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Fertility status of soil from *Kal amba* command area of konkan region of Maharashtra state

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Abstract
An investigation entitled, "Fertility status of Soil from *Kal Amba* Command area of Konkan region of Maharashtra State" was conducted to study the physico-chemical properties and primary nutrients in the soil from *Kal Amba* Command area. A total of 320 soil samples from sixty-four villages of Mangaon and Roha tehsil of Raigad district were collected randomly and were analyzed for the soil properties viz., soil reaction (pH), Electrical Conductivity, Organic Carbon, Available N, Available P_2O_5 and Available K_2O by following standard analytical methods. The analytical work was carried out in the research laboratory of the Department of Soil Science and Agricultural Chemistry, College of Agriculture, Dapoli. The data revealed that the soils are mildly acidic to neutral in reaction with normal electrical conductivity. The organic carbon, available nitrogen, available phosphorous and available potassium are found to vary.

Keywords: fertility status, *Kal Amba* command area, konkan

1. Introduction
Soil is the "soul" of infinite life and is generally referred to the loose material composed of weathered rock and other materials including partly decayed organic matter. Soil is the most vital and precious natural resource that sustains life on the earth and it takes almost 1000 years to produce an inch of top soil (Chandra and Singh, 2009) [5]. It is a reservoir of nutrients and plays a pivotal role in supporting the growth of crops and other vegetation, maintaining the earth's environment clean. It also acts as a source and sink for atmospheric gases (Sharma and Dogra, 2011) [11].

Nutrients needed by the plant to complete its' life cycle is called 'essential nutrients' and depending upon the quantity required by the plant, nutrients are classified as macronutrients and micronutrients. Nitrogen, phosphorous and potassium are called as 'primary nutrients' and are not usually available in sufficient amounts and therefore are added through fertilization for the best growth of the plant. 'Soil fertility' is the status or the inherent capacity of the soil to supply nutrients to plants in adequate amounts and in suitable proportions. It plays a key role in increasing crop production in the soil. It comprises not only supply of nutrients but also their efficient management. The fertility status of soil indicates their nutrient supplying capability. Therefore, it is necessary to maintain the fertility status of soil for sustainable crop production (Ajgaonkar and Patil, 2017) [1].

The Konkan region is characterized by humid, subtropical and monsoonic climate. The typical topography associated with high rainfall and other climatic conditions has given *viz*., Laterite and lateritic soils, Medium black soils, Coastal alluvial soils, Coastal saline soils, Reddish brown soils and Coarse shallow soils. *Kal Amba* irrigation project covers an area of 269.36 sq. km. of Roha and Mangaon tahsils of Raigad district of Maharashtra state. Mangaon and Roha are located on the banks of *Kal* river, a tributary of the *Savitri* river. The Mangaon district is geographically situated at latitude of 18˚14'17.6748" and longitude of 73˚16'54.0948". The Roha district is geographically situated at latitude of 18˚26'22.0992" and longitude of 73˚12'38.0856".

Rice is the major crop of the two regions in kharif season because of the peculiar rainfall pattern whereas summer rice is grown only in the areas irrigated under *Kal* project. The soil also supports garden crops like arecanut, coconut, banana, sapota, etc. Therefore, in order to sustain their productivity, it is very much necessary for their proper management, which calls for determination of the fertility status of the soils. Hence, the present research work entitled "Fertility status of Soil from *Kal Amba* Command Area of Konkan Region of Maharashtra State" was undertaken.

2. Material and Methods

A total of 320 soil samples were collected randomly from the command area of *Kal Amba* project which falls under Mangaon and Roha tehsils of Raigad district. Sixty-four villages from Mangaon and Roha tehsil of Raigad district were selected for the study. Five farmers were selected from each village and five soil samples were collected at a depth of 0-15 cm by following standard method of collection of soil sample from each farmers field to make one composite soil sample. Thus, there were five samples from each village which summed upto 320 samples from a total of 64 villages.

The pH of the soil was determined with pH meter having glass and calomel electrode using 1:2.5 of soil: water suspension ratio (Jackson, 1973) [7]. Electrical conductivity of the soil was determined using Systronic Conductivity Meter-306 with 1: 2.5 of soil: water suspension ratio (Jackson, 1973) [7]. Organic carbon of the soil was determined by following Walkley and Black wet digestion method (Black, 1965) [2].

