



Fertility Status of Soils of Narasaraopet Revenue Division in Guntur district

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ABSTRACT

The present study was conducted in Narasaraopet revenue division of Guntur district by collecting 102 representative soil samples using GPS. The soils of this region varied from Loamy sand to clay in texture. The soils were found to be neutral to moderately alkaline (pH 6.6 to 8.4) in reaction. The soils were non saline, slightly to moderately calcareous in nature, non sodic, low to medium in organic carbon. CEC of the soils ranged from 14.7 to 69.7 cmol (p⁺) kg⁻¹ soil. The most dominant exchangeable cation was calcium followed by magnesium, sodium and potassium with mean values of 27 and 4.84 and 1.60 and 1.10 cmol (p⁺) kg⁻¹ soil, respectively.

Key words: Electro-chemical properties, Physical, Physico-chemical.

Soil is the critical component of the earth system. The capacity of soil for sustaining production depends on its fertility status. This potential of soil therefore needs to be investigated, improved, explored and exploited. The fertility of the soil is largely influenced by the Physiography, climate and agricultural activities. But with increasing population pressure, low fertile areas are also utilized for agriculture and to get maximum production. Overexploitation of productive land creates serious problem of lowering the fertility status of soil and it leads to deterioration of soil. Hence, assessing fertility status of division level will be greater importance for nutrient management with better precision.

MATERIAL AND METHODS

The Guntur district is located in east coast of Andhra Pradesh in India. It is around 40 miles to the west of Bay of Bengal. It is divided into 57 mandals under three revenue divisions with headquarters at Tenali (18 mandals), Guntur (19 mandals), Narasaraopet (20 mandals).

The study area includes 20 mandals with different types of soils. The global position of the present study area lies between 16.25 00p N latitude and 80. 07 00p E longitudes with an average elevation of 33 meter above mean sea level. The climate of the study area is sub tropical, dry and sub humid with a min and max temperatures of 15p C and 47p C, respectively

with a mean annual rainfall of 761mm. One hundred and two (102) representative surface soil samples (0-30 cm) were collected from red and black soils in the study area and in Bollapalli mandal only red soils and in Chilakaluripeta, Nadendla, Edlapadu, Dachehalli, Karampudi and Gurazala mandals only black soils were taken and in Durgi, Rentachinthala, Nakarikalli, Narasaraopet and in Rompicherla mandal only one red sample and were in Nuzendla and in Ipur mandal only one black sample were collected by following random sampling technique.

Particle size analysis of the soil samples was carried out by following Bouyoucos hydrometer method (Piper, 1966), soil reaction and soluble salt content were determined in 1:2.5 soil: water suspension (Jackson, 1973), the organic carbon content was determined by Walkley and Black's "wet digestion method" as outlined by Jackson (1973). Calcium carbonate in the soil was estimated by rapid titration method and was expressed as per cent (Piper, 1966). The exchangeable cations and CEC, PBS was estimated by procedure given by (Bower *et al.*, 1952).

RESULTS AND DISCUSSION

Physical Properties:

The two major soil groups red and black soils of the study area were classified texturally into five groups viz., loamy sand, sandy loam, sandy clay loam, sandy clay, and clay (Table 1). The overall mean per cent sand, silt and clay contents

Table 1. Mechanical composition and textural class of soils of Narasaraopet revenue division of Guntur district.

