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Evaluation of organic carbon status in the soils of Saurashtra region

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Abstract

A field experiment entitled “Evaluation of Organic Carbon Status in the soils of Saurashtra Region” was carried out during summer season of 2021. Samples were collected from each taluka of different districts of Saurashtra region and analysed at Department of Soil science and agricultural chemistry, College of Agriculture, Junagadh Agricultural University, Junagadh.

Based on analysed data of soil samples, collected from different district of Saurashtra region of Gujarat, it can be concluded that soil of Saurashtra region was medium in Organic Carbon status with mean value of 0.57 per cent, whereas Porbandar district found highest organic Carbon percentage with 0.82 per cent value and Surendranagar district found lowest organic carbon percentage with 0.44 per cent. According to Nutrient index value, Porbandar, Gir-Somnath and Devbhoomi Dwarka district covered very high area of having Organic carbon per cent. Bhavnagar, Amreli, Rajkot and Surendranagar found very low organic carbon per cent area. Junagadh and Jamnagar covered medium area of having Organic carbon per cent. Morbi district covered high area of having Organic carbon per cent.

Keywords: Soil organic carbon, nutrient index value, Saurashtra region

1. Introduction

Now a day, there is major problem of soil fertility status. Due to use of wide range of chemical fertilizer which reduce the fertility status of soil and impact on soil physical, chemical and biological properties. SOC play vital role in improve the soil the different soil properties.

The soil organic carbon content is crucial parameter which determines many soil properties important for crop production. The prevailing environment in semi-arid regions characterized by higher temperature is depleting. The day-by-day decline in soil organic carbon reduction and poor soil health, it is necessary to add the organic matter to soil which increase soil organic carbon content and improve soil health. The soil organic carbon has large influence on the soil physical and chemical properties which determine soil quality. Crop residues play a major role in supplying nutrients to soil and becomes available to the subsequent crops on decomposition.

Higher SOC promotes soil structure or tilth meaning there is greater physical stability. This improves soil aeration (oxygen in the soil) and water drainage and retention and reduces the risk of erosion and nutrient leaching. SOC is also important to chemical composition and biological productivity, including fertility and nutrient holding capacity of a field. As carbon stores in the soil increase, carbon is “sequestered” and the risk of loss of other nutrients through erosion and leaching is reduced. An increase in SOC typically results in a more stable carbon cycle and enhanced overall agricultural productivity.

2. Materials and Methods

The present investigation was undertaken by conducting soil survey of Saurashtra Agro-climatic Zone of Gujarat state and soil samples analysed at the Department of Soil Science and Agricultural Chemistry, College of Agriculture, Junagadh Agricultural University, Junagadh.

Ten surface soil samples were collected from Junagadh, Bhesan, Keshod, Malia, Manavadar, Mangrol, Mendarda, Vanthali and Visavadar talukas of Junagadh district, Gir-Gadhada, Kodinar, Sutrapada, Talala, Una and Veraval talukas of Gir Somnath district, Amreli, Babra, Bagasara, Dhari, Jafrabad, Khambha, Kunkavav-Vadia, Lathi, Lilia, Rajula and Savarkundla talukas of Amreli district, Bhavnagar, Gariadhar, Ghogha, Jesar, Mahuva, Palitana, Sihor, Talaja, Umralla and Vallabhipur (Zone VIII) talukas of Bhavnagar district, Porbandar, Kutiyana and Ranavav talukas of Porbandar district, Rajkot, Paddhari, Lodhika, Dhoraji,

JamKandorna, Upleta, Jetpur, Kotda Sangani, Jasdan, Vinchhiya and Gondal talukas of Rajkot district, Dwarka, Bhanvad, Kalyanpur and Jam-Khambhaliya talukas of Devbhoomi Dwarka district, Morbi, Tankara, Halvad (Zone V), Wankaner and Maliya-Miyana talukas of Morbi district, Surendranagar, Chuda, Chotila, Dhrangadhra, Lakhatar, Limbdi, Muli, Patli, Sayla and Thangadh talukas of Surendranagar district, Jamnagar, Jam Jodhpur, Jodiya, Dhrol, Lalpur and Kalavad talukas of Jamnagar district of Saurashtra Agro-climatic Zone of Gujarat. Total 750 surface (0-15 cm)

soil samples were collected during summer season of 2021. All the soil samples collected were analysed for Soil organic carbon by titration method which was given. In order to compare the levels of soil fertility of one area with those of another it was necessary to obtain a single value for SOC. Here the nutrient index introduced by Parker *et al.* (1951)^[7] and modified by Ramamurthy and Bajaj (1969)^[10]; Shetty *et al.* (2008)^[12]; Stalin *et al.* (2010)^[13]; Pathak (2010)^[8] and Kumar *et al.* (2013)^[6]. Parker's nutrient index is a six-tier system used to evaluate the fertility status of soils.

