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Study of physical properties of soils from Mango orchards of Ratnagiri district of Konkan region

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Abstract

In Mango, micronutrients present in soil play important role in fruit yield and overall growth development. The present study was conducted to study the physical properties of soils of Mango orchards of Ratnagiri district of Konkan region. Total 58 soil samples were collected at 0-15 and 15-30 cm soil depth from Mango fields of Ratnagiri district. Thus, the study concluded that the soils of the Mango orchards of Ratnagiri district have high organic carbon content with average value found as 1.74 per cent at 0-15 cm and 1.64 per cent at 15-30 cm soil depth. The average bulk density of Ratnagiri district of mango orchard was found as 1.23 Mg/m³ at 0-15 cm and 1.27 Mg/m³ at 15-30cm soil depth.

Keywords: physical properties, mango, bulk density, texture

1. Introduction

Soil is one of the most important resources in the living planet earth. Soil is an interface of the organic as well as inorganic chemistry of terrestrial world. It is a reservoir of nutrients and plays a vital role in growth of plants and maintaining the earth's environment.

The fertility status of soil is one of the most important factor which governing the yield as well as quality of mango. In case of mango crop, soil texture, drainage and soil fertility are very important for sustaining its productivity. Also, organic carbon content in soil is an important parameter of the soil and which significantly responsible for the fertility and productivity of the soil ^[1].

India is the world's largest Mango producer and world's leading mango producers in area as well as production. About 18.431 MT of total production of Mango in India ^[2] which contributes about 64 % of the world's Mango production. In Maharashtra and Konkan region, about 4.82 lakh ha and 1.10 lakh ha area occupying Mango with annual production of 6.33 MT ^[2] and 2.6 lakh MT ^[3] respectively. Mango (*Mangifera indica* L.) belonging to family *Anacardiaceae* is the most important commercially grown fruit crop in India which is one of the delicious tropical seasonal fruit. It is known as the "The king of the fruits" due to its nutritionally rich fruit with unique flavour, fragrance, taste and health promoting qualities making it a common ingredient in new functional foods.

Ratnagiri district of Konkan region of Maharashtra is well known for commercial production of world famous Mango cultivation. Soil of Ratnagiri district is mainly lateritic soil, on which Mango grown on hilly area under rain-fed conditions. Konkan region of Maharashtra is bestowed with rich natural resources of soil, water and vegetation. However its vulnerability is also well known in the form of biodiversity hotspot ^[4] due to extreme weather conditions and undulating terrain. Thus, heavy rainfall and sloppy terrain leads to alteration of physical and chemical properties which further affects the availability of various nutrients and finally on soil fertility ^[5]. Thus, the objectives of present study were to estimate the various physical properties of soils form Mango fields of Ratnagiri district.

2. Materials and Methods

The present study was carried out in Ratnagiri district which is a coastal district of Konkan region of Maharashtra state. The total geographical area of Ratnagiri district is 8,461 sq. km. with average annual rainfall of 3,591 mm comprises nine tahsils. Total 58 locations of Mango orchards were selected for study area. At each location, soil samples were collected at 0-15 cm and 15-30 cm soil depth. Fig. 1 shows the location map of selected villages of Mango orchards in Ratnagiri district.