S.No	Name of the mandal	Sand		Silt		Clay		Textural class
		Range	Mean	Range	Mean	Range	Mean	
1	Narasaraopet	23.6 - 60.2	48.0	8.5-28.5	16.4	29.2 -34.4	35.6	scl - c
2	Rompicherla	45.6 -64.2	55.4	6.5-15.2	10.3	24.8-44.4	34.3	scl -sc
3	Chilakaluripeta	47.6-64.6	56.0	9.9-20.3	14.4	24.2-39.3	28.8	scl -sc
4	Nadendla	48.6-60.4	55.2	10.0-27.5	16.8	23.9-32.6	27.2	scl
5	Edlapadu	23.6-60.5	48.9	8.5-27.2	15.8	19.5-49.2	35.4	scl - c
6	Vinukonda	38.6-70.1	54.5	5.6-20.0	12.3	24.3-46.4	33.2	scl - c
7	Nuzendla	20.4-77.1	53.6	10.5-20.5	17.5	8.9-32.4	26.9	ls-c
8	Ipur	54.4-70.1	53.6	10.5-20.2	17.5	8.9-32.4	26.9	scl -sc
9	Bollapalli	45.2-70.6	57.7	5.1-20.3	15.3	19.6-34.4	27.0	sl-scl
10	Savalyapuram	46.2-75.6	57.7	12.5-20.4	16.5	11.9-34.6	25.9	ls-scl
11	Piduguralla	40.6-65.3	55.0	7.5-25.0	13.9	19.9-39.4	31.1	sl-scl
12	Machavaram	24.4-68.6	48.8	5.9-21.0	13.8	19.4-55.6	37.4	sl-c
13	Dachepalli	26.2-39.3	33.1	10.3-26.4	17.7	47.4-54.1	49.3	c
14	Karampudi	25.6-46.2	34.9	13.6-21.2	17.8	40.2-59.4	47.4	sc-c
15	Nakarikallu	25.6-70.2	54.3	5.2-21.0	12.4	24.6-53.4	33.2	scl-c
16	Macherla	51.2-70.6	61.4	8.8-21.2	12.2	19.4-40	26.5	sl-sc
17	Veldurthi	46.2-65.5	56.8	10.0-20.2	15.8	14.1-40.2	27.4	sl-sc
18	Durgi	29.3-70.2	56.7	10.5-23.5	15.4	19.2-47.2	27.9	sl-c
19	Rentachintala	20.2-70.4	45.8	10.0-21.2	13.0	24.3-58.6	41.2	scl-c
20	Gurazala	20.2-39.3	30.9	13.5-22.2	18.0	47.2-58.6	51.1	c
Overall Range & Mean		20.2-77.1	50.6	5.1-28.5	15.1	8.9-59.4	34.3	ls - c

ls:loamy sand ; sl: sandy loam ; scl: sandy clay loam ; sc : sandy clay ; c : clay

of black and red soils ranged from 35.8, 13.3 and 29.2 and 53.2, 10.7 and 22.9 respectively. The data indicated that red soils of the study area were coarser in texture and ranged from loamy sand to sandy clay while, black soils situated in low land region were finer in texture (Table 4). Overall, sandy clay loam was dominant texture of the study area. Similar findings were reported earlier in black soils of Thiruvuru mandal of Krishna western delta (Srinivas *et al.*, 2011), Chinthayapalem village of Guntur district (Sumathi, 2012), in red soils of Edlapadu mandal of Guntur district (Radhakrishna, 2007).

Physico-chemical Properties

The data pertaining to the range and mean pH values of each mandal are presented in table 2. The overall mean of soil reaction values in red and black soils of all the mandals were 6.99 and 6.15, respectively. Black soils recorded higher pH values

when compared to red soils. The higher pH values of black soils might be due to imperfect drainage and also efficient recycling of basic cations. Similarly, Radhakrishna, (2007) reported neutral to slightly alkaline soil reaction in red soils of Edlapadu mandal, Guntur district of Andhra Pradesh and Singh *et al.* (2014) in Chambal region of Madhya Pradesh.

The data on electrical conductivity of the soils presented in table 2 indicated that the soils were non saline, and the mean of red and black soils were 0.25 and 0.32 dS m⁻¹, respectively. The data suggested that black soils recorded higher EC values than the red soils because of finer texture coupled with accumulation of salts as they are present in low land situation. Similarly, in Naira village of Srikakulam district of Andhra Pradesh Jayaramarao *et al.* (2013) recorded higher EC values in black soils when compared to red soils.

Table 2. Physico- chemical and chemical properties of soils of Narasaraopet revenue division of Guntur district.