$$\text{Nutrient index} = \frac{\text{No. of samples (V.L)} \times 0.5 + \text{No. of samples (L)} \times 1.0 + \text{No. of samples (Medium)} \times 1.5 + \text{No. of samples (M High)} \times 2.0 + \text{No. of samples (High)} \times 2.5 + \text{No. of samples (V High)} \times 3.0}{\text{Total number of samples}}$$

Total number of samples

3. Results and Discussion

1. Status of SOC in Saurashtra region of Gujarat

Organic carbon content in the soils is important parameter from the fertility and physical properties points of view. Hence, the samples were analysed for soil organic carbon content in Saurashtra region (Fig 1 and 2). In general, the soil of Saurashtra region is Medium in O.C. status. Over all O.C. status in Saurashtra region with mean of 0.57 per cent and range in 0.21-1.56 per cent. In Saurashtra region, maximum mean value of Soil organic carbon was found in Porbandar District with 0.82 per cent. The lowest mean value of Soil organic carbon from Surendranagar district with 0.44 per cent recorded in the sample collected from Saurashtra region. Such low values for organic carbon status of soils are expected because of the arid climate and particularly negligible replacement of organic matter. Kanzaria *et al.*, (1982)^[4] also reported similar results for the soils of coastal area of Saurashtra and Kutchh region and Gundalia (1978)^[3] for

Bhavnagar district. Dubey *et al.*, (1986)^[2] observed similar status of O.C. in soils of Kutchh region. Polara *et al.*, (2004)^[9] also observed similar results for Kutchh region of Gujarat.

Table 1: SOC status in Saurashtra region of Gujarat

District	SOC (%)	
	Range	Mean
Rajkot	0.27-1.08	0.50
Amreli	0.21-0.87	0.52
Bhavnagar	0.24-0.81	0.45
Surendranagar	0.24-1.11	0.44
Junagadh	0.36-0.96	0.72
Gir-Somnath	0.27-1.17	0.75
Jamnagar	0.24-0.81	0.46
Morbi	0.21-1.20	0.47
Dwarka	0.21-1.56	0.57
Porbandar	0.51-1.56	0.82
Overall	0.21-1.56	0.57