Available nitrogen of the soil was determined by alkaline permanganate (0.32 % $KMnO_4$) method (Subbiah and Asija, 1956) [13]. Available phosphorous of the soil was determined by Brays No. 1 method as outlined by Bray and Kurtz (1945) [4]. Available potassium of the soil was determined by using neutral normal ammonium acetate as an extractant on Systronics Flame Photometer-128 as described by Jackson (1973) [7].

3. Results and Discussions

3.1 Physico-chemical properties of soil

The 320 soil samples collected from Roha and Mangaon Tehsils were analysed for their physico-chemical properties and the data is presented in Table 1 and discussed under the following subheads.

Table 1: Data of physico-chemical properties of soils from *Kal Amba* Command area

320 Soil Sample	Physico-chemical properties		
	pH	EC (dS m^{-1})	OC (%)
Range	6.1-7.43	0.05-0.28	0.08-2.77
mean value	6.67	0.12	1.16

3.1.1 Soil reaction (pH)

The analytical data related to the soil pH is given in Table 1. The pH of the 320 soil samples analysed ranged from 6.1 to 7.43 with a mean value of 6.67. Out of the 320 soil samples, 124 (38.75%) were mildly acidic (6.1-6.5) and 196 (61.25%) samples were neutral (6.6-7.5) and the data is presented in (Table 2). The study revealed that the village Pansai had highest pH (7.43) and Nivi had the lowest pH (6.1). In general, majority of the soil samples were neutral in reaction. The neutral pH of these medium black soil samples could be attributed to the high content of calcium and magnesium carbonates and other bases present in the soil (Joshi and Kadrekar 1987) [8]. Similar findings have been reported by Borkar *et al*., (2018) [3].

Table 2: Soil Reaction (pH)

pH (Ratings)	Range	No. of samples	Samples (%)
Extremely acidic	< 4.5	-	-
Very strongly acidic	4.6-5.0	-	-
Strongly acidic	5.1-5.5	-	-
Moderately acidic	5.6-6.0	-	-
Mildly acidic	6.1-6.5	124	38.75
Neutral	6.6-7.5	196	61.25
Mildly alkaline	7.5-8.0	-	-
Strongly alkaline	8.1-9.0	-	-
Very strongly alkaline	> 9.0	-	-

3.1.2 Electrical conductivity

The analytical data related to the electrical conductivity of the soilis given in Table 1. The EC of the soil of the study area ranged from 0.05 to 0.28 dS m^{-1} with a mean value of 0.12 dS m^{-1}. All the soil samples are found to be neutral (Table 3). It was found that the village Vashi had the highest EC (0.28 dS m^{-1}) and the villages Padam and Varse Roha had the lowest EC (0.05 dS m^{-1}). The low EC could be due to the leaching of soluble salts due to heavy precipitation resulting into less concentration of soluble salts in the soil. Similar are the findings of Chavan (1977) [6].

Table 3: Electrical conductivity

EC (dS m^{-1})		No. of samples	Samples (%)
Class	Range		
Normal	0-1	320	100
Poor seed	1-2	-	-
Emergence Harmful	>2	-	-

3.1.3 Organic carbon

The analytical data related to the soil organic carbon is given in Table 1. The organic carbon of the soil under study ranged from08 to 2.77 % with a mean of 1.16%. Among the soil samples analysed, 19 (5.937 %) had low (< 0.5) organic carbon, 30 (9.375%) soil samples were medium (0.5-0.75) and 271 (84.687%) soil samples were high (>0.75) in organic carbon (Table 4). It was observed from the study that the village Hatkeli had the highest (2.77%) organic carbon and Dhatav had the lowest (0.08%) organic carbon. The high organic carbon of majority of soils could be due to decomposition of vegetative residues, rice stubbles, roots, dried leaves of the trees into the soil during the formation of these soils Chavan (1977) [6], Patil (1986) [9] and Salvi (1988) [10].