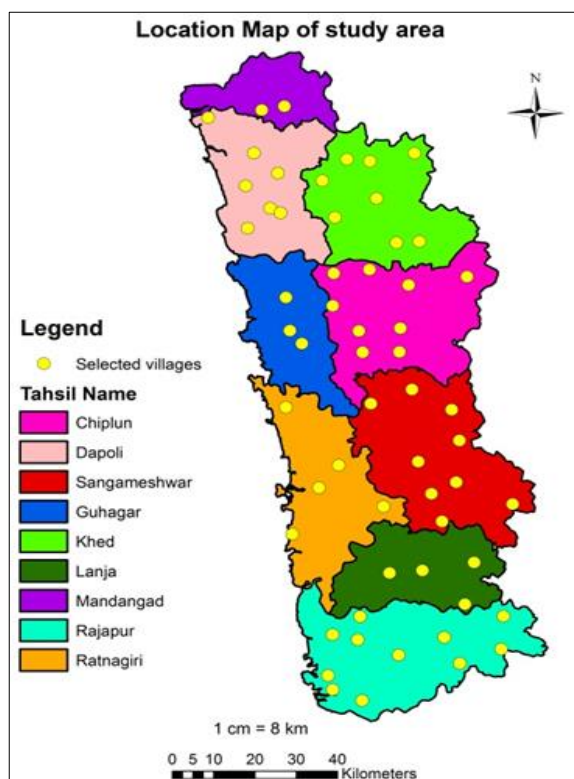


Fig 1: Location Map of Mango orchards in Ratnagiri district

2.1 Collection of soil samples and soil analysis

The standard method of the district soil testing laboratories

used for collection of soil samples. Soil samples were collected at 0-15 cm and 15-30 cm soil depths at each selected mango orchard field. Therefore, total 116 soil samples were collected at two depths from Ratnagiri district. All collected soil samples were dried under open room. Then, removed impurities like stones, pebbles, roots, dried leaves etc. if any were present in soil samples. After dried, soil samples were sieved through 2 mm and 0.5 mm sieve for measuring of sand %, silt %, clay % and soil organic carbon. These soil samples were analyzed for various soil properties by their respective standard analytical methods as shown in Table 1.

Table 1: Soil analytical methods used in study

Sr. No.	Properties	Name of method
1.	Mechanical analysis	Bouyoucos hydrometer [6]
2.	Bulk density	Soil clod method [7]
3.	Organic carbon	Walkley and Black's rapid titration method [7]

3. Results and Discussion

In present study, soil samples were analyzed in the Department of Soil Science and Agricultural Chemistry, College of Agriculture, Dr. BSKKV, Dapoli.

3.1 Physical properties of soil samples

The 116 soil samples were collected from 58 villages at two soil depths i.e. 0-15 cm and 15-30 cm depth of Ratnagiri district of Konkan region. Table 2 shows the taluk wise soil samples collected of Mango orchards of Ratnagiri district.

Table 2: Taluk wise number of soil samples collected of Mango orchards of Ratnagiri district

Sr. No.	Tehsil name	No. of Samples collected at two depths
1	Mandangad	2
2	Dapoli	7
3	Khed	8
4	Guhagar	3
5	Chiplun	9
6	Ratnagiri	5
7	Sangameshwar	9
8	Lanja	4
9	Rajapur	11

3.2 Per cent sand, silt and clay content

Table 3 shows the taluk wise average values of physical properties of soils of Mango crop of Ratnagiri district for 0-15 cm soil depth. Study indicated that sand, silt and clay content of Ratnagiri district were ranges from 61.70 to 88.10 from with a mean value of 83.63 per cent, 1.90 to 13.60 with mean value of 4.76 per cent and 6.30 to 31.90 with a mean value of 11.61 per cent, respectively. Table 4 shows the taluk wise average values of physical properties of soils of Mango crop

of Ratnagiri district for 15-30 cm soil depth. Study shown that sand, silt and clay content of Ratnagiri district were ranges from 57.14 to 89.10 from with a mean value of 84.45 per cent, 1.80 to 16.57 with mean value of 4.47 per cent and 5.04 to 27.80 with a mean value of 11.08 per cent, respectively. Fig. 2 to Fig. 4 maps were shows the sand, silt and clay % of Ratnagiri district. Thus, the mechanical composition of Ratnagiri district indicated the textural class was sandy loam and loamy sand.

Table 3: Status of physical properties of soils of Mango orchards of Ratnagiri district (0-15 cm soil depth)

Sr. No.	Tahsil Name	%Sand	%Silt	%Clay	Textural class	BD (Mg/m ³)	O.C. (%)
1	Mandangad	80.75	8.60	10.65	Loamy sand	1.30	1.38
2	Dapoli	79.39	8.62	12.00	Sandy loam	1.25	1.79
3	Khed	80.31	7.83	11.86	Sandy loam	1.29	1.51
4	Guhaghar	74.93	9.07	16.00	Sandy loam	1.29	1.48
5	Chiplun	80.87	7.66	11.47	Sandy loam	1.28	1.51
6	Ratnagiri	81.62	6.84	11.54	Loamy sand	1.30	1.42
7	Sangmeshwar	80.63	6.35	13.02	Sandy loam	1.23	2.02
8	Lanja	77.31	4.80	17.89	Sandy loam	1.28	1.55
9	Rajapur	83.63	4.76	11.61	Loamy sand	1.23	1.94

