Journal of the Indian Society of Soil Science, Vol. 66, No. 2, pp 182-187 (2018)
DOI: 10.5958/0974-0228.2018.00023.3

# Assessment of Available Macro and Micronutrient Status of Coastal Jamnagar District in Saurashtra Region of Gujarat

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Two hundred surface (0-20 cm) soil samples from the ten *talukas* of coastal Jamnagar district *viz.,* Jamjodhpur, Bhanvad, Kalyanpur, Dwarka, Kalavad, Jamnagar, Lalpur, Jamkhambhalia, Jodiya and Dhrol were collected from the cultivated soils, and were analyzed for different chemical properties. Soils were deficient with respect to available N and S, whereas medium in available P and high in available K status. The soils are alkaline in reaction with overall $pH_{2.5}$ 8.18. Soils of entire district were calcareous (free $CaCO_3$ 54.9%) in nature with low to medium in organic carbon. Among the DTPA extractable micronutrients, Mn and Cu found sufficient, whereas the soils are medium in Fe and Zn. The nutrient index found for available N (1.59) and S (1.62), medium for available P (1.68) and high for K (2.67), DTPA extractable Zn (1.59) low, and high for Fe (2.35), Mn (2.36) and Cu (2.48) in the soils of Jamnagar district. Significant and positive correlation was found between soil organic carbon content and pH, available N, Mn and Zn. The soil pH was found to negatively correlated with available N, P, K and S.

**Key words:** Chemical characteristics, macronutrient, micronutrient, nutrient index, correlation matrix

Evalution of fertility status of the soils of an area or region is an important aspect in context of sustainable agricultural production. Nitrogen (N), phosphorus (P), potassium (K) and sulphur (S) are important soil nutrient elements that controls its fertility and yields of the crops (Singh and Mishra 2012). Because of imbalanced and inadequate fertilizer use coupled with low efficiency of other inputs, the response (production) efficiency of chemical fertilizer nutrients has declined tremendously under intensive agriculture in recent years. The variation in major and micronutrients supply in soil is natural phenomenon and some of them may be sufficient where others deficient. The stagnation in crop productivity cannot be boosted without judicious use of macro and micronutrients of the study area. Therefore, the present study was undertaken to assess the status of available major and micronutrients in coastal Jamnagar district in Saurashtra region of Gujarat.

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## Materials and Methods

The study area (Jamnagar district) is located between 21°47' and 22°57' N latitude and 68°57' and 70°37' W longitude, covering about 10,921 sq. km area in the Saurashtra region of Gujarat state, India. The climate of the district is characterized by semi-arid to sub-humid, with an average annual rainfall of 670 mm, average minimum and maximum temperature are 24 °C and 43 °C, respectively and high evaporation during summer season. Major area of the Jamnagar district is rainfed agriculture except villages in Jamnagar, Jodiya and Kalyanpur *talukas* receiving water from canal and ground water source. The major *kharif* crops include groundnut, cotton, castor and pearlmillet, along with sesame, greengram and blackgram crops. The sorghum is cultivated for fodder purpose. The *rabi* crops include wheat, garlic, onion and cumin.

The random soil samples from 0-20 cm depth were collected from 200 sites representing ten talukas *viz*., Jamjodhpur, Bhanvad, Kalyanpur, Dwarka, Kalavad, Jamnagar, Lalpur, Jamkhambhalia, Jodiya and Dhrol of the Jamnagar district. The air-dried soil samples were ground with a wooden pestle and mortar to break soil lumps. These samples were passed

through 2-mm sieve and analyzed for pH and electrical conductivity (EC) following standard procedures (Jackson 1973). Calcium carbonates were determined by the acid neutralization method. Organic carbon (OC) was determined following Walkley and Black (1934), available P was estimated by Olsen reagent (Olsen *et al.* 1954) and available K by flame photometry as described by Jackson (1973). Available iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) in the soil were extracted with DTPA (Lindsay and Norvell 1978) and were determined with the help of atomic absorption spectrophotometer (AAS). The nutrient indices (NI) for available nutrients was calculated using the formula as suggested by Ramamoorthy and Bajaj (1969): NI = [(Nl × 1) + (Nm × 2)+ (Nh × 3)]/Nt, where Nl, Nm, and Nh are the number of soil samples falling in low, medium and high categories for nutrient status and are given weightage of 1, 2 and 3, respectively. The Nt is the total number of samples (*i.e.* 200 samples), and classified this index as low (<1.66), medium (1.66 to 2.33) and high (>2.33). Simple correlation coefficients were computed between macronutrient, micronutrient content with physicochemical properties of the soils as suggested by Panse and Sukhatme (1961).

