GEOGRAPHICAL ANALYSIS

RESEARCH ARTICLE

CHEMICAL CHARACTERISTIC OF SOIL: SPECIAL REFERENCE IN HEMAVATHI WATERSHED

S Bindumathi[1]

1 *Guest Faculty, Maharaja's College, University of Mysore, Mysuru, Karnataka, India*

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Abstract

Soil is the important element for the crops or plants. Crop yield is depends on soil quality and climatic condition of the region or area. Quality of the soil can be judge through the physical and chemical parameters. The present study is concentrate on chemical condition of the soils in study region. The chemical parameters are Organic carbon (OC), Phosphorus (P), Potash (K), soil reaction (pH) and Electrical conductivity (EC). Hemavathi watershed is one of the important tributary of river Cauvery. From this study it has been revealed the soil quality in the agriculture land, through these farmers can use suitable quality of fertilizer for particular crops.

Introduction

Agriculture, being the most primitive occupation of the civilized man, draws much attention to its development, beginning with the shifting cultivation and progressing to advance precision farming. With the advancement of civilization, man became more knowledgeable about varied crops and started to cultivate many of these crops. Populations increased and advancement in the civilization, inspired man to settle in one place and inspired man to cultivate the same area, year after year. Now agriculture became a profession, acquiring a given name, commercial agriculture and precision agriculture and sustainable agriculture as being the part of it (Praksh 2003).

The term "soil quality" has been coined to describe the combination of chemical, physical, and biological characteristics that enables soils to perform a wide range of functions. The assessment of soil quality requires quantification of critical soil attributes. Initial measurements of soil quality attributes should be made in high and low productivity areas to establish ranges of values that are site specific. Monitoring is an important part of managing soils and this can be achieved through soil testing. Soil testing helps to determine the fertility of soils to grow better crops and pastures. Soil testing can help assess potential fertiliser requirements as well as the need for other amendments such as lime or gypsum. It is always important to monitor the chemical characteristics that will be useful to help improve your crops and pastures. Monitoring is an essential component of developing an Environmental Management System (EMS). The 'soil fertility tool' outlined below will assist you to understand your soils and their suitability and limitations to growing plants for both production and environmental purposes. There are many methods used to assess different aspects of soils.

Working out what you need to know and how you are going to use the information is the first step.

Objective and Methodology

The present study is to find out the chemical condition of the soil in sample villages. The chemical parameters are Organic carbon, Phosphorus, Potash, pH, and Electrical conductivity. This study is based on primary survey.

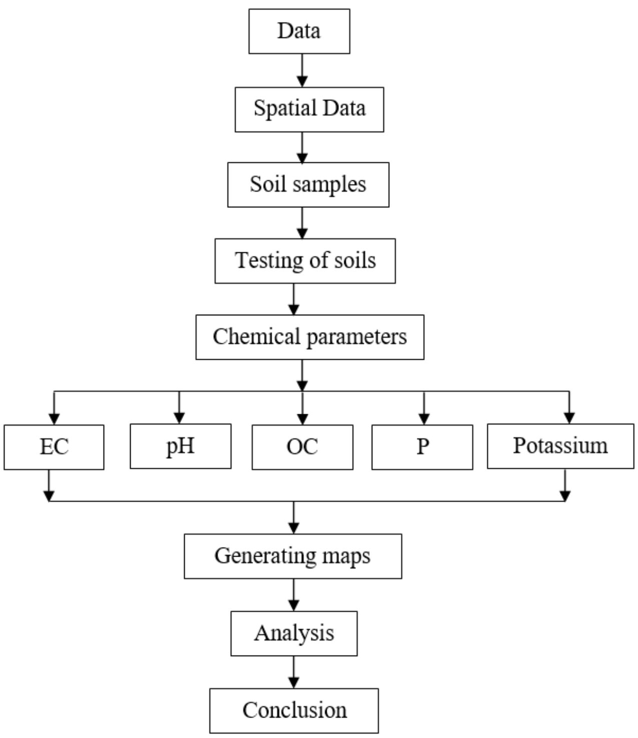

Diagram 1: Methodology

Study Area

The Hemavathi River is a very important tributary of the Cauvery river. It starts in the Western Ghats at an elevation of about 1,219 meters near Ballala Rayana Durga in the Chikamagalur district of the state of Karnataka and flows through Chikamagalur, Hassan, Mandya and Mysore districts, before joining the Cauvery River near Krishnarajasagara. It is 245 km long and it has a drainage area of about 5,697.65 km^2. A larger reservoir has been built on the river at Gorur in the Hassan district. In the entire Cauvery basin the Hemavathi watershed is second largest in terms of area.