Table 4: Status of physical properties of soils of Mango orchards of Ratnagiri district (15-30 cm soil depth)

Sr. No.	Village Name	%Sand	%Silt	%Clay	Textural class	BD (Mg/m ³)	O.C. (%)
1	Mandangad	80.45	7.75	11.80	Sandy loam	1.36	1.01
2	Dapoli	75.87	8.22	15.91	Sandy loam	1.27	1.60
3	Khed	82.12	6.72	11.16	Loamy sand	1.30	1.40
4	Guhaghar	71.34	11.07	17.59	Sandy loam	1.31	1.31
5	Chiplun	84.22	5.75	10.03	Loamy sand	1.30	1.41
6	Ratnagiri	85.98	5.18	8.84	Loamy sand	1.36	0.96
7	Sangmeshwar	82.24	4.90	12.86	Sandy loam	1.29	1.53
8	Lanja	83.57	5.55	10.88	Loamy sand	1.30	1.43
9	Rajapur	84.45	4.47	11.08	Loamy sand	1.27	1.64

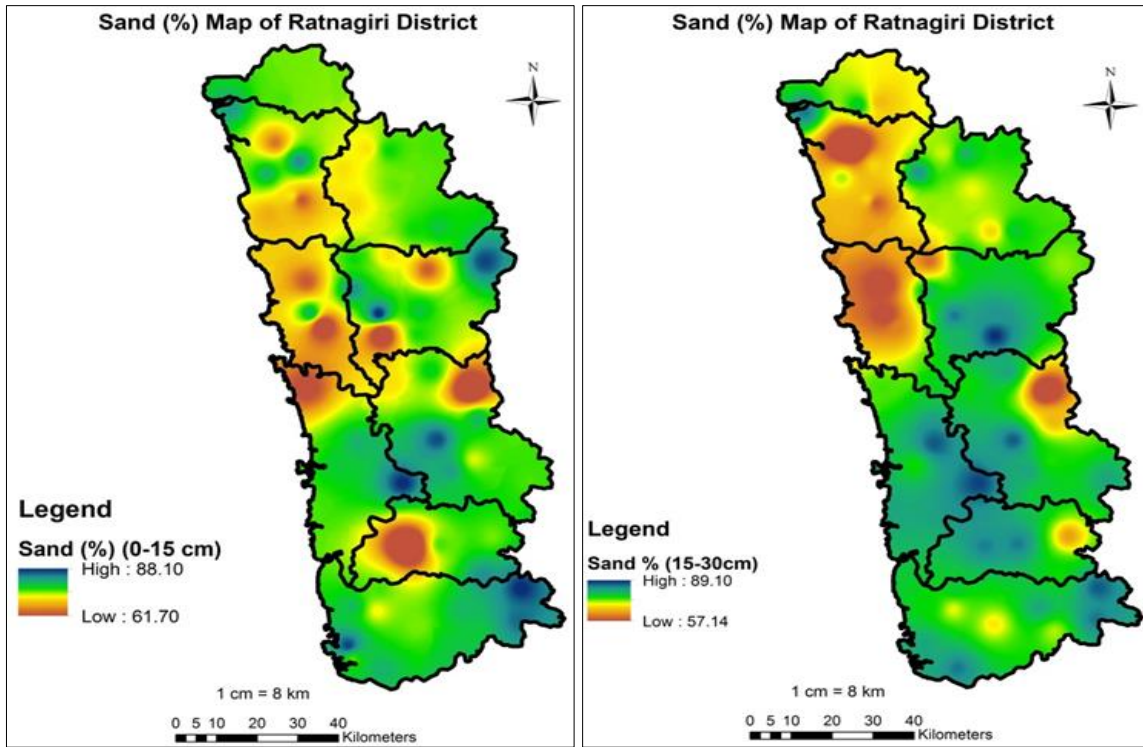


