wp	-	cs	c-f	f-f	e
Ap2	12-29	7.5 YR 3/2	scl	m2sbk	-	dh	mfi	ws wp	-	cs	c-f	f-f	e
Bt1	29-59	7.5 YR 4/3	scl	m2sbk	-	dh	mfi	ws wp	tn-py	cs	c-f	-	e
Bt2	59-76	7.5 YR 4/4	scl	m2sbk	-	dh	mfi	ws wp	tk-py	cs	c-f	-	e
Bt3	76-115	7.5 YR 4/4	scl	m2sbk	-	dh	mfi	ws wp	tk-py	cs	c-f	-	e
R	115+					Hard granite rock							
13. Tumkur: Fine-loamy, mixed, isohyperthermic Typic Haplustepts													
Ap1	0-9	7.5 YR 3/4	sl	f1sbk	-	dsh	mfr	ws wp	-	cs	f-vf	f-f	-
Ap2	9-20	7.5 YR 3/4	scl	m2sbk	-	dh	mfi	ws wp	-	gs	f-vf	f-f	-
BC	20-36	7.5 YR 3/3	scl	m2sbk	-	dh	mfi	ws wp	-	gs	f-vf	f-f	-
Cr	36-60					Weathered granite							

contd.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
14. Wadagera: Fine, mixed, isohyperthermic Udic Haplustalfs													
Ap1	0-12	5 YR 3/3	scl	m2sbk	-	dsh	mfi	ws wp	-	cs	c-f	f-f	-
Ap2	12-28	5 YR 3/3	scl	m2sbk	-	dh	mfi	ws wp	-	gs	c-f	f-f	-
Bt1	28-42	5 YR 3/3	c	m2sbk	-	dh	mfi	ws wp	tn-py	gs	f-f	f-f	-
Bt2	42-58	5 YR 3/3	c	m2sbk	-	dh	mfi	ws wp	tk-py	gs	f-f	-	-
Bt3	58-84	5 YR 3/3	c	m2sbk	-	dh	mfi	ws wp	tk-py	gs	f-f	-	-
Cr	84 +					Weathered granite							
Pediplains (3-10% slope) Limestone landscape													
15. Chennai: Fine, smectitic, isohyperthermic Typic Haplusterts													
Ap1	0-11	10 YR 3/2	c	m2sbk	-	dh	mfi	ws wp	2-5	cs	f-vf	vf-f	es
A12	11-28	10 YR 3/2	c	m2sbk	-	dh	mfi	ws wp	2-3	gs	f-vf	vf-f	es
Bwk1	28-52	10 YR 3/1	c	m2sbk	-	dvh	mfi	wvs wvp	pf	cs	f-vf	vf-f	ev
Bssk2	52-72	10 YR 3/1	c	m2abk	-	dvh	mvfi	wvs wvp	ss	gs	f-vf	-	ev
Bssk3	72-110	10 YR 3/1	c	m2abk	-	dvh	mvfi	wvs wvp	ss	-	f-vf	-	ev
16. Kaladevanahalli: Fine, smectitic, isohyperthermic Calcic Haplusterts													
Ap1	0-10	7.5 YR 3/1	c	m2sbk	-	dh	mfi	ws wp	1-2	cs	f-vf	vf-m	ev
Ap2	10-18	7.5 YR 3/1	c	m2sbk	-	dh	mfi	ws wp	1-2	gs	f-vf	vf-f	ev
Bwk1	18-38	7.5 YR 3/1	c	m2abk	-	dvh	mvfi	wvs wvp	pf	gs	f-vf	vf-f	ev
Bssk2	38-70	7.5 YR 3/1	c	m2abk	-	dvh	mvfi	wvs wvp	ss	gs	f-vf	-	ev
Bssk3	70-110	7.5 YR 3/1	c	m2abk	-	dvh	mvfi	wvs wvp	ss	-	f-vf	-	ev
Alluvial plain (1-5% slope) Alluvium													
17. Kurvihal: Fine, smectitic, isohyperthermic Typic Haplusterts													
Ap1	0-12	10 YR 3/1	c	m2sbk	-	dh	mfi	ws wp	2-3	cs	f-vf	vf-f	ev
Ap2	12-27	10 YR 3/1	c	m2sbk	-	dh	mfi	ws wp	2-3	gs	f-vf	vf-f	ev
Bwk1	27-45	10 YR 3/1	c	m2sbk	-	dh	mfi	wvs wvp	pf	gs	f-vf	vf-f	ev
Bssk2	45-71	10 YR 3/1	c	m2abk	-	dh	mfi	wvs wvp	ss	gs	f-vf	vf-f	ev
Bssk3	71-110	10 YR 3/1	c	m2abk	-	dh	mfi	wvs wvp	ss	-	f-vf	-	ev
18. Shellagi: Fine, mixed, isohyperthermic Typic Natrustalfs													
Ap1	0-12	10 YR 3/4	scl	m2sbk	-	dh	mfr	ws wp	-	cs	c-vf	vf-f	es
Ap2	12-27	10 YR 3/2	cl	m2sbk	-	dh	mfi	ws wp	-	cs	f-vf	vf-f	ev
Bt1	27-54	10 YR 3/2	c	m2sbk	-	dh	mfi	ws wp	tn-py	gs	f-vf	vf-f	ev
Bt2	54-77	10 YR 3/2	c	m2sbk	-	dh	mfi	ws wp	tk-py	gs	f-vf	-	ev
Bt3	77-120	10 YR 3/2	c	m2sbk	-	dh	mfi	ws wp	tk-py	-	f-vf	-	ev

