The Soil Nutrient Status of Parbhani District, Maharashtra

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Abstract: *Parbhani has been described as the land of saints as several saints have been associated with Parbhani (Prabhavati nagri) including Janabai from Gangakhed . Soil and water are the most important natural resources and all the basic needs of human beings and plants depend on these natural resources. Soil testing is an essential method for evaluating the soil's nutrient-supplying capacity. In the present study, 10 soil samples were collected from different locations of Pedgaon and Dharmapuri villages of Parbhani Taluka, Parbhani district. The chemical parameters such as soil pH, EC, organic carbon, available nitrogen, phosphorus and potassium from soil were determined by using standard procedures. The result shows that the pH of all the soil samples from both the villages was reported in the neutral to alkaline range with mean values of both the villages Pedgaon and Dharmapuri were 7.47 and EC were in normal range with mean values of 0.27 dSm^{-1} and 0.25 dSm^{-1} and fit for crop production. The organic carbon content in both villages found in the medium range with the mean of Pedgaon and Dharmapuri villages were 0.45 % and 0.50 %. In Pedgaon village the available nitrogen and a greater number of samples were in low range, available phosphorus and potassium in medium range. Concern to Pedgaon village most of the samples of available nitrogen, phosphorus and potassium were in medium range.*
Keywords: *Nutrient, Nitrogen, Organic carbon, Phosphorus and Potassium*

I. Introduction

Healthy soil functions as a dynamic living system that provides numerous ecosystem services, including supporting water quality, enhancing plant productivity, regulating nutrient recycling and decomposition and mitigating greenhouse gases by removing them from the atmosphere [1]. India plants about 155 million hectare of which about 75 million hectare are problematic and nutrient deficient. Soil analysis provides nutrient availability index for judicious crop planning. Soil-test based nutrient management maximizes farm profitability and reduces environmental pollution. Major nutrients in soil like nitrogen, phosphorus and potassium have a pilot role in crop growth and production. Understanding the nutrient status of farms will enable farmers and land managers to optimize crop yield through efficient fertilizer management. The nutrient content of soil is influenced by various factors such as parent material, climate and land management practices. For instance, nutrient availability depends upon the weathering of parent material, decomposition of organic matter and microbial activity. Assessing and monitoring soil nutrient status is crucial for sustainable agricultural practices. It helps identify nutrient deficiencies, prevent over-fertilization and mitigate environmental impacts, thereby promoting balanced nutrient management for long-term soil health and productivity. This study aims to analyze the nutrient status of soil in specific regions to provide a framework for sustainable agricultural recommendations [2].

II. Materials and Methods

The Parbhani tehsil study area spans 6250.58 square kilometres and is located between 18 45' to 20.10' North latitude and 76.13 to 77.39' East longitude. Situated in the Marathwada region of Maharashtra, Parbhani is the northernmost tehsil of Parbhani district, bordering Maharashtra to the north. The tehsil lies within the Lower Dudna basin, with the Godavari River flowing westward through its southern part. The river is joined by tributaries from the north, including the Purna and Dudhna rivers, depositing alluvial soil along its banks. The climate of Parbhani tehsil is predominantly dry, except during the southwest monsoon season. It falls within the assured rainfall zone, receiving 400 to 500 mm of rainfall annually, with 55 % of the total precipitation occurring during the monsoon, which supports Kharif crop cultivation.

The surface soil samples (0-20 cm depth) were collected from 15 locations in two villages. 10 soil samples from Pedgaon village and 10 samples from Dharmapuri village of Parbhani taluka were collected based

on soil variation and the exact sample location was recorded using a GPS. Soil samples were analyzed by using standard procedures. Soil pH and Electrical conductivity were determined in 1:2.5 suspension using a standard pH meter and EC meter by potentiometry and conductometry respectively. Soil organic carbon was analyzed by using the wet oxidation method.[3] Soil available N was determined by the modified alkaline permanganate method [4], available P by 0.5M $NaHCO_3$ method [5] and available K by flame photometer (1N NH_4OAc pH 7) method.