S.No	Name of the mandal	pH		EC (dS m ⁻¹)		OC (%)		CaCO ₃ (%)	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean
1	Narasaraopet	7.8-8	7.9	0.23-0.98	0.40	0.56-0.71	0.62	3.73-5.50	4.73
2	Rompicherla	7.7-8.1	7.8	0.18-0.89	0.37	0.35-0.74	0.58	3.26-6.38	4.66
3	Chilakaluripeta	7.7-7.9	7.8	0.27-0.50	0.58	0.36-0.63	0.49	3.29-4.64	3.99
4	Nadendla	7.7-8.1	7.8	0.21-0.83	0.47	0.27-0.66	0.50	3.23-4.89	4.64
5	Edlapadu	7.8-8.3	8.0	0.33-0.79	0.65	0.33-0.68	0.51	4.64-6.54	5.24
6	Vinukonda	7.5-8.1	7.8	0.16-0.43	0.26	0.20-0.66	0.43	1.28-6.63	4.05
7	Nuzendla	6.9-8.0	7.6	0.13-0.31	0.21	0.29-0.69	0.47	1.25-7.32	3.86
8	Ipur	7.4-7.8	7.7	0.14-1.63	0.54	0.14-0.66	0.38	1.89-4.91	3.89
9	Bollapalli	7.3-8.1	7.7	0.23-0.46	0.36	0.23-0.62	0.37	1.02-6.84	3.48
10	Savalyapuram	7.8-8.0	7.8	0.52-1.69	1.07	0.50-0.74	0.66	0.59-7.35	4.07
11	Piduguralla	7.6-8.2	8.0	0.15-0.68	0.27	0.53-0.72	0.63	4.53-7.90	6.16
12	Machavaram	7.6-8.3	8.0	0.16-0.36	0.24	0.36-0.72	0.59	3.33-7.02	5.19
13	Dachepalli	8.0-8.4	8.2	0.16-0.33	0.25	0.23-0.54	0.38	5.18-7.38	6.24
14	Karampudi	7.8-8.2	8.0	0.18-0.34	0.28	0.33-0.69	0.55	6.11-7.85	7.22
15	Nakarikallu	7.7-8.0	7.8	0.24-0.37	0.27	0.54-0.74	0.63	4.43-5.45	4.89
16	Macherla	7.8-8.0	7.9	0.14-0.40	0.31	0.42-0.59	0.50	4.24-6.28	5.56
17	Veldurthi	7.7-8.0	7.8	0.25-0.54	0.31	0.51-0.63	0.58	4.49-5.63	4.84
18	Durgi	8.0-8.2	8.0	0.16-0.30	0.22	0.21-0.56	0.34	4.38-5.70	5.14
19	Rentachintala	7.9-8.2	8.0	0.16-1.03	0.43	0.30-0.53	0.44	4.98-8.59	6.06
20	Gurazala	7.6-7.9	7.8	0.18-0.23	0.20	0.35-0.65	0.50	5.78-6.88	6.4
Overall Range & Mean		6.9-8.4	7.9	0.13-1.69	0.35	0.14-0.74	0.50	0.59-8.59	5.13

The mean soil organic carbon content in different soils of all the mandals of the study area were 0.46 to 0.41 per cent (Table 2). Among the mandals, the soils of Savalyapuram mandal recorded highest mean soil organic carbon (0.66 %) content while, the lowest (0.34 %) was in Durgi mandal. The mean organic carbon content in black soils was more when compared to red soils, this might be due to finer texture of black soils. The results were in tune with the findings of Singh *et al.* (2014) in black soils of Chambal region of Madhya Pradesh, respectively.

The average calcium carbonate content in red and black soils under study varied from 3.94 to 5.08 per cent (Table 2). Out of 102 samples, 53 per cent of the samples were non calcareous while, 47 per cent of the samples were moderately calcareous in nature. Black soils of the study area recorded comparatively higher contents of calcium carbonate than red soils. The difference in the content between red and black soils might due to the variation in soil texture, elevation, drainage and parent material.

These results were in accordance with the findings of Varaprasadrao *et al.* (2008) in soils of Ramachandrapuram mandal of chittoor district, Andhra Pradesh.

Electrochemical Properties

The data pertaining to the exchangeable bases are presented in table 3a & 3b. The exchangeable bases on the exchange complex of black soils were found to be in the order of Ca⁺² > Mg⁺² > Na⁺ > K⁺ while in red soils were in the order of Ca⁺² > Mg⁺² > K⁺ > Na⁺, relatively, higher exchangeable calcium, magnesium and sodium contents were present in black soils than the red soils. Similar observations were earlier reported by Likhar and Jagdishprasad (2011) in soils of Nagpur district, Maharashtra

The overall mean of cation exchange capacity of soils of the study area are presented in table 3a & 3b and the mean cation exchange capacity of red and black soils varied from 26.8 and 32.4 cmol (p⁺) kg⁻¹ soil, respectively. It was

Table 3 . Electro - chemical properties of soils of Narasaraopet revenue division of Guntur district.

