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# ASSESSMENT OF SOIL FERTILITY STATUS OF DIFFERENT VILLAGES FROM PALAKKAD DISTRICT, KERALA

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**Abstract**– An assessment of soil fertility status of different villages from Palakkad district, Kerala carried out 2021-22. The prime objectives of this work were to study the physico-chemical properties of soil at different depths of various sites of Attappady block of Palakkad District, Kerala to determine the availability of macro and micro nutrient on soil of these soil samples and provide Soil Health Card for farmers of the Attappady block, Palakkad District, Kerala. For the assessment 9 sampling locations were selected. Soil samples were collected with depth of 0-15 cm, 15-30 cm and 30-45 cm respectively. The Soil colour (Dry Condition) of soil varied from Brown, Dark brown, Yellowish brown, Yellowish red, Dark greyish brown, very dark brown and Brownish yellow. Soil colour (Wet Condition) of the soil varied Brown, Dark brown, Yellowish red, very dark greyish brown, very dark brown and Brownish yellow colour. Soil textural classes were sandy loam. It clearly indicated that soil has good Water Holding Capacity (54.19 to 61.80 %) and good physical condition, Bulk Density (0.938Mg $m^{-3}$ to 1.365Mg $m^{-3}$). Particle Density (2.124 Mg $m^{-3}$ to 2.866 Mg $m^{-3}$). Pore Space (50.018 % to 64.321%). The pH of soil is acidic nature (5.517 to 6.687) and the Electrical Conductivity (0.121 to 0.229 $dSm^{-1}$) was suitable for all crops. Organic carbon ranged from medium to high (0.902 to 1.182 %). These soils have low Nitrogen (127 kg $ha^{-1}$ to 252 kg $ha^{-1}$) in all villages. Phosphorus (18 kg $ha^{-1}$ to 34 kg $ha^{-1}$) content is high at eight locations and medium at one location. Potassium (131.8 kg $ha^{-1}$ to 383.9 kg $ha^{-1}$) is low in one location and high in two locations. Calcium (5.9 cmol ($p^+$) $kg^{-1}$ to 8.6cmol ($p^+$) $kg^{-1}$) and Magnesium (1.2 cmol ($p^+$) $kg^{-1}$ to 9.8 cmol ($p^+$) $kg^{-1}$) are very sufficient in this soil. Sulphur (17 Mg $kg^{-1}$ to 30.5 Mg $kg^{-1}$) is high in five locations. Zinc (0.79 Mg $kg^{-1}$ to 0.81 Mg $kg^{-1}$) content is sufficient in this soil. There is an including awareness of the need to pay greater attention in the role of macronutrients enhancement pin the soil for good soil health and proper nutrition of plant so as to attain optimum economic yield and soil is suitable for all major tropical and sub-tropical crops.

## INTRODUCTION

Soils are natural unconsolidated materials on the surface of the earth and are composed of solid, liquid, and gas. They have organic as well as inorganic matter, which are intimately mixed together by natural processes. By this mixing and transforming, they are aggregated into a porous body (Osman, 2012).

Soil fertility is the ability of a soil to sustain plant growth by providing essential plant nutrients and favourable chemical, physical, and biological characteristics as a habitat for plant growth. Plant nutrients include the macronutrients nitrogen, phosphorus and potassium, sulphur, calcium and magnesium. Micronutrients are essentially boron, chlorine, copper, iron, manganese, molybdenum and zinc. Fertilizers are chemical or natural substance or material that is used to provide nutrients to plants, usually via application to the soil, but also to foliage or through water in rice systems, fertigation or hydroponics or aquaculture operations. Nutrient sources include chemical and mineral fertilizers, organic fertilizers, such as livestock manures and composts, and sources of recycled nutrients (FAO, 2021).

The soil fertility status is the backbone on which all input-based high agricultural production

systems can be built. it provides physical conditions and nutrients for plants growth and fructification (Marschner, 2008).

Soil sampling is the process of taking a small sample of soil, which is then sent to a lab to determine the nutrient content. The soil can also be tested for the chemical, physical and biological properties, which are critical to plant nutrition. Basic plant nutrition requires the presence of nutrients such as nitrogen, phosphorus and potassium – soil sampling can also determine the pH levels of the soil alongside humus content, available lime, complete sulphur content and total $CaCO_3$ (AWSM, 2021).