Fig 2: Sand (%) map of Ratnagiri district at 0-15 cm and 15-30 cm depth

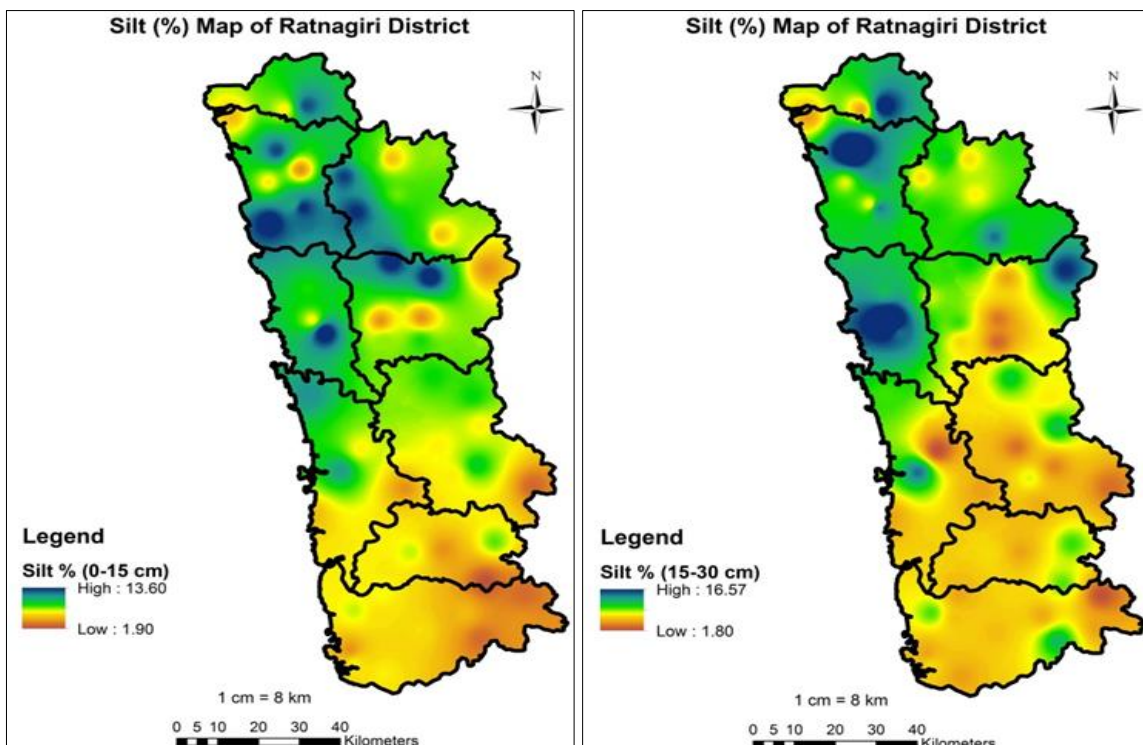


Fig 3: Silt (%) map of Ratnagiri district at 0-15 cm and 15-30 cm depth

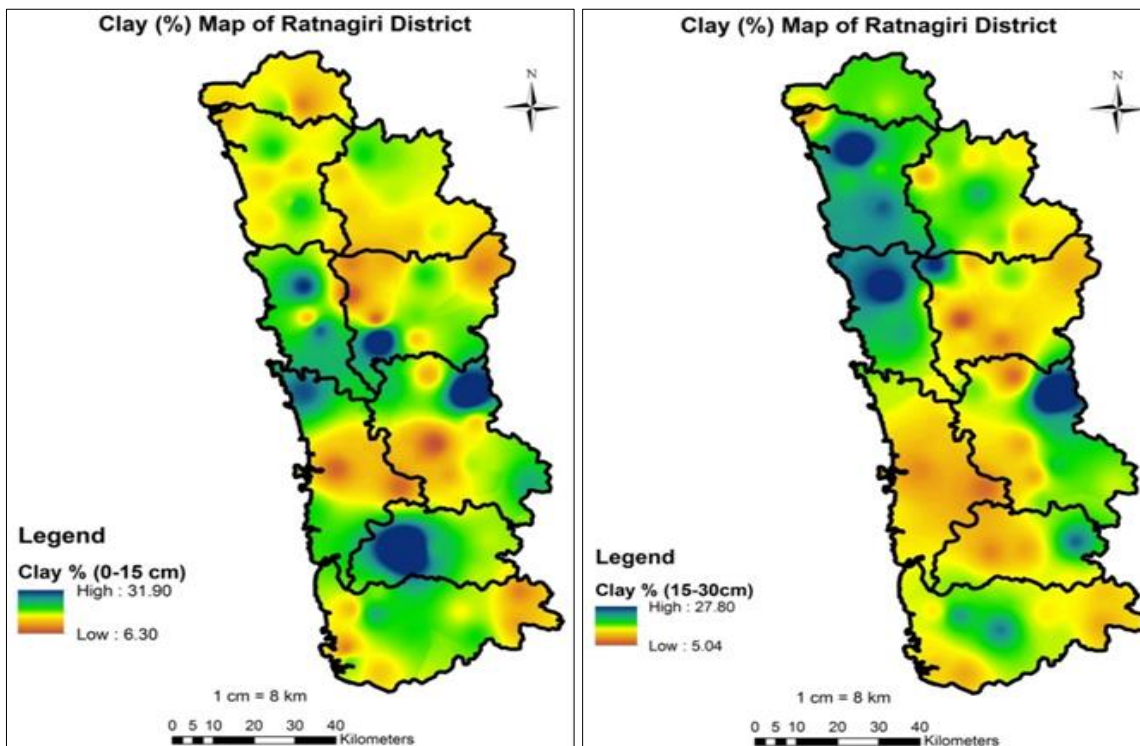


Fig 4: Clay (%) map of Ratnagiri district at 0-15 cm and 15-30 cm depth

3.3 Bulk density

The data presented in Table 3 shows that the values of bulk density of Ratnagiri district of mango field ranged from 1.15 to 1.39 with an average value of 1.23 Mg/m³ at 0-15 cm soil depth while for 15-30 cm soil depth it ranges from 1.16 to 1.45 with a mean value of 1.27 Mg/m³ (Fig. 5). Similarly findings were reported for lateritic soils of Konkan [8,9].

3.4 Organic carbon

The data presented in Table 3 shows that the values of soil organic carbon in Ratnagiri district of mango field were

ranging from 0.74 – 2.77 % with an average value of 1.74 % for 0-15 cm depth and for 15-30 cm depth were ranging from 0.55 – 2.61 % with an average value of 1.64 % (Fig. 6). These observations are in conformity with the observations for lateritic soils of Konkan [10, 11].

However, a high carbon level on the surface soil than on subsurface layers can be due to profuse root growth of grasses in the surface layers rather than subsurface [9]. In general, all samples were rated as "very high," according to the ratings of [12] indicating that the organic carbon content in mango-growing soil was adequate.