## Results and Discussion

*Soil characteristics*

The $EC_{2.5}$ of soils ranged from 0.26 to 3.06 with a mean value of 0.86 dS $m^{-1}$ (Table 1). The highest $EC_{2.5}$ 3.06 dS $m^{-1}$ (mean 1.14 dS $m^{-1}$) was observed in Dwarka *taluka*. The wide variation in $EC_{2.5}$ could be due to the influence of seawater or shallow watertable or poor quality of ground water (Anonymous 1994). The data of $EC_{2.5}$ value indicate the potential danger of salinity development in this area. The pH of the soils for the entire district ranged from 7.66 to 9.01 with a mean value of 8.18 indicating that the soils are alkaline in reaction. Similar results were reported for Churu district of Rajasthan (Kumar *et al.* 2011), and Bhavnagar District (Rajput and Polara 2012). The overall free lime ($CaCO_3$) content ranged from 4.18 to 115.6 with a mean value of 54.9 g $kg^{-1}$ indicating the calcareous nature of the soil. This might be due to impregnation of lime in the transported materials and accumulation of shells in the marine alluvial soils in the district. The highest mean value of 69.9 g $kg^{-1}$ was recorded in Kalavad *taluka* and the lowest value of 44.0 g $kg^{-1}$ was recorded in Bhanvad *taluka*. The high content of $CaCO_3$ in salt affected soils of coastal

**Table 1.** Range, mean, and coefficient of variation of chemical properties of soils of Jamnagar district

| Name of talukas | $EC_{2.5}$ (dS $m^{-1}$) | CV (%) | $pH_{2.5}$ | CV (%) | $CaCO_3$ (g $kg^{-1}$) | CV (%) | CEC [cmol($p^+$)$kg^{-1}$] | CV (%) |
|---|---|---|---|---|---|---|---|---|
| Jamjodhpur | 0.49-1.14 (0.70)* | 33.0 | 7.66-8.16 (7.97) | 1.00 | 15.0-111.6 (52.4) | 59.4 | 25.3-42.9 (34.0) | 13.8 |
| Bhanvad | 0.32-1.97 (0.87) | 52.3 | 7.93-8.51 (8.26) | 2.93 | 18.6-87.8 (44.0) | 45.0 | 27.5-53.4 (37.3) | 20.5 |
| Kalyanpur | 0.43-2.97 (1.12) | 62.6 | 7.73-8.54 (8. 27) | 2.16 | 21.3-100.0 (58.4) | 44.5 | 20.6-56.8 (43.7) | 18.3 |
| Dwarka | 0.26-3.06 (1.14) | 90.1 | 7.90-8.66 (8.22) | 3.16 | 34.6-75.0 (50.6) | 22.0 | 15.5-50.0 (33.0) | 31.7 |
| Kalavad | 0.28-2.43 (0.63) | 73.7 | 7.86-8.46 (8.14) | 2.85 | 15.2-113.6 (69.9) | 41.8 | 15.8-42.1 (31.0) | 23.2 |
| Jamnagar | 0.33-2.29 (0.89) | 70.2 | 7.85-8.76 (8.16) | 2.24 | 10.2-88.3 (51.4) | 53.8 | 19.8-49.4 (36.7) | 18.8 |
| Lalpur | 0.45-1.21 (0.72) | 37.1 | 7.94-8.24 (8.12) | 1.74 | 4.18-108.8 (57.9) | 58.6 | 24.4-47.4 (36.5) | 18.1 |
| Jamkhambhalia | 0.42-2.44 (0.91) | 58.9 | 7.94-9.01 (8.16) | 2.43 | 15.3-94.1 (54.9) | 40.9 | 21.2-47.1 (36.6) | 20.3 |
| Jodiya | 0.28-1.96 (0.90) | 51.6 | 7.90-9.01 (8.23) | 3.24 | 20.8-91.6 (44.1) | 45.1 | 20.4-56.6 (40.3) | 23.1 |
| Dhrol | 0.26- 2.13 (0.71) | 71.7 | 7.85-8.66 (8. 24) | 3.02 | 73.1-115.6 (65.0) | 48.7 | 21.1-49.7 (33.9) | 21.8 |
| Overall district | 0.26-3.06 (0.86) | 60.1 | 7.66- 9.01 (8.18) | 2.48 | 4.18-115.6 (54.9) | 46.0 | 15.8-56.8 (36.5) | 21.0 |