Attappady is a tribal taluk in Kerala state covering an area of 735 km2 (284 sqm). It is carved out from Mannarkkad taluk in Palakkad district on 2021. Attappady Reserve Forest is a protected area comprising 249 km2 of land area in the western parts of Attappady. It is one among the reserved forests and protected forests of India. Attappady valley in Palakkad district along with the neighbouring Chaliyar valley of the Nilambur region in Malappuram district, is known for natural Gold fields, which is also seen in the other regions of Nilgiri Biosphere Reserve.

Areas adjacent to Silent Valley and help long-term sustainability of the protected area. The elevation of Attappady valley ranges from 750 meters (2,460 ft) the Malleswaran peak at 11°62323N 76°33283E which rises to 1,664 meters (5,459 ft) from the center of the valley. The Bhavani River flows from the Northwest around the mountain in a tight bend past Attappady village and continues to the Southeast (The Hindu, 2007).

There are three villages which taken for the soil samples collection is Agali, Kavundikkal and Pudur from the block Attappady. The major crops that cultivated at Attappady is Banana, Coconut, Aricanut, Pepper, Vegetables, Coffee, Tea, Cardamom, Ginger and Turmeric.

A comparison of the Physico-Chemical Properties of some of the soils of different regions of the Kerala state has been undertaken by comparing the results of the present study with the studies done earlier in the other regions of the state. Hence, a detailed study for evaluation of soils is needed to realize the concept of Fertility Status analysis successfully. With this following objective, a study has been undertaken in soil resources inventory for sustainable land use planning in Attappady region of Kerala.

## MATERIALS AND METHODS

### Sampling site and collection

Kerala is a state in south western region of India. The average rainfall here is about 3100 mm and monsoon begin by June and till the end of September. Palakkad is one of the fourteen districts of Kerala and has no coastal line. The district opens the state to the rest of the country through the Palakkad Gap with a width of 32 to 40 km. Its geographical position, historical background, educational status, tourism hot-spots and above all, the development activities that are carried out, are wide and varied. The district is one of the main granaries of Kerala and its economy is primarily agricultural.

The Block Attappady R-GIS coordinates Lattitude : 11 06′ 19.20" N 76 33′ 4.79" E. The location covers the area of 735 km2 (284 sq mi). Most of the part are using for crop production. for the study three villages selected from the block Attappady, And Attappady reserve forest is a protected area comprising 249 $km^2$.

Soil samples were collected from three different villages of Attappady block, Palakkad district of Kerala. They are Jellippara, Kavundikal, Pudur. Soil samples were collected with the help of khurpi, spade and meter scale. In each Villages three locations were selected for sampling and samples were obtained from three different depths 0-15 cm,15-30cm, and 30-45cm with the help of GPS, totally 27 soil sample were collected and analysed the Physico-chemical parameters.

## METHODOLOGY

Analysis of the soil samples were under the methods, the physical parameters include Soil Colour, Soil Texture, Bulk Density, Particle Density, Pore Space, Water Holding Capacity, whereas chemical parameters include pH, Electrical Conductivity, Organic Carbon, Macro-Nutrients (N, P, K, Ca, Mg, S), Micro-Nutrient (Zinc) Soil textural class was determined by using Bouyoucos Hydrometer (Bouyoucos, 1927). Bulk density, Particle density, Water holding capacity was determined by using Graduated Measuring Cylinder method (Muthuaval *et al.*, 1992). pH was estimated with the help of Digital pH meter after making 1:2 soil water suspension (Jackson, 1958). Electrical Conductivity was estimated with the help of Digital Conductivity meter (Wilcox, 1950).

Percent Organic Carbon was estimated by Wet Oxidation method (Walkley and Black, 1947). Available Nitrogen was estimated by Alkaline Potassium Permanganate method, using Kjeldahl apparatus (Subbiah and Asija, 1956), available Phosphorus was estimated by Olsen's extraction followed by Spectrophotometric method (Olsen *et al.*, 1954), available Potassium was estimated by Neutral normal Ammonium Acetate extraction followed by Flame photometric method (Toth and Prince, 1949), Exchangeable Ca2+ and Mg2+ were estimated by Normal Ammonium Acetate saturation method (Cheng and Bray, 1951), available Sulphur was estimated by Turbidimetric method followed by Spectrophotometric analysis (Chesnin and Yien, 1950) and available Zinc was estimated by DTPA Method (Lindsay and Norvell, 1978).