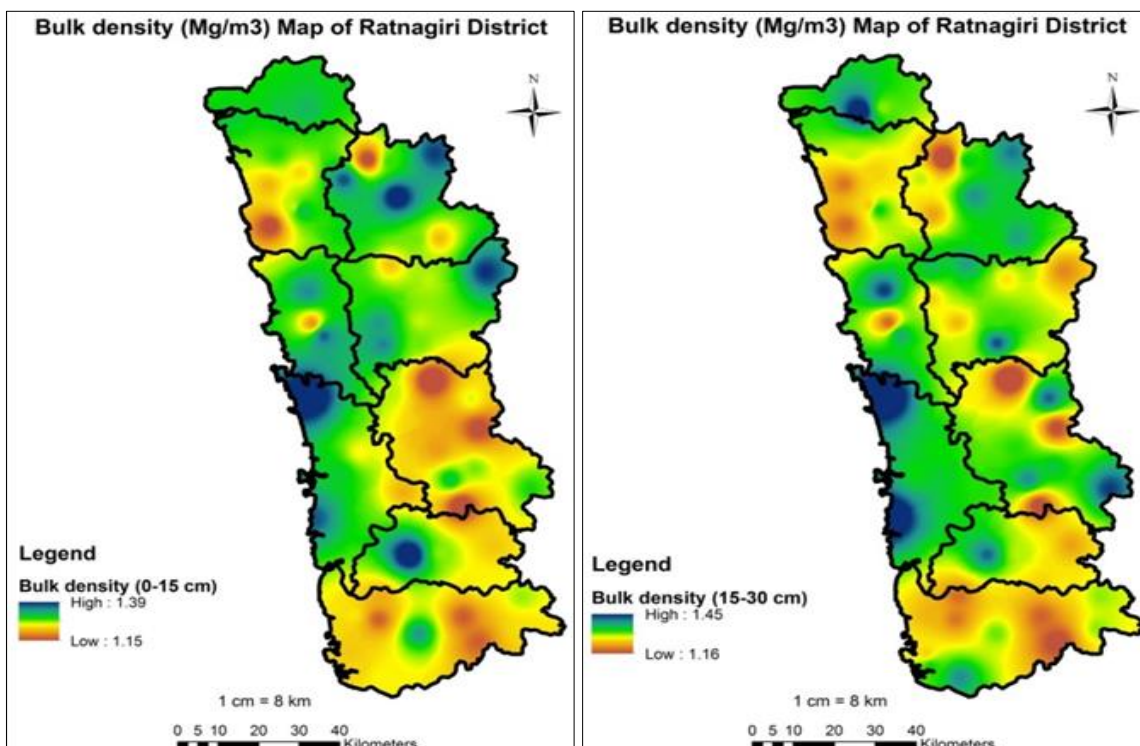


Fig 5: Bulk density (Mg/m³) map of Ratnagiri district at 0-15 cm and 15-30 cm depth

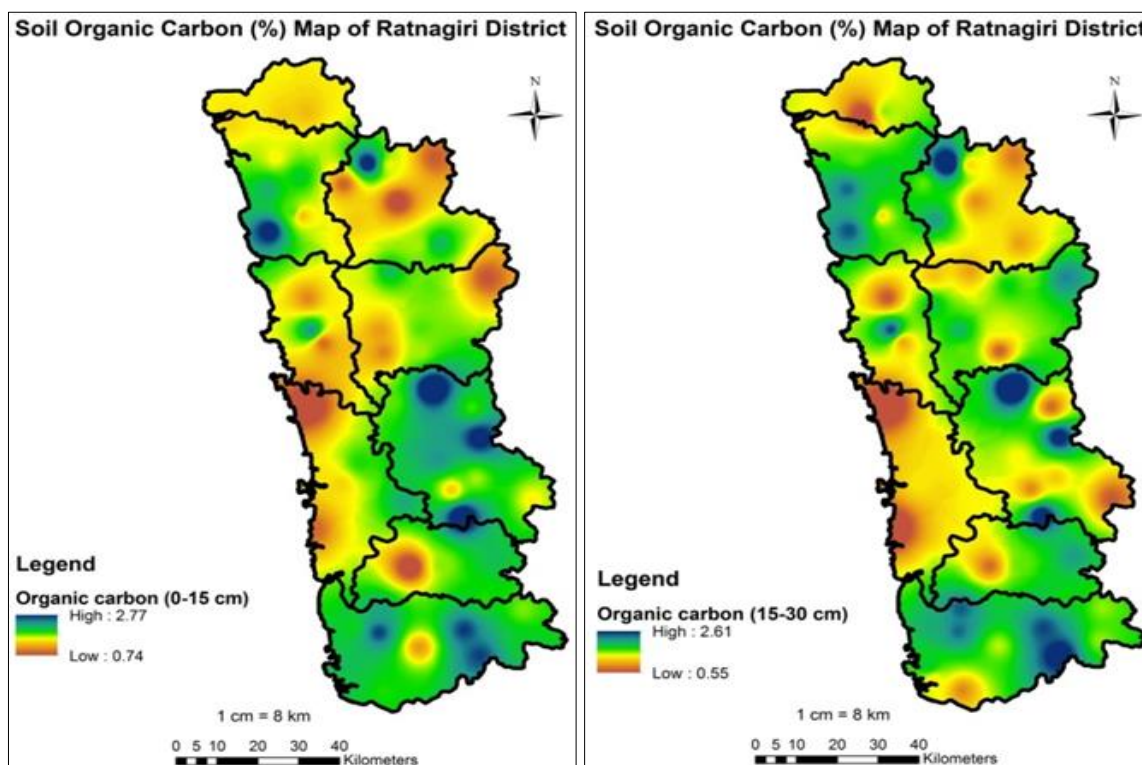


Fig 6: Soil Organic Carbon (%) map of Ratnagiri district at 0-15 cm and 15-30 cm depth

4. Conclusions

The present study was conducted to study the physical properties of soils of Mango orchards of Ratnagiri district at depth of 0-15 cm and 15-30 cm depth by using standard analytical methods. The results show that sand content was higher than clay content. Organic carbon was found as very high in the soils of Mango fields of Ratnagiri district.

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