*Figures in parentheses are mean values

areas was observed by Challa *et al*. (2000.) Polara *et al*. (2004) also observed similar results for Ahmednagar district (Maharashtra) and for North West agroclimatic zone of Gujarat. The overall range of CEC was 15.1 to 56.8 with a mean value of 36.5 cmol($p^+$)$kg^{-1}$. The highest mean value of 43.7 cmol($p^+$) $kg^{-1}$ was recorded in Jodiya *taluka* whereas, the lowest mean value of 31.0 cmol($p^+$)$kg^{-1}$ was recorded in Kalavad *taluka*.

*Available major nutrients*

The OC content in the soils of Jamnagar District ranged from 0.30 to 10.20 g $kg^{-1}$ with mean value of 4.97 g $kg^{-1}$ indicating low value for soil organic carbon content because of the arid climate and particularly negligible addition of organic matter. High temperature and good aeration in these soils increased the rate of oxidation of organic matter resulting in the reduction of soil organic carbon content (Meena *et al*. 2006; Singh *et al.* 2007; Kumar *et al.* 2009). About 75% of the samples rated low in OC content (Table 2). This also reflected on the poor available N status of soils. The available N status for the target district was low and it ranged from 116 to 376 kg $ha^{-1}$ with mean value of 208 kg $ha^{-1}$. Kumar *et al.* (2011) also reported similar result for Churu district of western Rajasthan. Similarly, the available P was also low to medium and varied from 2.60 to 81.9 kg $P_2O_5$ $ha^{-1}$ with a mean of 28.3 kg $P_2O_5$ $ha^{-1}$. Phosphorus is being retained by $CaCO_3$ rich soils as higher calcium compounds of lower solubility and limit this nutrient availability to plants. Even after fertilizer application surface adsorption and precipitation are major mechanisms of P retention in soils rich in $CaCO_3$. The lower status of P in the soil is attributed to intensive cropping systems resulting in absorption of plant nutrients in higher amounts (Pandey *et al*. 2000). Similar results were also reported for Banaskantha district (Patel *et al*. 2012). The available K content varied from 71.0 to 798.0 kg $K_2O$ $ha^{-1}$ with pooled mean of 406 kg $ha^{-1}$ indicating high available K status. The highest mean value for available K was found in Dwarka (564 kg $K_2O$ $ha^{-1}$) followed by Kalyanpur (527 kg $K_2O$ $ha^{-1}$) *talukas*. Overall district scenario of Jamnagar district revealed that, 6.0, 20.5 and 73.5% soil samples were in low, medium and high categories for available K, respectively. The high status of available K might be due to presence of potash bearing minerals (feldspar, muscovite and biotite) which upon weathering release K. The results of Ashok Kumar and Prasad (2010) and Patel *et al*. (2012) supports the present findings.