S.No	Name of the mandal	Ca ⁺²		Mg ⁺²		K ⁺		Na ⁺		CEC (cmol (P ⁺) kg ⁻¹)		PBS	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1	NARASARAOPET	18-31	23.0	3.04-7.90	5.23	1.30-1.84	1.46	0.75-3.5	2.44	27.35-36.34	34.88	84.42-94.56	91.55
2	ROMPICHERLA	18-31	25.0	3.91-5.21	4.58	0.66-1.89	1.10	0.94-1.74	1.28	28.60-38.17	33.84	88.01-99.50	94.24
3	CHILAKALURIPETA	21-28	25.0	3.65-6.13	5.14	0.5-1.80	2.56	0.80-4.0	2.56	32.69-40.40	35.54	91.50-97.40	94.78
4	NADENDLA	17-28	23.0	3.91-4.80	4.30	0.50-2.10	2.30	1.74-2.84	2.30	27.17-36.73	33.01	90.73-99.36	94.21
5	EDLAPADU	16-35	24.0	4.13-5.78	5.10	0.30-1.77	2.10	0.82-3.10	2.10	23.65-46.82	33.92	91.48-99.4	95.41
6	VINUKONDA	20-41	30.0	2.34-5.21	4.55	0.87-2.05	1.97	0.68-3.26	1.97	26.89-52.52	40.52	85.49-96.68	92.59
7	NUZENDLA	6< 39	22.0	2.86-5.26	4.27	1.80-2.50	1.42	0.71-1.85	1.42	14.69-51.13	33.34	85.85-93.74	89.18
8	IPUR	16-44	25.0	2.34-5.52	4.28	0.50-1.40	0.94	0.61-1.51	0.94	23.73-53.69	35.62	83.50-95.98	87.85
9	BOLLAPALLI	9< 24	17.0	3.13-5.82	4.52	1.64-2.02	1.81	0.90-1.89	1.47	21.30-36.08	28.56	83.90-99.35	87.68
10	SAVALYAPURAM	14-34	22.0	3.25-5.82	4.55	0.20-0.66	0.34	1.20-2.0	1.46	18.60-33.80	29.40	90.22-98.92	96.79
11	PIDUGURALLA	12< 37	38.0	4.52-5.91	5.22	0.20-1.89	1.15	0.66-1.69	1.24	22.62-49.73	37.61	85.28-99.59	92.67
12	MACHAVARAM	18-38	26.0	4.52-5.26	4.83	0.40-1.58	0.83	0.51-1.60	1.02	23.86-48.21	35.34	85.16-99.46	91.86
13	DACHEPALLI	34-41	39.0	4.26-5.60	4.87	0.56-1.07	0.80	1.20-3.80	2.48	45.73-51.56	48.79	93.29-97.13	95.56
14	KARAMPUDI	34-58	44.0	4.26-5.39	4.94	0.15-1.71	0.84	1.45-2.80	2.07	43.39-51.56	54.93	90.96-97.25	93.28
15	NAKARIKALLU	19-45	31.0	4.69-5.86	5.14	0.50-1.80	1.10	0.51-1.90	1.12	31.08-53.82	40.06	86.74-99.59	94.21
16	MACHERLA	18-38	29.0	4.36-5.80	4.99	0.80-1.54	1.12	1.07-2.40	1.52	32.08-51.03	40.18	80.27-97.0	89.80
17	VELDURTHI	14-31	25.0	4.26-5.82	5.22	0.40-1.07	0.76	0.40-1.66	0.98	24.52-41.04	35.02	85.30-94.38	89.57
18	DURGI	12< 44	29.0	4.69-5.43	5.11	0.30-1.30	0.70	0.46-1.50	1.02	21.13-53.45	38.15	87.32-96.98	93.07
19	RENTACHINTALA	22-41	33.0	4.20-5.82	5.29	0.30-1.50	0.77	0.82-2.50	1.41	34.69-49.26	43.20	87.98-97.85	94.18
20	GURAZALA	32-35	33.0	4.69-5.30	4.88	0.40-0.92	0.70	0.82-2.80	1.46	42.56-43.95	43.17	91.19-94.95	93.30
OVERALL RANGE & MEAN		5.8-58	27.0	2.3-7.9	4.84	0.2-2.5	1.10	0.4-4	1.60	14.7-69.7	37.47	80.30-99.60	92.52

Table 4. Mechanical composition and textural class of soils of Narasaraopet revenue division of Guntur district.

