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Fertility status of irrigated soils of Rajkot District of Gujarat

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Abstract
Twenty representative surface (0-15 cm) soil samples were collected from cultivated farmer's field of each taluka of Rajkot district viz. Paddhari, Rajkot, Lodhika, Kotda Sangani, Jetpur, Dhoraji, Upleta, Gondal and Jasdan during 2014. The chemical analysis of 200 surface samples indicates that soil were medium in available N and P_2O_5, whereas high in available S and in available K_2O status. Among the DTPA extractable micronutrients, Mn and Cu were found sufficient, whereas the soils were medium in Fe and Zn. The nutrient index values was low for DTPA available Zn (1.48), medium for available N (1.55), available P_2O_5 (2.01), available S (2.44) and DTPA available Fe (1.57) and high for K_2O (2.94), DTPA available Mn (2.84) and DTPA available Cu (2.94) in the soils of Rajkot district.

Keywords: *Available macronutrients, DTPA extractable micronutrients, Nutrient index*

Introduction
Soil fertility has a direct relation with the crop yields, provided other factors are in optimum level. Soil fertility must be periodically estimated as there is continuous removal of macro and micro nutrients by the crop intensively grown in every crop season. In order to achive higher productivity and profitability, every farmer should realize that fertility levels must be measured as these measurement can then be used to manage soil fertility. Balanced nutrient use ensures high production level and helps to maintain the soil health. Fertilizing the soils to bring all the deficient elements at high levels as to provide sufficient ionic activity in soil solution for crop uptake is one of the most important consideration for maximization of the crop yield. Such information for newly formed Rajkot district of Saurashtra region of Gujarat was lacking. Therefore, an attempt has been made to study the fertility status of cultivated farmer's field of Rajkot district of Gujarat.

Material and Methods
Rajkot district is falls in North and South Saurashtra Agro Climatic Zone, located at 22º18' N–70º46' E, 22º3' N–70º78' E. It has an average elevation of 128 meters (420 ft). It occupies area of 170 km². The length from North to South of this territory is about 105.4 kms and from east to west about 102.6 kms. It is bounded in the north by Morbi district and in north-west by Jamnagar and in the west by Porbandar and Junagadh districts and in the south by Amreli and east by Surendranagar and Botad_districts. The area covered by the district is 7,570 Sq. kms. Twenty surface soil samples (0-15 cm) were collected from each of the ten talukas of Rajkot district, viz. Paddhari, Rajkot, Lodhika, Kotda Sangani, Gondal, Jetpur, Dhoraji, Upleta, Jam Kandorna and Jasdan during 2014. Soil samples were air dried, ground carefully with a wooden mortar and pastel to break soil lumps and passed through 2 mm sieve. The available N, P_2O_5, K_2O and S were determined as per the methods described by Jackson (1973) [1], while DTPA extractable micronutrients were determined by Atomic Absorption Spectrophotometer as per method outline by Lindsay and Norvell (1978) [2]. The nutrient index (NI) values for available nutrients present in the soils were calculated utilizing the formula as suggested by Parker *et al*. (1951) and classified this index as low (<1.5), medium (1.5 to 2.5) and high (>2.5) giving under weightage to medium category. Ramamoorthy and Bajaj (1969) modified the index classification as low (<1.66), medium (1.67 to 2.33) and high (>2.33).

$$\text{Nutrient Index} = \frac{(\text{Nl} \times 1) + (\text{Nm} \times 2) + (\text{Nh} \times 3)}{\text{Nt}}$$

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. Nt is the total number of samples.