**Table 2.** Range, mean, and coefficient of variation of available macronutrients in soils of Jamnagar district

| Name of talukas | OC (g $kg^{-1}$) | CV (%) | Available N (kg $ha^{-1}$) | CV (%) | Available $P_2O_5$ (kg $ha^{-1}$) | CV (%) | Available $K_2O$ (kg $ha^{-1}$) | CV (%) |
|---|---|---|---|---|---|---|---|---|
| Jamjodhpur | 5.34-9.00 (5.34)* | 30.4 | 161-376 (221) | 20.7 | 15.4-46.0 (25.6) | 37.7 | 175-754 (390) | 37.5 |
| Bhanvad | 0.90-9.30 (5.15) | 37.2 | 154-307 (221) | 17.9 | 10.2-64.0 (31.5) | 55.5 | 120-710 (378) | 43.8 |
| Kalyanpur | 3.60-8.70 (5.25) | 29.3 | 169-326 (218) | 19.1 | 5.12-66.5 (26.6) | 55.5 | 131-754 (527) | 32.4 |
| Dwarka | 1.20-7.80 (4.28) | 34.4 | 144-332 (206) | 23.9 | 7.70-46.0 (27.2) | 40.9 | 251-798 (564) | 28.5 |
| Kalavad | 3.30-10.20 (5.51) | 31.4 | 116-342 (224) | 21.1 | 15.4-41.0 (25.2) | 29.9 | 441-771 (441) | 32.7 |
| Jamnagar | 2.70-9.00 (5.39) | 30. 6 | 166-310 (223) | 17.1 | 10.2-48.6 (25.5) | 30.7 | 126-771 (402) | 51.8 |
| Lalpur | 0.30-8.70 (4.89) | 40.1 | 122-229 (188) | 16.8 | 17.9-69.1 (31.6) | 38.9 | 169-563 (325) | 33.0 |
| Jamkhambhalia | 0.30-9.30 (5.28) | 37.2 | 159-260 (207) | 13.3 | 2.60-56.3 (30.2) | 50.7 | 104-781 (295) | 49.1 |
| Jodiya | 1.20-8.10 (4.70) | 33.3 | 144-229 (179) | 12.8 | 10.2-81.9 (27.8) | 59.8 | 126-732 (412) | 41.9 |
| Dhrol | 0.30-7.20 (4.35) | 31.4 | 122-295 (191) | 19.3 | 12.8-64.0 (31.4) | 45.5 | 71-585 (324) | 44.5 |
| Overall district | 0.30-10.20 (4.97) | 33.5 | 116-376 (208) | 18.2 | 2.60-81.9 (28.3) | 44.5 | 71-798 (405) | 39.5 |

*Figures in parentheses are mean values

**Table 3.** Range, mean, and coefficient of variation of available micronutrients in soils of Jamnagar district

| Name of *taluka* | Fe (mg kg$^{-1}$) | CV (%) | Mn (mg kg$^{-1}$) | CV (%) | Zn (mg kg$^{-1}$) | CV (%) | Cu (mg kg$^{-1}$) | CV (%) |
|---|---|---|---|---|---|---|---|---|
| Jamjodhpur | 3.78-14.20 (7.50)* | 50.8 | 4.64-26.36 (12.28) | 45.4 | 0.26-1.96 (0.95) | 37.8 | 0.42-2.89 (1.91) | 50.9 |
| Bhanvad | 4.64-22.01 (12.09) | 39.2 | 8.67-24.52 (16.24) | 29.5 | 0.37-1.50 (0.71) | 43.9 | 0.41-3.27 (1.23) | 84.0 |
| Kalyanpur | 3.44-15.56 (9.40) | 34.0 | 8.70-25.50 (15.94) | 34.2 | 0.37-1.22 (0.77) | 42.2 | 0.41-4.10 (1.77) | 79.7 |
| Dwarka | 3.74-11.76 (7.12) | 38.8 | 8.92-24.80 (17.18) | 28.8 | 0.37-1.58 (0..88) | 44.5 | 0.41-4.81 (2.51) | 56.4 |
| Kalavad | 5.23-17.32 (10.86) | 26.7 | 8.52-35.30 (22.32) | 37.4 | 0.38-1.20 (0.81) | 36.9 | 0.53-2.39 (1.71) | 33.1 |
| Jamnagar | 4.85-12.48 (10.06) | 16.4 | 8.24-38.00 (20.01) | 50.2 | 0.39-2.59 (1.19) | 58.5 | 0.81-2.37 (1.21) | 30.9 |
| Lalpur | 9.92-22.48 (12.10) | 21.4 | 8.42-39.04 (21.02) | 57.5 | 0.37-1.51 (0.84) | 43.1 | 0.64-1.04 (0.89) | 13.8 |
| Jamkhambhalia | 8.20-17.36 (11.76) | 16.9 | 6.69-42.56 (22.38) | 60.5 | 0.39-1.52 (0.81) | 47.1 | 0.47-1.00 (0.67) | 25.9 |
| Jodiya | 7.10-14.44 (11.82) | 19.3 | 6.53-29.56 (14.18) | 48.0 | 0.40-1.29 (0.80) | 41.5 | 0.49-1.38 (0.80) | 31.4 |
| Dhrol | 7.39-20.52 (11.44) | 27.8 | 9.10-41.88 (18.83) | 51.8 | 0.41-1.57 (0.90) | 38.5 | 0.47-1.00 (0.59) | 20.7 |
| Overall district | 3.44-22.48 (10.41) | 29.1 | 4.64-42.56 (18.04) | 44.3 | 0.26-2.59 (0.87) | 43.4 | 0.41-4.84 (1.32) | 42.7 |