III. Results

Status of soil pH and EC

The soil pH range of selected samples from Pedgaon village ranges from 6.70 to 8.15 with a mean value 7.17 and Dharmapuri village ranges from 6.10 to 8.10 with a mean value 7.17 (Table 1). Most of the samples from both the villages were found in between neutral to slightly alkaline range. The pH value is affected by various factors such as parent material, climatic conditions, type of fertilizer used and management practices during crop production. The EC of various soil samples of both the villages were ranged from 0.15 to 0.79 dSm^{-1} with averages 0.29 dS m^{-1} in Pedgaon and 0.25 $dsSm^{-1}$ in Dharmapuri village (Table 1 and 2).

Table1- The status of PH and E.C. in the soil of Pedgaon and Dharmapuri village of the Parbhani taluka

Village Name	Parameter	Range	Mean
Pedgaon	PH	6.70 - 8.15	7.17
	E.C. (dSm^{-1})	0.15- 0.79	0.29
Dharmapuri	PH	6.10 - 8.10	7.16
	E.C. (dSm^{-1})	0.11- 0.44	0.25

Table 2- The status organic carbon available Nitrogen, available P_2O_5 and available K_2O in the soils of Pedgaon and Dharmapuri villages of Parbhani Taluka.

Village Name	Parameters	Range	Mean
	Organic carbon (%)	0.20 - 0.80	0.50
	Available Nitrogen ($Kgha^{-1}$)	121-356	235
Pedgaon	Available P_2O_5 ($Kgha^{-1}$)	26.52- 69.12	47.99
	Available K_2O ($Kgha^{-1}$)	96.12 - 239.18	147.78
Dharmapuri	Organic carbon (%)	0.35 - 0.98	0.50
	Available Nitrogen ($Kgha^{-1}$)	123 - 452	3.1
	Available P_2O_5 ($Kgha^{-1}$)	31.40 - 62.30	51.08
	Available K_2O ($Kgha^{-1}$)	113.20 - 358.24	220.40

IV. Discussion

The pH of both the villages was found neutral to alkaline range. Generally, soils were alkaline in nature might be due to medium black soil with well-irrigated conditions and pH less than 8 because of soils were light in texture. Similar result was reported in soils of this may be due to the basaltic type of parent material with a high content of basic cations. Similar observations were found in previous works in various districts of Maharashtra black soil regions. The organic carbon in most of the samples was low to medium range. This might be due to the rapid decomposition of organic matter as attributed to high temperatures during the summer season of Parbhani tehsil. Similar findings were reported in early findings. In available nitrogen, most of the samples from both villages fall under the low to medium category. This might be due to the semi-arid climate of Parbhani taluka with high temperatures which favor faster decomposition of organic matter and decline of organic matter, resulting in low to medium status of available nitrogen. Similar results were found in soils of Nanded District of Marathwada region of Maharashtra. The higher number of samples of available phosphorus from both the villages was found in the medium category. This might be due to the soil of both the villages being alkaline in nature and the high pH of the soil the calcium precipitate with phosphorus as Ca-phosphate and reduce phosphorus availability in soil were found similar results. The medium to high level of available Phosphate content in the soil can be attributed to the dissolution and diffusion of potassium from the internal crystal lattice of silicate clay minerals, particularly in soils with high clay content [7, 8].

V. CONCLUSION :

The pH is neutral to slightly alkaline and EC are safe for all the selected samples, so no need to add any amendments. The overall status of organic carbon, available nitrogen, phosphorus and potassium in Pedgaon and Dharmapuri villages of Parbhani district were low to medium category. Thus, the need to increase the recommended dose of fertilizer by 35 percent, the site where the soil samples were reported to have a *low level*

of nutrient status. Along with chemical fertilizer, adequate organic fertilizers such as *vermicompost need* to be added for improvement of nutrient status as well as organic matter status of soils for sustainable crop production[9,10,11].

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