S.No	Name of the mandal	Black soils						Red soils						Overall Textural Class
		Sand		Silt		Clay		Sand		Silt		Clay		
		Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	
1	Narasaraopet	23.6-55.1	19.6	10.5-28.5	9.75	32.1-47.9	20	60.2	10.6	10.6	29.2	29.2	29.2	scl - c
2	Rompicherla	45.6-64.1	21.9	6.5-15.2	4.34	29.4-44.4	14.7	64.2	10.8	10.8	24.8	24.8	24.8	scl -sc
3	Chilakaluripeta	47.6-64.6	56.0	9.9-20.3	14.4	24.2-39.3	28.8	-	-	-	-	-	-	scl -sc
4	Nadendla	48.6-60.4	55.2	10.0-27.5	16.8	23.9-32.6	27.2	-	-	-	-	-	-	scl
5	Etlapadu	23.6-60.5	48.9	8.5-27.2	15.8	19.5-49.2	35.4	-	-	-	-	-	-	scl - c
6	Vinukonda	38.6-59.4	1.5	8.9-15	5.97	30.1-46.4	19.1	49.4-70.1	59.8	12.8	24.3-30.6	27.5	27.5	scl - c
7	Nuzendla	20.4	20.4	20.5	20.5	49.1	49.1	49.6-55.2	26.2	8.5	8.9-32.4	10.3	10.3	ls-c
8	Ipur	54.4	54.4	15	15.0	30.6	30.6	59.4-70.1	32.3	6.4	19.6-24.3	10.9	10.9	scl -sc
9	Bollapalli	-	-	-	-	-	-	45.2-70.6	57.7	15.3	19.6-34.4	27.0	27.0	sl-scl
10	Savalyapuram	46.2-75.6	57.7	12.5-20.4	16.5	11.9-34.6	25.9	-	-	-	-	-	-	ls-scl
11	Piduguralla	40.6-60.6	50.6	7.5-20	9.1	29.4-39.4	22.9	50.2-65.3	38.5	11.7	19.9-39.2	19.7	19.7	sl-scl
12	Machavaram	24.4-68.6	31.0	12.21	11	19.4-55.6	25	60.1-60.2	60.1	8.05	29.6-34	31.8	31.8	sl-c
13	Dachepalli	26.2-39.3	33.1	10.3-26.4	17.7	47.4-54.1	49.3	-	-	-	-	-	-	c
14	Karampudi	25.6-46.2	34.9	13.6-21.2	17.8	40.2-59.4	47.4	-	-	-	-	-	-	sc-c
15	Nakarikallu	25.6-70.2	24.0	10.2-21	7.8	24.6-53.4	19.5	60.1	60.1	5.8	34.1	34.1	34.1	scl-c
16	Macherla	51.2-65.2	38.8	8.8-11.2	6.66	24.40	21.3	55.2-70.6	62.9	10.2-25	19.4-24.4	21.9	21.9	sl-sc
17	Veldurthi	50.2-56.3	53.3	15.3-20	17.65	28.4-29.8	29.1	46.2-65.7	37.3	10.2-20.2	14.1-40.2	18.1	18.1	sl-sc
18	Durgi	29.3-70.2	24.8	10.5-15.5	6.5	24.4-47.2	17.9	65.3	65.3	15.5	19.2	19.2	19.2	sl-c
19	Rentachintala	20.2-70.4	22.7	5.2-21.2	20.75	24.4-58.6	20.75	67.2	67.2	8.5	24.3	24.3	24.3	scl-c
20	Gurazala	20.2-39.3	30.9	13.5-22.2	18.0	47.2-58.6	51.1	-	-	-	-	-	-	c
Overall mean		35.8	13.3	29.2	18.0	53.2	10.7	22.9	10.7	22.9	10.7	22.9	10.7	ls-c

ls: loamy sand ; sl: sandy loam ; scl: sandy clay loam ; sc : sandy clay ; c : clay ; _ : absence of red / black soils in that mandal

Table 5. Physico-chemical and chemical properties of soils of Narasaraopet revenue division of Guntur district.