## RESULTS

### Physical Properties

The Soil Textural classes identified were Sandy Loam. The sand, silt and clay percentage varied from 68.3 to 75.7sand, 12.7 to 19.2 silt and 12.7 to 25.3 clay in Sandy Loam. Bulk Density was varied from the 0.938Mg $m^{-3}$ to 1.365Mg $m^{-3}$ and the highest Bulk Density was found in $L_5$ (1.365 Mg $m^{-3}$) which locations from Kavundikkal. The Particle Density varied from 2.124 Mg $m^{-3}$ to 2.866Mg $m^{-3}$ and the highest Particle Density was found in L3 (2.866 Mg $m^{-3}$) which location from the village Jellippara. The Pore Space (%) ranged from 50.018% to 64.321%. The highest Pore Space % was found at location L3 (64.321%) from the village Jellippara. The Water Holding Capacity (%) ranged from 54.19 to 61.80 % and $L_4$ from the village Kavundikkal hold the water best at 75.19%.

### Chemical Properties

The pH value ranged from 5.517 to 6.687 and the highest value was recorded at location $L_6$ (pH 6.687) from the village Kavundikkal. The Electrical Conductivity ranged from 0.121 to 0.229 dS $m^{-1}$ and the highest value was recorded at the location $L_4$ (0.229dS $m^{-1}$) from the village Kavundikkal and the soil was found to be normal. The value of total Organic Carbon (%) varied from 0.902 to 1.182% and the organic carbon content was found highest at location $L_1$ (1.182%) from the village Jellippara. The available Nitrogen content of soil ranged from 127 to 252 kg $ha^{-1}$ and nitrogen content was low in all villages. The available Phosphorus content of soil

**Table 1.1** Physico-Chemical Parameters of different villages from Palakkad, Kerala

| Sampling Site | Textural Class | Bulk Density (Mg m-3) | Particle Density (Mg m-3) | Water Holding Capacity (%) | pH | EC | OC | N | P | K | Ca | Mg | S | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Jellippara | | | | | | | | |
| L1 | Sandy loam | 0.938 | 2.225 | 55.97 | 5.51 | 0.121 | 1.182 | 127.6 | 27.5 | 208.7 | 7.6 | 6.3 | 19.2 | 0.79 |
| L2 | Sandy loam | 1.079 | 2.516 | 56.83 | 5.28 | 0.151 | 1.021 | 145.6 | 27.4 | 177.5 | 6.5 | 7.1 | 23.3 | 0.80 |
| L3 | Sandy loam | 1.354 | 2.866 | 59.14 | 5.63 | 0.154 | 0.902 | 158.6 | 18.1 | 190.6 | 6.6 | 7.9 | 18.0 | 0.79 |
| | | | | | | Kavundikkal | | | | | | | | |
| L4 | Sandy loam | 1.083 | 2.124 | 54.19 | 5.86 | 0.229 | 1.033 | 160.3 | 27.3 | 145.2 | 5.9 | 2.1 | 26.9 | 0.79 |
| L5 | Sandy loam | 1.365 | 2.225 | 56.02 | 6.34 | 0.139 | 0.929 | 250.3 | 27.3 | 131.8 | 7.4 | 1.2 | 30.5 | 0.79 |
| L6 | Sandy loam | 1.269 | 2.230 | 57.03 | 6.68 | 0.194 | 1.016 | 247.6 | 24.3 | 161.0 | 8.6 | 2.3 | 25.0 | 0.81 |
| | | | | | | Pudur | | | | | | | | |
| L7 | Sandy loam | 1.152 | 2.231 | 61.80 | 6.31 | 0.198 | 0.928 | 252.0 | 34.4 | 383.9 | 7.6 | 3.3 | 17.0 | 0.79 |
| L8 | Sandy loam | 1.269 | 2.510 | 55.87 | 6.21 | 0.213 | 1.073 | 252.0 | 34.5 | 364.7 | 8.2 | 9.5 | 18.9 | 0.79 |
| L9 | Sandy loam | 1.117 | 2.224 | 56.89 | 6.26 | 0.148 | 0.999 | 241.6 | 30.3 | 336.8 | 6.5 | 9.8 | 21.5 | 0.80 |

ranged from 18 to 34 kg ha$^{-1}$. Only location $L_3$ from village Jellippara have medium Phosphorus content, all other locations have high phosphorus content. Available Potassium content of soil ranged from