contd.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
19. Venkatapur: Fine, smectitic, isohyperthermic Sodic Haplusterts													
Ap1	0-11	10 YR 3/2	c	m2sbk	-	dh	mfi	ws wp	2-3	cs	f-vf	vf-f	ev
Ap2	11-27	10 YR 3/2	c	m2sbk	-	dh	mfi	wvs wvp	2-3	gs	f-vf	vf-f	ev
Bw	27-43	10 YR 3/2	c	m2sbk	-	dh	mfi	wvs wvp	pf	gs	f-vf	vf-f	ev
Bss1	43-72	10 YR 3/2	c	m3abk	-	dh	mfi	wvs wvp	ss	gs	f-vf	-	ev
Bss2	72-92	10 YR 3/2	c	m3abk	-	dh	mfi	wvs wvp	ss	gs	f-vf	-	ev
Bss3	92-110	10 YR 3/2	c	m3abk	-	dh	mfi	wvs wvp	ss	-	f-vf	-	ev

* Symbols used according to Soil Survey Manual (Soil Survey Staff 2000 and AIS and LUS 1970).

13. Tumkur: Fine- loamy, mixed, isohyperthermic Typic Haplustepts															
0-9	80	4	16	6.8	0.2	0.4	0.0	4.0	1.0	0.3	0.1	5.4	9.0	3.0	60
9-20	75	3	22	6.3	0.1	0.3	0.0	3.0	3.0	0.3	0.1	6.4	12.0	3.0	53
20-36	67	5	28	6.5	0.1	0.2	0.0	15.0	2.0	0.3	0.2	17.5	23.0	1.0	76
14. Wadagera: Fine, mixed, isohyperthermic Udic Haplustalfs															
0-12	60	8	32	6.2	0.2	0.8	1.0	4.0	1.0	0.4	0.2	5.6	13.0	3.0	43
12-28	59	8	33	6.4	0.2	0.5	1.0	6.0	2.0	0.4	0.2	8.6	16.0	3.0	54
28-42	30	29	41	7.9	0.4	0.5	1.0	11.0	8.0	1.1	0.3	20.4	29.0	4.0	70
42-58	40	17	43	7.8	0.3	0.4	1.0	5.0	12.0	1.1	0.3	18.4	25.0	4.0	74
58-84	40	17	43	7.9	0.3	0.4	1.0	4.0	15.0	1.2	0.3	20.5	30.0	4.0	68
Pediplains (3-10% slope) Limestone landscape															
15. Chennai: Fine, smectitic, isohyperthermic Typic Haplusterts															
0-11	8	37	55	8.4	0.3	1.1	10.0	20.0	14.0	1.3	0.4	35.7	46.0	3.0	78
11-28	9	35	56	8.4	0.4	1.0	10.0	20.0	16.0	1.8	0.3	38.1	48.0	4.0	79
28-52	5	36	59	8.4	0.2	0.6	10.0	20.0	17.0	1.5	0.4	38.9	49.0	3.0	79
52-72	8	34	58	8.5	0.3	0.6	15.0	15.0	22.0	0.3	0.4	37.7	48.0	1.0	79
72-110	9	32	59	8.4	0.3	0.4	12.0	17.0	17.0	2.2	0.3	36.5	47.0	5.0	78
16. Kaladevanahalli: Fine, smectitic, isohyperthermic Calcic Haplusterts															
0-10	38	17	45	8.7	0.9	0.1	20.0	12.0	13.0	3.7	0.8	29.5	36.0	10.0	82
10-18	30	15	55	9.1	6.4	0	18.0	7.0	9.0	20	0.7	36.7	44.0	45.0	83
18-38	45	5	50	9.2	5.5	0	15.0	7.0	7.0	20	0.6	34.6	41.0	49.0	84
38-70	40	10	50	9.2	5.3	0	10.0	5.0	10.0	19	0.6	34.6	41.0	46.0	84
70-110	40	10	50	9.0	5.0	0	17.0	7.0	10.0	17	0.6	34.6	42.0	40.0	82
Alluvial plain (1-5% slope) Alluvium															
17. Kurvihal: Fine, smectitic, isohyperthermic Typic Haplusterts															
0-12	15	35	50	8.1	0.8	1.0	12.0	9.0	5.0	2.2	0.6	16.8	22.0	10.0	76
12-27	15	40	45	8.5	0.4	0.4	19.0	14.0	6.0	2.8	0.4	23.2	29.0	10.0	80
27-45	15	40	45	8.6	0.4	0.4	19.0	18.0	2.0	2.5	0.4	22.9	28.0	9.0	82
45-71	15	40	45	8.9	0.3	0.4	15.0	12.0	8.0	3.6	0.4	24.0	29.0	12.0	83
71-110	30	45	25	9.1	0.5	0.4	17.0	15.0	8.0	4.1	0.4	27.5	33.0	12.0	83

contd.