S.No	Name of the mandal	Black soils						Red soils									
		pH		EC (dS m ⁻¹)		OC (%)		CaCO ₃ (%)		pH		EC (dS m ⁻¹)		OC (%)		CaCO ₃ (%)	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1	Narasaraopet	7.8-8.0	3.95	0.23-0.98	0.3	0.57-0.71	0.32	3.73-5.05	22	8	0.31	0.31	0.56	0.56	5.5	5.5	5.5
2	Rompicherla	7.7-8.1	3.16	0.18-0.89	0.21	0.35-0.71	0.21	3.26-6.38	1.92	7.7	0.3	0.3	0.74	0.74	4.29	4.29	4.29
3	Chilakaluripeta	7.7-7.9	7.8	0.27-0.50	0.58	0.36-0.63	0.49	3.29-4.64	3.99	-	-	-	-	-	-	-	-
4	Nadendla	7.7-8.1	7.8	0.21-0.83	0.47	0.27-0.66	0.50	3.23-4.89	4.64	-	-	-	-	-	-	-	-
5	Edlapadu	7.8-8.3	8.0	0.33-0.79	0.65	0.33-0.68	0.51	4.64-6.54	5.24	-	-	-	-	-	-	-	-
6	Vinukonda	7.7-8.1	3.95	0.18-0.43	0.15	0.27-0.66	0.23	3.56-6.63	2.54	7.5-7.7	7.6	0.16-0.22	0.19	0.20-0.51	0.71	1.28-3.64	2.46
7	Nuzendla	7.7	7.70	0.22	0.22	0.69	0.69	3.64	3.64	6.9-8.0	3.7	0.13-0.31	0.11	0.29-0.44	0.18	1.25-7.32	2.14
8	Ipur	7.7	7.70	0.42	0.42	0.59	0.59	3.25	3.25	7.4-7.8	3.8	0.14-1.63	0.44	0.14-0.66	0.2	1.89-4.91	1.7
9	Bollapalli	-	-	-	-	-	-	-	-	7.3-8.1	7.7	0.23-0.46	0.36	0.23-0.62	0.37	1.02-6.84	3.48
10	Savalyapuram	7.8-8.0	7.8	0.52-1.69	1.07	0.50-0.74	0.66	0.59-7.35	4.07	-	-	-	-	-	-	-	-
11	Piduguralla	8.0-8.2	5.4	0.15-0.22	0.12	0.56-0.69	0.41	6.11-7.90	4.67	7.6-8.1	7.8	0.15-0.68	0.41	0.53-0.72	0.62	4.53-6.56	5.54
12	Machavaram	8.0-8.3	8.1	0.16-0.34	0.25	0.36-0.71	0.53	4.20-7.02	5.61	7.6-8.0	5.2	0.16-0.36	0.17	0.53-0.72	0.41	3.33-4.75	2.69
13	Dachepalli	8.0-8.4	8.2	0.16-0.33	0.25	0.23-0.54	0.38	5.18-7.38	6.24	-	-	-	-	-	-	-	-
14	Karampudi	7.8-8.2	8.0	0.18-0.34	0.28	0.33-0.69	0.55	6.11-7.85	7.22	-	-	-	-	-	-	-	-
15	Nakarikallu	7.7-8.0	3.14	0.24-0.37	0.12	0.54-0.66	0.24	4.43-5.45	1.97	7.8	7.8	0.26	0.26	0.74	0.74	5.2	5.2
16	Macherla	7.8-8	5.26	0.29-0.36	0.21	0.45-0.59	0.34	5.74-5.89	3.87	7.9-7.9	7.9	0.14-0.40	0.18	0.42-0.54	0.32	4.24-5.63	3.29
17	Veldurthi	7.7-8.0	5.23	0.25-0.54	0.26	0.57-0.63	0.4	4.49-5.63	3.37	7.8-7.9	7.8	0.25-0.28	0.26	0.51-0.63	0.57	4.63-4.83	4.73
18	Durgi	8.0-8.2	4.00	0.16-0.30	0.11	0.21-0.56	0.19	4.38-5.70	2.52	8	8	0.19	0.19	0.23	0.23	5.24	5.24
19	Rentachintala	7.8-8.2	4.00	0.26-1.03	0.32	0.30-0.53	0.2	5.23-8.59	3.45	7.9	7.9	0.16	0.16	0.41	0.41	4.98	4.98
20	Gurazala	7.6-7.9	7.8	0.18-0.23	0.20	0.35-0.65	0.50	5.78-6.88	6.4	-	-	-	-	-	-	-	-
	Overall mean	6.15		0.32		0.41		5.08		6.99		0.25		0.46		3.94	

Table 6a. Electro - chemical properties of black soils of Narasaraopet revenue division of Guntur district.