*Figures in parentheses are mean values

*DTPA-extractable Micronutrients*

The content of Fe, Mn, Zn and Cu varied from 3.44 to 22.48, 4.64 to 42.56, 0.26 to 2.59 and 0.41 to 4.84 mg kg$^{-1}$ with the mean value of 10.41, 18.04, 0.87 and 1.32 mg kg$^{-1}$, respectively (Table 3). The soils of the district are well supplied with available Fe as only 10.5% soils are deficient. These results are comparable with the findings of Rajput and Polara (2012), where available Fe in the Jamnagar District was reported to be between 3.44 to 22.48 mg kg$^{-1}$. Considering 2.0 mg kg$^{-1}$ as threshold value for DTPA-extractable Mn (Katyal and Rattan 2003), all the soils are adequate in its content. The soils of Jamkhambhalia, Kalavad and Lalpur *talukas* generally had higher content than the other soils. These results are in close agreement with those reported by Rajput and Polara (2012) and Kumar *et al*. (2011). In light of 0.6 mg kg$^{-1}$ DTPA-extractable Zn as the critical limit (Katyal and Rattan 2003), nearly 27% of the samples showed low test value for Zn (<0.6 mg kg$^{-1}$), 25% had shown the Zn between 0.6 to 1.0 mg kg$^{-1}$ and 48% samples had Zn value above 1.0 mg kg$^{-1}$. The soils of Jamnagar *taluka* possess highest mean value (1.19 mg kg$^{-1}$) of available Zn. The results indicate a wide spread deficiencies of available Zn in the soils of Jamnagar district. Similar results were also reported for soils of Saurashtra region (Maliwal and Timbadia 1993). Considering the critical limits of 0.20 mg kg$^{-1}$ (Katyal and Rattan 2003) for Cu, all the soil have sufficient amount of available Cu. Soils of almost all the *talukas* have mean value for DTPA-extractable Cu greater than 0.5 mg kg$^{-1}$ and 100% soil samples were found in sufficient categories for available Cu. These results are in conformity with those of Rajput and Polara (2012).

*Nutrient Indices*

The overall nutrient index values (Table 4) were low for available N (1.15) and available P (1.55), medium for available S (1.69) and DTPA-Zn (2.11), high for available K (2.68), DTPA-Fe (2.48), DTPA-Mn (2.74) and DTPA-Cu (3.0) in the soils of Jamnagar district. Based on nutrient index values of soils and the modified criteria suggested by Ramamurthy and Bajaj (1969), the soils of Jamnagar district were deficient with respect to available N and P while in medium for S, available DTPA-Zn and high for available K, DTPA-Fe, Mn and Cu status. The findings are in close agreement with those reported by Marsonia *et al*. (2008) for Porbandar district and Rajput and Polara (2012) for Bhavnagar district of Gujarat state.

**Table 4.** *Taluka*-wise nutrient indices of available macro and micronutrients in the soils of Jamnagar district

| Name of *taluka* | Macronutrient | | | | Micronutrient | | | |
|---|---|---|---|---|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ | S | Fe | Mn | Zn | Cu |
| Jamjodhpur | 1.15 | 1.30 | 2.70 | 1.20 | 1.85 | 2.60 | 2.15 | 3.00 |
| Bhanvad | 1.30 | 1.65 | 2.65 | 1.10 | 2.45 | 2.75 | 1.70 | 3.00 |
| Kalyanpur | 1.15 | 1.60 | 2.85 | 1.65 | 2.35 | 2.70 | 1.95 | 3.00 |
| Dwarka | 1.20 | 1.60 | 2.95 | 1.85 | 1.90 | 2.80 | 2.20 | 3.00 |
| Kalavad | 1.25 | 1.45 | 2.80 | 1.35 | 2.45 | 2.85 | 2.20 | 3.00 |
| Jamnagar | 1.30 | 1.50 | 2.55 | 2.15 | 2.55 | 2.70 | 2.30 | 3.00 |
| Lalpur | 1.00 | 1.65 | 2.70 | 1.90 | 2.95 | 2.70 | 2.15 | 3.00 |
| Jamkhambhalia | 1.10 | 1.60 | 2.40 | 1.95 | 2.85 | 2.70 | 2.00 | 3.00 |
| Jodiya | 1.00 | 1.45 | 2.65 | 2.00 | 2.70 | 2.65 | 2.05 | 3.00 |
| Dhrol | 1.05 | 1.70 | 2.50 | 1.75 | 2.70 | 2.90 | 2.35 | 3.00 |
| Overall district | 1.15 | 1.55 | 2.68 | 1.69 | 2.48 | 2.74 | 2.11 | 3.00 |