Research and Discussion

The data on available macro and micronutrients obtained from the present investigation are presented in table 1. The highest mean value for available N (390.8 kg ha^{-1}) and available P_2O_5 (78.1 kg ha^{-1}) were observed in Rajkot taluka, available K_2O (598.2 kg ha^{-1}), DTPA available Fe (8.26 mg kg^{-1}), DTPA available Mn (45.65 mg kg^{-1}), DTPA available Zn (0.91 mg kg^{-1}) and DTPA available Cu (2.32 mg kg^{-1}) were observed in the soils of Dhoraji taluka, while available S (34.0 mg kg^{-1}) was observed in upleta taluka. The lowest mean values for available N (196.6 kg ha^{-1}), DTPA available Fe (3.00 mg kg^{-1}), DTPA available Mn (9.21 mg kg^{-1}) and DTPA available Zn (0.34 mg kg^{-1}) were observed in the soils of Jasdan taluka, Av. P_2O_5 (34.5 kg ha^{-1}) was observed in Upleta taluka, Av. K_2O (292.9 kg ha^{-1}) and Av. S (15.8 mg kg^{-1}) were observed in the soils of Paddhari taluka and DTPA available Cu (1.15 mg kg^{-1}) was observed in soils of Jetpur taluka. In general, the soils of Rajkot district were medium in available nitrogen and phosphorus and the values were ranged from 101.9 to 642.9 and 15.0 to 128.1 kg ha^{-1} with a mean value of 277.8 and 42.9 kg ha^{-1}, respectively. The lower status for available N and P_2O_5 in the soil is attributed to the adoption of intensive cropping systems by cultivators resulting in absorption of plant nutrient in higher amount, lower organic carbon content and less use of FYM in the semi arid tract. The soils of Rajkot district were high in available K_2O and available S the values were ranged from 159.9 to 985.2 kg ha^{-1} and 4.8 to 76.2 mg kg^{-1} with a mean value of 468.1 kg ha^{-1} and 22.6 mg kg^{-1}. The high available K_2O status in surface soils could be attributed to more intensive weathering, prevalence of potassium-rich minerals like muscovite and biotite mica, release of labile-K from organic residues of cultivated crop plants and upward translocation of K from lower depth along with capillary rise of ground water (Malavath and Mani, 2014) [4]. The soils of Rajkot district were high in available Mn and Cu and medium in Fe and Zn. The DTPA extractable Fe, Mn, Zn and Cu varied from 0.42 to 14.93, 2.43 to 74.06, 0.13 to 2.87 and 0.11 to 4.23 with their corresponding mean values of 5.23, 19.73, 0.53 and 1.64 mg kg^{-1}, respectively. These results are in agreement with the finding of Polara and Kabaria (2006) [5] and Malavath and Mani (2014) [4].

Based on nutrient index values of soils (Table 2) and the criteria as suggested by Parker *et al.* (1951), the soils of Rajkot district was low for DTPA available Zn (1.48), medium for available N (1.55), available P_2O_5 (2.01), available S (2.44) and DTPA available Fe (1.57) and high for K_2O (2.94), DTPA available Mn (2.84) and DTPA available Cu (2.94), while as per criteria suggested by Ramamoorthy and Bajaj (1969) similar results were found. These results confirmed the finding as reported by Polara and Kabaria (2006) [5] for soils of Amreli district, Rajput and Polara (2012) [6] for Bhavnagar district of Gujarat and Malvath and Mani (2014) [4] for Shivaganga district of Tamil Nadu.

Table 1: Talukawise range and mean value for available macro and micronutrients in irrigated surface soils of Rajkot district