S.No	Name of the mandal	Ca ²⁺		Mg ²⁺		K ⁺		Na ⁺		CEC (cmol (P ⁺) kg ⁻¹)		PBS	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1	Narasaraopet	19-31	12.5	3.91-7.90	2.95	1.30-1.84	0.78	2-3.5	1.37	32.62-44.45	19.26	92.44-94.56	46.75
2	Rompicherla	24-31	11	3.91-5.21	1.82	0.66-1.89	0.51	0.94-1.74	0.53	31.56-38.17	13.9	91.14-99.50	38.12
3	Chilakaluripeta	21-28	25.0	3.65-6.13	5.14	0.5-1.80	2.56	0.80-4.0	2.56	32.69-40.40	35.54	91.50-97.40	94.78
4	Nadendla	17-28	23.0	3.91-4.80	4.30	0.50-2.10	2.30	1.74-2.84	2.30	27.17-36.73	33.01	90.73-99.36	94.21
5	Etlapadu	16-35	24.0	4.13-5.78	5.10	0.30-1.77	2.10	0.82-3.10	2.10	23.65-46.82	33.92	91.48-99.47	95.41
6	Vinukonda	29-41	117.5	4.19-5.21	2.35	1.53-2.05	0.89	1.50-3.26	1.19	40.34-52.52	23.21	94.30-96.68	47.74
7	Nuzendla	39	39.0	5.26	5.26	2.5	2.50	1.17	1.17	51.13	51.13	93.74	93.74
8	Ipur	44	44.0	5.52	5.52	0.5	0.50	1.51	1.51	53.69	53.69	95.98	95.98
9	Bollapalli	-	-	-	-	-	-	-	-	-	-	-	-
10	Savalyapuram	14-34	22.0	3.25-5.82	4.55	0.20-0.66	0.34	1.20-2.0	1.46	18.60-33.80	29.40	90.22-98.92	96.79
11	Piduguralla	14-34	16.0	3.25-5.82	3.02	0.20-0.66	0.28	1.20-2.0	1.06	18.60-33.80	17.46	90.22-98.92	63.04
12	Machavaram	29-36	16.25	4.52-5.73	3.41	0.20-0.80	0.33	1.07-1.56	0.87	36.92-43.82	26.9	96.26-99.59	65.28
13	Dachepalli	34-41	39.0	4.26-5.60	4.87	0.56-1.07	0.80	1.20-3.80	2.48	45.73-51.56	48.79	93.29-97.13	95.56
14	Karampudi	34-58	44.0	4.26-5.39	4.94	0.15-1.71	0.84	1.45-2.80	2.07	43.39-51.56	54.93	90.96-97.25	93.28
15	Nakarikallu	25-45	17.5	4.69-5.86	2.63	0.50-1.80	0.76	0.51-1.90	0.6	34.13-53.82	21.98	92.97-99.59	48.14
16	Macherla	28-38	22	4.36-5.80	3.38	0.80-1.00	0.6	1.07-2.40	1.15	36.35-51.03	29.12	92.24-97.0	63.08
17	Veldurthi	28-31	29.5	5.62-5.82	5.72	0.4-0.66	0.53	1.41-1.66	1.53	38.08-41.04	39.56	94.13-94.38	94.23
18	Durgi	18-24	10.5	5.04-5.43	2.61	0.30-0.82	0.28	0.97-1.50	0.61	26.56-53.45	20.00	92.13-96.98	47.27
19	Rentachintala	27-41	17	4.20-5.86	2.51	0.30-0.90	0.3	0.82-2.50	0.83	36.65-49.26	21.47	94.02-97.85	47.96
20	Gurazala	32-35	33.0	4.69-5.30	4.88	0.40-0.92	0.70	0.82-2.80	1.46	42.56-43.95	43.17	91.19-94.95	93.30
	Overall mean		29.61		3.94		0.94		1.41		32.4		74.4

Table 6b. Electro - chemical properties of red soils of Narasaraopet revenue division of Guntur district.