contd.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
7. Hosur: Loamy, mixed, isohyperthermic Lithic Ustorthents															
0-12	75	10	15	7.3	0.2	0.5	0.0	4.0	1.0	0.3	0.2	5.5	9.0	3.0	61
12-24	70	8	22	7.3	0.1	0.2	0.0	4.0	3.0	0.3	0.1	7.4	12.0	3.0	62
Pediplains (1-5% slope) Granitic landscape															
8. Fatepur: Fine, smectitic, isohyperthermic Vertic Haplustepts															
0-8	15	30	55	8.5	0.3	0.4	11.0	19.0	13.0	0.6	0.6	33.2	43.0	1.0	77
8-21	15	32	53	8.6	0.2	0.3	14.0	13.0	10.0	0.6	0.3	23.9	29.0	2.0	82
21-46	15	35	50	8.5	0.2	0.2	15.0	14.0	15.0	0.6	0.3	29.9	38.0	2.0	79
9. Gabbur: Fine, smectitic, isohyperthermic Leptic Haplusterts															
0-10	6	49	45	8.4	0.2	0.3	5.0	10.0	16.0	1.1	0.4	27.5	35.0	3.0	79
10-37	10	42	48	8.5	0.3	0.3	5.0	18.0	12.0	1.6	0.2	31.8	40.0	4.0	80
37-60	6	49	45	8.3	0.5	0.1	5.0	21.0	15.0	1.9	0.2	38.1	46.0	4.0	83
10. Holiguda: Fine, smectitic, isohyperthermic Sodic Haplusterts															
0-13	30	20	50	8.6	0.3	0.7	9.0	12.0	17.0	2.2	0.3	31.5	40.0	6.0	79
13-30	30	15	55	8.6	0.4	0.4	11.0	12.0	17.0	4.6	0.2	33.8	40.0	12.0	79
30-63	45	7	48	8.6	0.6	0.4	4.0	12.0	14.0	6.2	0.2	32.4	39.0	16.0	83
63-85	40	15	45	8.6	0.9	0.4	10.0	10.0	10.0	10	0.3	30.3	36.0	28.0	84
85-110	45	10	45	8.6	0.9	0.4	5.0	8.0	10.0	11	0.3	29.3	35.0	31.0	84
11. Kavadiutti: Coarse- loamy, mixed, isohyperthermic Typic Haplustepts															
0-9	87	2	11	7.1	0.2	0.3	1.0	3.0	1.0	0.2	0.1	4.3	6.0	3.0	72
9-17	87	2	11	7.6	0.1	0.1	1.0	2.0	2.0	0.2	0.1	4.3	6.0	3.0	72
17-32	75	11	14	7.6	0.1	0.1	1.0	1.0	1.0	0.3	0.2	2.7	5.0	6.0	54
32-51	75	11	14	7.1	0.1	0	1.0	1.0	1.0	0.3	0.1	2.4	4.0	6.0	60
51-69	75	11	14	7.2	0.1	0	1.0	1.0	1.0	0.2	0.1	2.3	4.0	5.0	58
69-105	73	11	16	7.2	0.1	0	1.0	2.0	2.0	0.6	0.1	4.7	8.0	8.0	59
12. Talawagera: Fine- loamy, mixed, isohyperthermic Typic Haplustalfs															
0-12	65	15	20	7.4	0.5	0.4	0.0	4.0	5.0	0.5	0.2	9.7	13.0	4.0	75
12-29	51	22	27	7.4	0.2	0.3	0.0	6.0	5.0	0.5	0.2	11.7	17.0	3.0	69
27-59	50	22	28	8.0	0.2	0.2	0.0	9.0	4.0	0.3	0.1	13.4	18.0	2.0	74
59-76	50	18	32	8.2	0.4	0.1	1.0	14.0	1.0	0.8	0.1	15.9	20.0	4.0	80
76-115	52	14	34	8.7	0.4	0.1	1.0	10.0	8.0	0.8	0.1	18.9	23.0	4.0	82