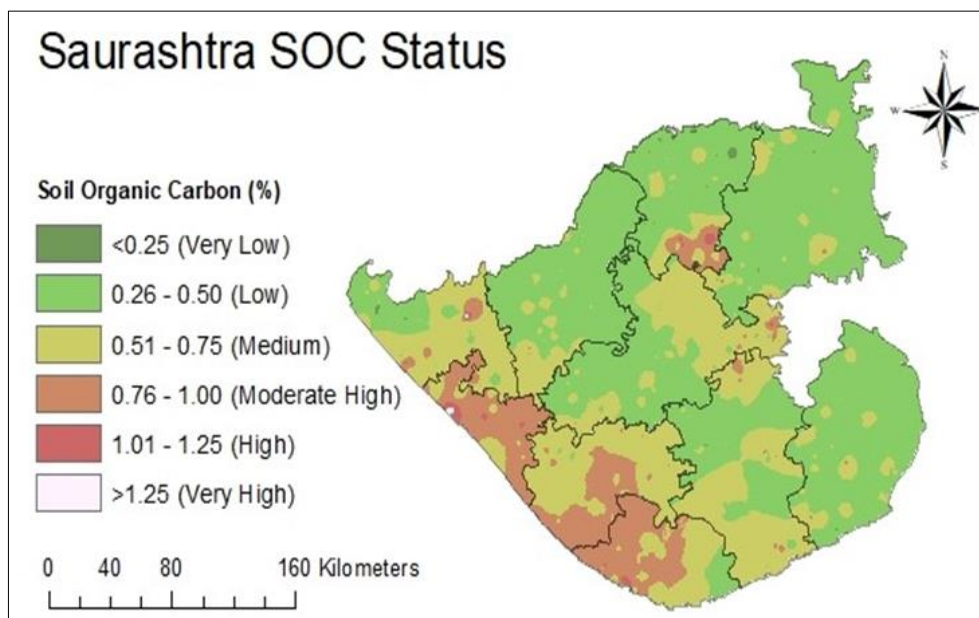


Fig 1: Map of SOC status in Saurashtra region of Gujarat

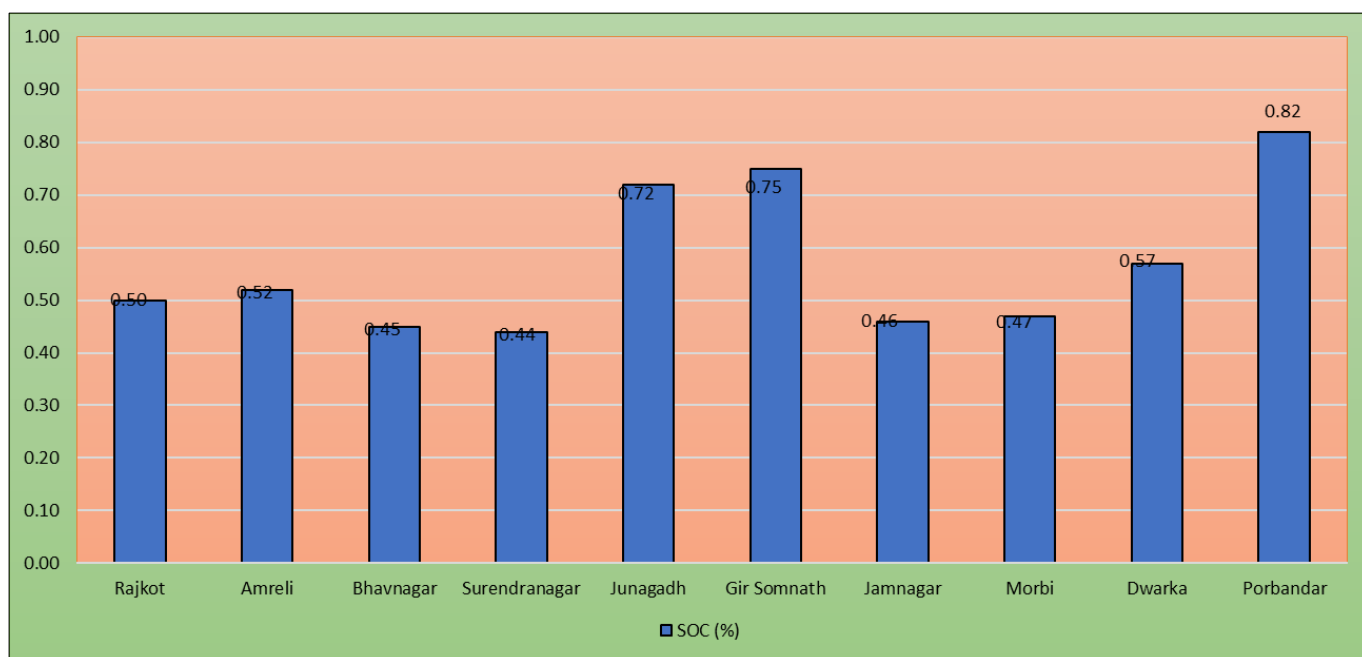


Fig 2: Status of SOC in Saurashtra region of Gujarat

Table 2: Classification of Nutrient Index

Nutrient Index	Classes
<1.33	Very Low
1.33-1.66	Low
1.66-2.00	Medium
2.00-2.33	Moderate High
2.33-2.66	High
>2.66	Very High

Surendranagar with 1.15%, Rajkot with 1.14% and Amreli with 1.20% nutrient index value, they were referred in very low class. The soils were deficient in content of organic carbon, this may probably attribute due to low adoption of crop residue recycling and organic manure addition practices coupled with rapid decomposition and mineralization of Organic matter in Sub-tropical climate condition and crop residue burning which may be the probable reason of low organic carbon in the soils.