S.No	Name of the mandal	Ca ⁺²		Mg ⁺²		K ⁺		Na ⁺		CEC(cmol (P ⁺) kg ⁻¹)		PBS	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1	Narasaraopet	18	18.0	3.04	3.04	1.3	1.3	0.75	0.75	27.35	27.35	84.42	84.42
2	Rompicherla	18	18.0	4.34	4.34	1.89	1.89	0.94	0.94	28.6	28.6	88.01	88.01
3	Chilakaluripeta	-	-	-	-	-	-	-	-	-	-	-	-
4	Nadendla	-	-	-	-	-	-	-	-	-	-	-	-
5	Edlapadu	-	-	-	-	-	-	-	-	-	-	-	-
6	Vinukonda	20-25	22.5	2.34-5.16	3.75	0.87-1.02	0.94	0.68-1.58	1.13	26.89-38.32	32.6	85.49-88.84	87.16
7	Nuzendla	6<34	10.0	2.86-5.21	2.01	1.80-2.50	1.07	0.71-1.85	0.64	14.69-50.17	16.21	85.85-91.03	44.22
8	Ipur	16-27	10.8	2.34-5.52	1.96	0.80-1.40	0.55	0.61-1.12	1.73	23.73-39.36	15.79	83.50-88.52	43.00
9	Bollapalli	9<24	17.0	3.13-5.82	4.52	1.64-2.02	1.81	0.90-1.89	1.47	21.30-36.08	28.56	83.90-99.35	87.68
10	Savalyapuram	-	-	-	-	-	-	-	-	-	-	-	-
11	Piduguralla	12-37	16.3	4.65-5.91	3.52	1.50-1.89	1.13	0.66-1.69	0.78	22.62-49.73	24.11	85.28-90.77	58.68
12	Machavaram	18-22	20.0	4.52-4.78	4.65	0.76-1.58	1.17	0.60-1.00	0.8	28.04-33.91	30.97	85.16-86.58	85.87
13	Dachepalli	-	-	-	-	-	-	-	-	-	-	-	-
14	Karampudi	-	-	-	-	-	-	-	-	-	-	-	-
15	Nakarikallu	19	19.0	5.65	5.65	1.8	1.8	0.51	0.51	31.08	31.08	86.74	86.74
16	Macherla	18-28	23.0	4.56-4.86	4.71	1.40-1.54	1.47	1.24-1.35	1.29	32.08-40.43	36.25	80.27-87.06	83.66
17	Veldurthi	14-26	13.3	4.26-5.82	3.36	0.66-1.07	0.57	0.40-0.95	0.45	24.52-36.95	20.49	85.30-87.64	57.64
18	Durgi	12	12.0	4.69	4.69	1.3	1.3	0.46	0.46	21.13	21.13	87.32	87.32
19	Rentachintala	22	22.0	5.82	5.82	1.5	1.5	1.2	1.2	34.69	34.69	87.98	87.98
20	Gurazala	-	-	-	-	-	-	-	-	-	-	-	-
	Overall mean		17.1		4.0		1.3		0.9		26.8		26.8

further observed that relatively higher CEC values were recorded high in black soils than in red soils. This implicated the contribution of clay fraction towards CEC of soils and also due to the dominance of smectitic type of clay. Alkaline soil reaction and high clay content of these soils conduces higher CEC values. This implicated the contribution of clay fraction towards CEC of soils and also due to the dominance of smectitic type of clay. Jayaramarao *et al.* (2013) found lower CEC values in red soils of Naira village, Srikakulam district of Andhra Pradesh.

The per cent base saturation of red and black soils ranged from 75.6 to 74.4 per cent (Table 3a & 3b). The black soils of the study area recorded higher per cent of base saturation values when compared to red soils. This could be attributed that red soils have either mixed or illitic mineralogy in clay fraction and neutral to slightly alkaline in soil reaction. The results were in agreement with the findings of Mandal *et al.* (2010) in soils of Surabardi watershed area, Nagpur district, Maharashtra.

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