contd.

well drained to well drained, slow to moderately permeable, and have colours *i.e.* brown (7.5 YR 5/4) to dark brown (7.5 YR 3/4) and very dark grayish brown (10 YR 3/2) to dark grey (10 YR 3/1) and have developed over alluvium, granite and limestone. These soils are cultivated as rainfed and irrigated and occur on very gently to gently (1-5%) sloping pediplains. These soils cover an area of 71.0%. The soils of hill side, foot hills and pediments are coarse textured and wide variation in soil texture is caused by topographic position, nature of parent material, weathering, translocation of clay and age of soils (Nayak *et al.* 2002). The variation in soil structure is a reflection of physiographic position of the pedons (Singh and Agrawal 2003).

Physico-chemical characteristics

Physico-chemical characteristics of the soils are presented in table 2. The clay content in soils of hill side slope ranges from 21-22%, foot hill slope from 15-30%, pediments from 15-34%, pediplains from 6-59% and alluvial plains from 25-55%, respectively. The higher clay content in the soils of pediplains and alluvial plains was due to deposition of finer fractions from the hill side slope, foot hill slope and pediments. Sand and silt content of all the pedons ranged from 6 to 87% and 2 to 49%, respectively. Sand content in soils of higher altitudes was higher and decreased with increasing depth whereas silt content in all the pedons have irregular trend with the depth. The soils of higher altitude such as hill side, foot hill and pediments are almost neutral in pH, low to medium in organic carbon, low in secondary accumulation of calcium carbonate, exchangeable cations and cation exchange capacity whereas soils of pediplains and alluvial plains are neutral to alkaline in nature, low in organic carbon and have high cation exchange capacity. The soluble minerals and exchangeable ions are expected to move down slope and be deposited at the foot slope whereas non-soluble materials such as organic carbon are expected to be highest at the summit and toe (Gerrard 1981).

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