2. Nutrient index value

Very Low

Saurashtra with 0.18%, Bhavnagar, with 1.16%,

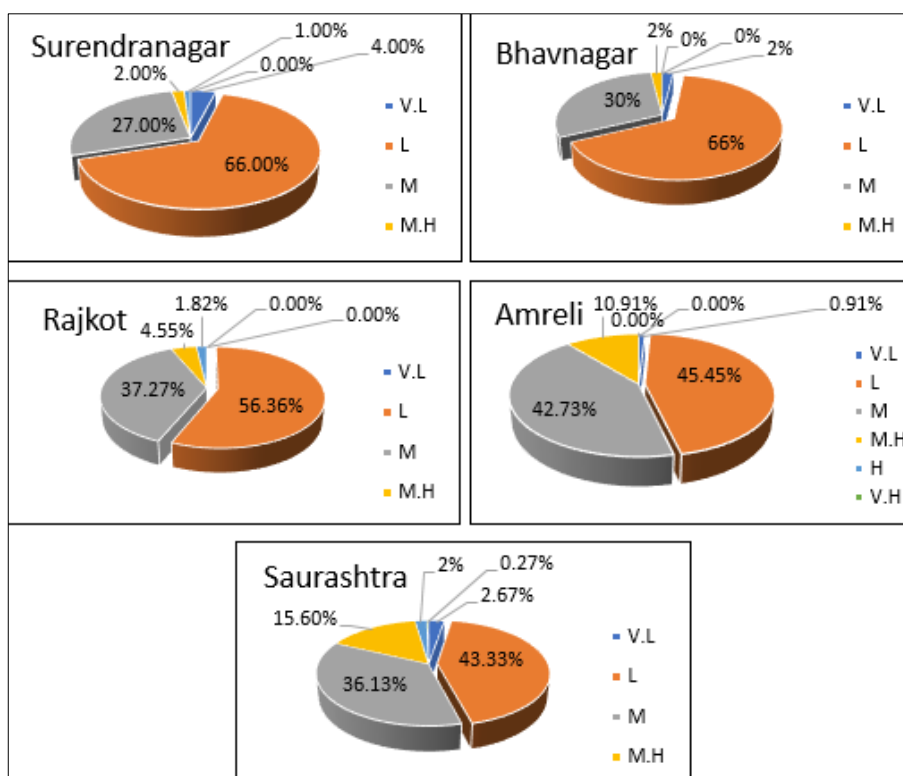


Fig 3: Saurashtra and District wise overall percentage of very low nutrient index value

Medium

Jamnagar with 1.99% and Junagadh with 1.91% nutrient index value, they were referred in medium class. The observation of predominance of medium range of organic carbon content in Junagadh and Jamnagar soils might be due to intensive cultivation with little deposition of organic residues and greater oxidation of organic matter caused by Hotter climate (Rousk *et al.*, 2009) [11].

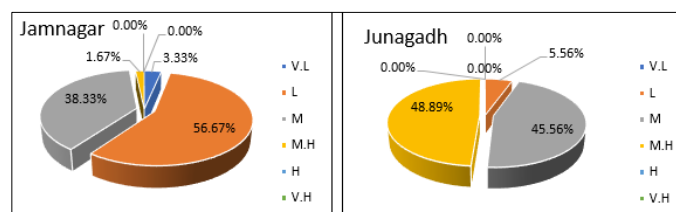


Fig 4: District wise overall percentage of Medium nutrient index value

High

Morbi with 2.42% nutrient index value, it was referred in high class. The prevailing low temperature results in suppression of microbial and enzymatic activities, which results least soil organic matter decomposition and its accumulation in surface

soils (Bhattacharya *et al.*, 2008) [11].

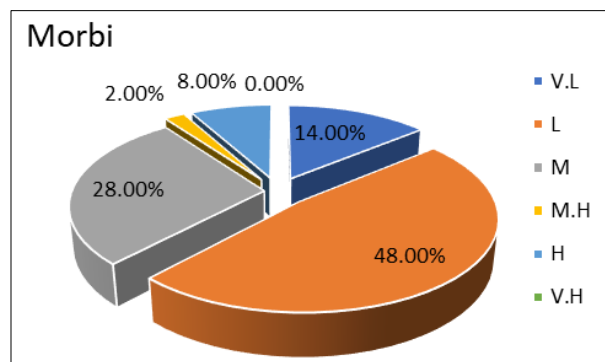


Fig 5: District wise overall High nutrient index value

Very High

Gir Somnath with 2.93%, Porbandar with 6.39%, Devbhoomi Dwarka with 3.44% nutrient index value, they were referred in very high class. According to Kavitha and Sujata (2015) [5], Very high levels of organic matter not only provide part of the N requirement of crop plants, but also enhance nutrient and water retention capacity of soils and create favourable physical, chemical and biological environment.