Name of Taluka	Available nutrients in kg ha^{-1}			Av. S mg kg^{-1}	DTPA extractable micronutrients in mg kg^{-1}			
	N	P_2O_5	K_2O		Fe^{++}	Mn^{++}	Cu^{++}	Zn^{++}
Paddhari	243.0-385.7 (312.3)*	24.0-114.0 (61.4)	159.9-811.8 (292.9)	4.8-24.2 (15.8)	0.78-8.16 (3.41)	10.65-25.00 (16.42)	0.18-2.87 (0.57)	1.01-3.14 (1.76)
Rajkot	271.3-470.4 (390.8)	33.0-128.1 (65.6)	287.3-727.1 (471.9)	4.8-64.1 (20.9)	3.10-7.68 (5.32)	10.04-26.55 (17.92)	0.20-1.38 (0.55)	0.33-3.05 (1.72)
Lodhika	228.9-418.7 (341.5)	19.5-76.5 (35.0)	391.1-695.9 (431.2)	9.7-29.0 (17.7)	3.00-7.93 (4.80)	6.66-30.62 (15.46)	0.20-1.52 (0.37)	0.32-3.09 (1.19)
Kotda Sangani	214.8-642.9 (321.8)	19.5-88.5 (38.2)	384.4-750.0 (529.3)	15.7-58.1 (27.6)	2.16-14.93 (5.60)	8.31-36.04 (14.78)	0.20-2.20 (0.51)	0.92-4.23 (1.81)
Upleta	101.9-453.2 (233.7)	15.0-69.0 (34.5)	375.0-939.5 (560.6)	15.7-71.2 (34.0)	2.67-9.17 (4.57)	8.60-32.07 (24.37)	0.13-1.13 (0.52)	0.61-3.04 (1.74)
Dhoraji	166.2-376.5 (257.2)	15.9-79.5 (38.4)	329.3-934.1 (598.2)	4.8-76.2 (20.0)	4.62-14.04 (8.26)	22.56-74.06 (45.65)	0.78-2.35 (0.91)	1.26-3.64 (2.32)
Jam Kandorna	197.6-293.2 (237.7)	19.8-84.0 (41.9)	318.5-985.2 (496.0)	13.3-33.9 (22.1)	4.25-10.10 (6.54)	10.49-43.02 (23.08)	0.27-0.67 (0.47)	1.05-2.16 (1.62)
Gondal	175.6-370.0 (249.6)	21.0-96.2 (43.6)	255.4-756.7 (452.6)	13.3-35.1 (19.9)	3.07-9.47 (6.40)	6.00-28.19 (14.48)	0.34-0.98 (0.60)	0.72-2.65 (1.72)
Jetpur	145.8-406.1 (225.7)	18.0-82.5 (35.5)	231.2-951.6 (427.3)	15.7-53.2 (26.0)	0.75-9.20 (4.42)	7.90-26.67 (16.00)	0.25-1.13 (0.51)	0.11-1.96 (1.15)
Jasdan	152.1-265.0 (196.6)	18.0-72.0 (35.8)	221.8-881.7 (422.3)	10.9-30.3 (19.5)	0.42-5.61 (3.00)	2.43-19.55 (9.21)	0.16-0.72 (0.34)	0.71-2.46 (1.41)
Overall	101.9-642.9 (277.8)	15.0-128.1 (42.9)	159.9-985.2 (468.1)	4.8-76.2 (22.6)	0.42-14.93 (5.23)	2.43-74.06 (19.73)	0.13-2.87 (0.53)	0.11-4.23 (1.64)

*Values in parenthesis indicates the mean values

Table 2: Talukawise nutrient index values of macro and micro nutrients of the soils of Rajkot district

Name of Taluka	N	P_2O_5	K_2O	S	Fe	Mn	Zn	Cu
Paddhari	1.95	2.40	2.75	2.25	1.15	3.00	1.45	3.00
Rajkot	2.00	2.45	3.00	2.05	1.60	3.00	1.50	2.80
Lodhika	1.90	1.70	3.00	2.45	1.35	2.90	1.20	2.70
Kotda Sangani	1.90	1.70	3.00	2.75	1.75	2.80	1.35	3.00
Upleta	1.30	1.55	3.00	2.80	1.35	2.95	1.45	3.00
Dhoraji	1.40	1.95	3.00	2.15	2.25	3.00	2.00	3.00
Jam Kandorna	1.35	1.95	3.00	2.55	1.95	3.00	1.40	3.00
Gondal	1.45	2.45	2.95	2.35	1.75	2.80	1.75	3.00
Jetpur	1.10	1.85	2.80	2.80	1.45	2.90	1.55	2.90

Jasdan	1.10	1.90	2.85	2.40	1.10	2.05	1.15	3.00
Overall	1.55	2.01	2.94	2.44	1.57	2.84	1.48	2.94

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