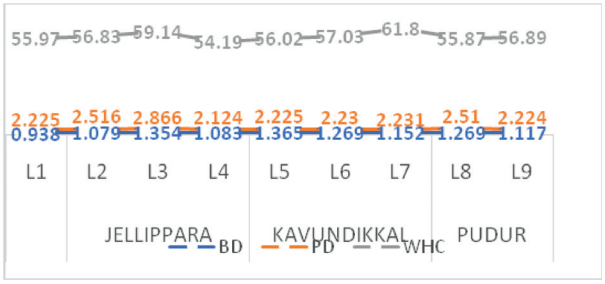


**Fig. 1.1** Particle Density, Bulk Density, Water Holding Capacity

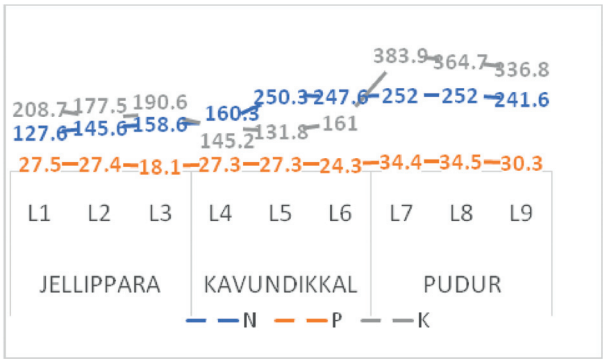


**Fig. 1.2** Available N,P,K

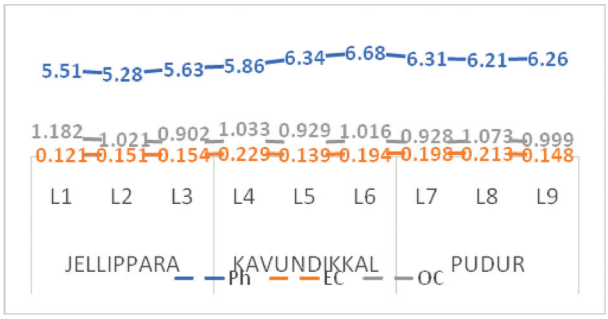


**Fig. 1.3** pH, EC, Organic Carbon

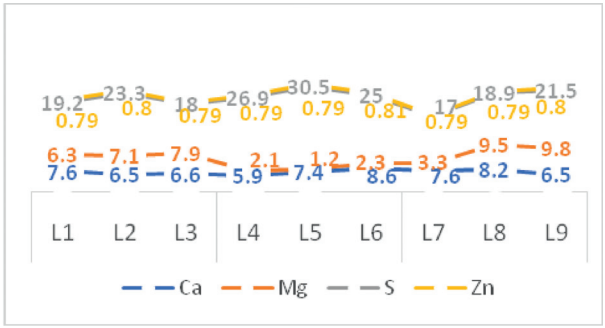


**Fig. 1.4** Calcium, Magnesium, Sulphur, Zinc

131.8 to 383.9 kg ha$^{-1}$. Location $L_5$ from the village Kavundikkal have low in Potassium content, 2 locations have high in potassium content $L_7$ and $L_8$ from the village Pudur. Exchangeable Calcium content of soil ranged from 5.9 cmol (p$^+$) kg$^{-1}$ to 8.6 cmol (p$^+$) kg$^{-1}$ with the highest value recorded at location $L_6$ (8.6 c mol (p$^+$) kg$^{-1}$) from the village Kavundikkal. Exchangeable Magnesium content of soil ranged from 1.2 cmol (p$^+$) kg$^{-1}$ to 9.8 cmol (p$^+$) kg$^{-1}$ with the highest value recorded at $L_9$ (9.8 c mol (p$^+$) kg$^{-1}$) from the village Pudur. Calcium and Magnesium are very sufficient in this soil. The Sulphur content of soil ranged from 17 to 30.5 Mg kg$^{-1}$ and Sulphur content high in five locations $L_2$, $L_4$, $L_5$, $L_6$ and $L_9$. The Zinc content of soil ranged from 0.79 to 0.81 Mgkg$^{-1}$ and sufficient in this soil.

## CONCLUSION

It was concluded that soil parameters studied during the course of investigation clearly indicated that soil has good water holding capacity and good physical condition. The pH of soil is acidic in nature and the Electrical conductivity was suitable for all crops. Organic carbon ranged from medium to high. These soils have low Nitrogen in all villages. Phosphorus content is high at eight locations and medium at one location. Potassium is low in one location and high in two locations. Calcium and Magnesium are very sufficient in this soil. Sulphur is high in five locations. Zinc content is sufficient in this soil. According to soil depths, the nutrients distribution is varying with different depths. Some nutrients are mostly present in upper depths and some of other nutrients is present in lowest depths. The main reason for lack of macronutrients is leaching due to high amount of precipitation in the area and nutrient uptake by plants. There is a need to pay greater attention in the role of macronutrients enhancement in the soil for good soil health and proper nutrition of plant so as to attain optimum economic yield for all major tropical and sub-tropical crops.

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