Table 4: Organic carbon

Organic carbon (%)		No. of samples	Samples (%)
Class	Range		
Low	< 0.5	19	5.937
Medium	0.5-0.75	30	9.375
High	> 0.75	271	84.687

3.2 Available Primary nutrients *viz*., N, P_2O_5 and K_2O status of the soil

The 320 soil samples collected from Roha and Mangaon Tehsils were analysed for their available primary nutrients viz., N, P_2O_5 and K_2O status of the soil and the data is presented in Table 5 and discussed under the following subheads.

Table 5: Data of available primary nutrients in soils from *Kal Amba* Command area

320 Soil Sample	Available Primary nutrient		
	N (Kg ha^{-1})	P_2O_5 (Kg ha^{-1})	K_2O (Kg ha^{-1})
Range	200.70-539.39	4.50-33.39	49.28-916.16
mean value	337.95	14.31	265.87

3.2.1 Available nitrogen

The analytical data related to available nitrogen in the soil is given in Table 5. The available nitrogen in the soil ranged from 200.70 to 539.39 kg ha^{-1}with a mean value of 337.95 kg ha^{-1}. Among the soil samples analysed, 21 (6.562 %) were low, 292 (91.25 %) soil samples were medium and 7 (0.334 %) soil samples were high in available nitrogen (Table 6). It was observed from the study that the village Pugaon had the highest (539.39 kg ha^{-1}) available nitrogen and Sange had the lowest (200.70 kg ha^{-1}) available nitrogen. High availability of nitrogen could be due to the organic carbon present in the soil while the low availability of nitrogen might be due to slow mineralization rate of organic matter Patil (1986) [9].

Table 6: Available nitrogen

Available N (kg ha^{-1})		No. of samples	Samples (%)
Class	Range		
Low	< 250	21	6.56
Medium	250 – 500	292	91.25
High	>500	7	0.33

3.2.2 Available phosphorous

The analytical data related to available phosphorous in the soil is given in Table 5. The available phosphorous in the soil ranged from 4.50 to 33.39 kg ha^{-1} with a mean value of 14.31 kg ha^{-1}. Among the soil samples analysed, 274 (85.625 %) were low and 46 (14.375 %) soil samples were medium (Table 7). It was observed from the study that the village Kolad had the highest (33.39 kg ha^{-1}) available phosphorous and Killa had the lowest (4.50 kg ha^{-1}) available phosphorous. According to Shivanna and Nagendrappa (2014) [12] the increase in phosphorous due to increase in pH may be due to lowering of activities of Fe^{3+} and Al^{3+} which increase the solubility of strangle and variscite and increase the electro-negativity of colloidal complex with a consequent decrease in sorption of phosphorous.

Table 7: Available phosphorous

Available P_2O_5 (kg ha^{-1})		No. of samples	Samples (%)
Class	Range		
Low	< 20	274	85.625
Medium	20-50	46	14.375
High	> 50	-	-

3.2.3 Available potassium

The analytical data related to the available potassium in the soil is given in Table 5. The available potassium in the soil ranged from 49.28 to 916.16 kg ha^{-1} with a mean value of 265.87 kg ha^{-1}. Among the soil samples analysed, 85 (26.562 %) were low, 135 (42.187 %) soil samples were medium and 100 (31.25 %) soil samples were high in available potassium (Table 8). It was observed from the study that the village Padam had the highest (916.16 kg ha^{-1}) available potassium and Pansai had the lowest (49.28 kg ha^{-1}) available potassium. The high content of available potassium may be due to more accumulation of organic matter (Patil, 1986) [9]. Medium to high amount of available potassium content in the soils might be due to greater degree of weathering of potash minerals in the region. Similar findings are reported by (Chavan, 1977) [6] and (Patil, 1986) [9].

Table 8: Available potassium

Available K_2O (kg ha^{-1})		No. of samples	Samples (%)
Class	Range		
Low	< 125	85	26.562
Medium	125 - 300	135	42.187
High	>300	100	31.25

4. Conclusion

From the present investigation, it can be concluded that soil from Mangaon and Roha tehsils of Raigad district of *Kal Amba* Command area of Konkan region of Maharashtra State has mildly acidic to neutral pH, normal EC with varying amounts of organic carbon, available nitrogen, available phosphorous and available potassium.

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