**Table 5.** Correlation coefficient (r) between soil properties and available nutrients

| Soil properties | EC | pH | $CaCO_3$ | OC | N | P | K | S | Fe | Mn | Zn | CEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | -0.349** | | | | | | | | | | | |
| $CaCO_3$ | 0.115 | 0.000 | | | | | | | | | | |
| OC | 0.016 | 0.206** | 0.048 | | | | | | | | | |
| N | 0.137 | -0.306** | -0.008 | 0.626** | | | | | | | | |
| P | 0.006 | -0.095 | -0.055 | 0.014 | 0.051 | | | | | | | |
| K | 0.226** | -0.162* | -0.090 | 0.079 | 0.127 | -0.008 | | | | | | |
| S | 0.535** | -0.163* | 0.122 | 0.061 | -0.082 | 0.028 | 0.123 | | | | | |
| Fe | -0.027 | -0.013 | 0.060 | -0.047 | -0.167* | -0.067 | -0.055 | 0.134 | | | | |
| Mn | 0.200** | -0.096 | 0.194** | 0.155* | 0.144* | 0.007 | 0.077 | 0.175* | 0.118 | | | |
| Zn | 0.122 | -0.096 | 0.020 | 0.188** | 0.210** | 0.001 | 0.113 | 0.178* | -0.034 | 0.280** | | |
| CEC | 0.345** | -0.101 | 0.606** | 0.060 | -0.029 | -0.136 | 0.001 | 0.279** | 0.159* | 0.069 | 0.029 | |
| Cu | -0.026 | -0.016 | 0.032 | 0.041 | 0.131 | -0.044 | 0.151* | -0.040 | -0.149* | -0.015 | 0.185** | -0.063 |

*Correlation matrix*

The data on simple correlation studies between available major nutrient, micronutrient and soil properties (OC, pH and $CaCO_3$) are presented in table 5. The significant and positive correlation of pH, available N, Mn and Zn with OC content of the soils (r = 0.260**, r = 0.626**, r = 0.155* and r = 0.188**, respectively) was observed which indicates the importance of organic matter in promoting the availability of these micronutrients in the soils. The availability of these ions (Mn and Cu) increased with the increase in organic matter because organic matter acts as chelating reagent. Similar kinds of relationship between Mn and Cu with OC were also reported by Sharma and Kolarkar (1983), Sharma *et al.* (1985) and Sharma *et al*. (2003). The soil pH was negatively correlated with available N, P, K and S (r = -0.306**, r = -0.095, r = -0.162* and r = -0.163*, respectively). An inverse relationship of pH with available micronutrients cations had also been reported by Katyal and Agarwala (1982). Significant and positive correlation was also observed between EC, $CaCO_3$, available S and Fe with CEC of soil (r = 0.345**, r = 0.606**, r = 0.279** and r = 0.159*, respectively).

## Conclusions

Based on findings of present study, it is concluded that the soils of Jamnagar districts are alkaline in reaction and low in organic carbon. Majority of the soils of Jamnagar district were low in available N (85%), P (50.0%) and S (50.5%). While about one third of these soils were low in available K. Among the micronutrients, content of available Mn, Fe and Cu were high, whereas the available Zn was medium. The nutrient indices of the soils of Jamnagar district were low for available N (1.15) and P (1.55), medium for available S (1.69) and DTPA-extractable Zn (2.11) and high for K (2.68), DTPA-extractable Fe (2.48), Mn (2.74) and Cu (3.00). The significant and positive correlation of pH, available N, Mn and Zn with OC content of the soils was found. The soil pH was found to be negatively correlated with available N, P, K and S. This information can be

useful in developing management practices for the cultivated soils of coastal Jamnagar district.

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Received 09 March 2018; Accepted 16 June 2018