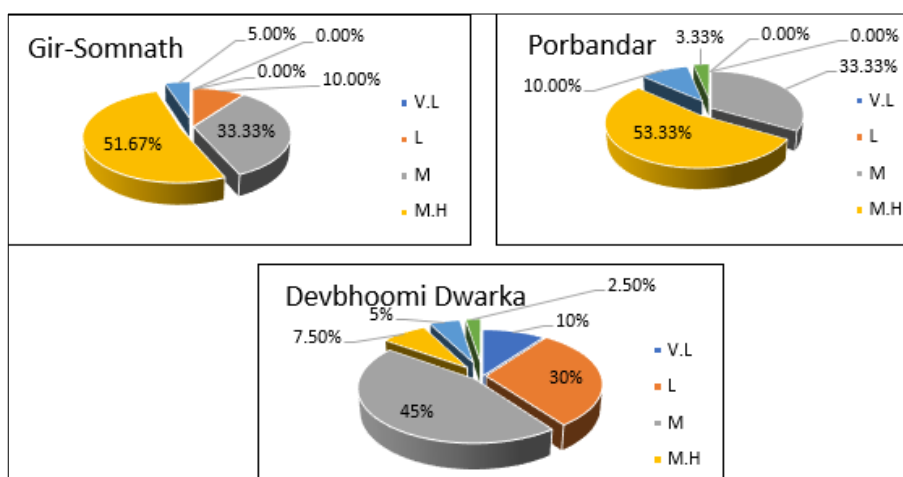


Fig 6: District wise overall very high nutrient index value

Table 3: District wise Nutrient Index Value of organic carbon of Saurashtra region

District	Soil organic carbon (%)	No. of sample/ District	Classification of Nutrient						Total analysis	Nutrient Index Value	Nutrient Index Class
			V.L.	L.	M.	M.H.	H.	V.H.			
Bhavnagar	0.24-0.81 (0.45)	No. of sample	2	66	30	2	0	0	100	1.16	Very Low
		Percent	2	66	30	2	0	0	100		
Amreli	0.21-0.87 (0.52)	No. of sample	1	50	47	12	0	0	110	1.20	Very Low
		Percent	0.91	45.45	42.73	10.91	0	0	100		
Rajkot	0.27-1.08 (0.50)	No. of sample	0	62	41	5	2	0	110	1.14	Very Low
		Percent	0	56.36	37.27	4.55	1.82	0	100		
Morbi	0.21-1.20 (0.47)	No. of sample	7	24	14	1	4	0	50	2.42	High
		Percent	14	48	28	2	8	0	100		
Jamnagar	0.24-0.81 (0.46)	No. of sample	2	34	23	1	0	0	60	1.99	Medium
		Percent	3.33	56.67	38.33	1.67	0	0	100		
Gir-Somnath	0.27-1.17 (0.75)	No. of sample	0	6	20	31	3	0	60	2.93	Very High
		Percent	0	10	33.33	51.67	5	0	100		
Porbandar	0.51-1.56 (0.82)	No. of sample	0	0	10	16	3	1	30	6.39	Very High
		Percent	0	0	33.33	53.33	10	3.33	100		
Junagadh	0.36-0.96 (0.72)	No. of sample	0	5	41	44	0	0	90	1.91	Medium
		Percent	0	5.56	45.56	48.89	0	0	100		
Surendranagar	0.24-1.11 (0.44)	No. of sample	4	66	27	2	1	0	100	1.15	Very Low
		Percent	4	66	27	2	1	0	100		

Devbhoomi Dwarka	0.21-1.56 (0.57)	No. of sample	4	12	18	3	2	1	40		
		Percent	10	30	45	7.5	5	2.5	100	3.44	Very High
Overall	0.21-1.56 (0.57)	No. of sample	20	325	271	117	15	2	750		
		Percent	2.67	43.33	36.13	15.60	2	0.27	100	0.18	Very Low

4. Conclusion

Overall the soils of Saurashtra region was medium in organic carbon status of soils with mean of 0.57 per cent indicated the need for additions of FYM, fish manures, *etc.*, to improve the soil physical conditions and soil sustainability. Maximum mean value of Soil organic carbon was found in Porbandar District with 0.82 per cent. The lowest mean value of Soil organic carbon from Surendranagar district with 0.44 per cent. The soils of Saurashtra region were low to medium in organic carbon. According to soil organic carbon nutrient index value, 2.67% soil samples fall in the organic carbon as very low content and the highest 43.33% soil samples fall in the organic carbon as low content.

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