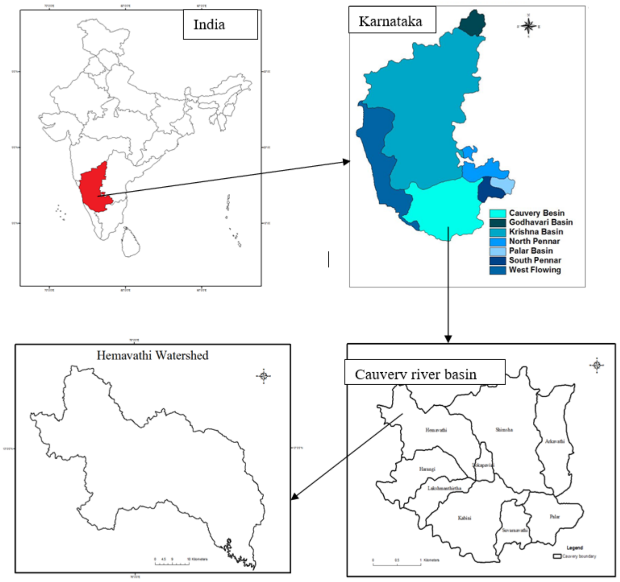

Fig. 1. Location map of Hemavathi watershed

Electrical Conductivity

Salinity is a soil property referring to the amount of soluble salt in the soil. It is, generally, a problem of arid and semiarid regions. Electrical conductivity (EC) is the most common measure of soil salinity and is indicative of the ability of an aqueous solution to carry an electric current. Plants are detrimentally affected, both physically and chemically, by excess salts in some soils and by high levels of exchangeable sodium in others (ECO RES 2004).

Table 1. Hemavathi Watershed : Electrical Conductivity

Classes	Total area (in %)
<0.80	96.77
0.80-1.6	3.22

Source: Field survey, computed by the author.

Table 1 and Figure 2 show the electrical conductivity in the Hemavathi Watershed, with low and medium classes of EC. Less than 0.80 dS/m is considered a low salinity class and 0.8 to 1.67 dS/m is classified as a medium salinity class. The study region has an area of only 3.22 percent that has a medium salinity class, of EC, while the remaining area is in the low salinity class of EC.

pH

Soil pH is an expression of the degree of acidity or alkalinity of a soil. It influences plant nutrient availability. A very acidic soil (pH <5.0) typically has lower levels of nitrogen, phosphorus,

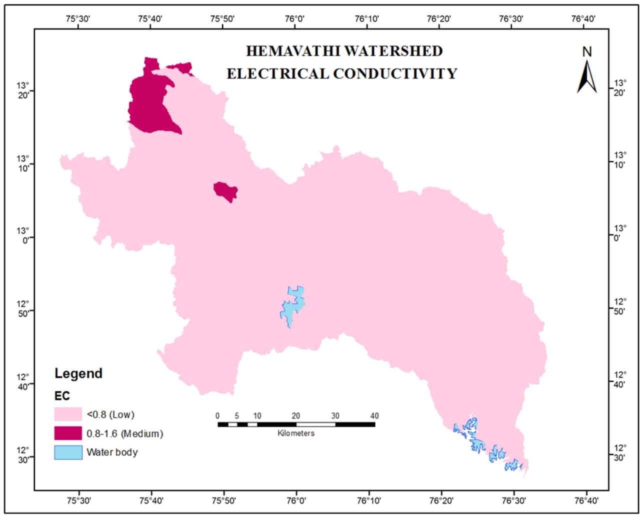

Fig. 2. Hemavathi Watershed: Electrical Conductivity

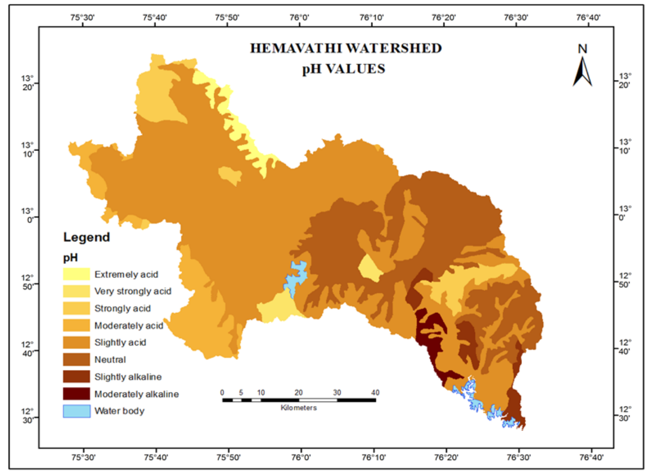

Fig. 3. Hemavathi Watershed: pH Values In Various Soils

calcium and magnesium available for plants and higher levels of availability of aluminium, iron and boron than soil with pH 7.0. At the other extreme, if the pH is too high, availability of iron, manganese, copper, zinc and especially phosphorus and boron may be low. A pH above 8.3 may indicate a significant level of exchangeable sodium.

The Table 2 shows the pH values in various soils and it shows the proportion, or percentage of the area in the study zones. Soil pH can be classified into 10 classes, the study region has a total of 8 kinds of soil pH ranges.

Extremely acid: If the soil has a pH value of 3.5 to 4.4, that soil can be considered as extremely acidic. This kind of soil is not suitable for any crops. In the study region 1.95 percent area have extremely acidic soil.

Soil pH or soil reaction is an indication of the acidity or alkalinity of soil and is measured in pH units. Soil pH is defined as the negative logarithm of the hydrogen ion concentration.

Table 2. Hemavathi Watershed: pH Values In Various Soils

Soil reaction	Total area (in %)
Extremely acid	1.95
Very strongly acid	1.59
Strongly acid	5.58
Moderately acid	6.85
Slightly acid	57.46
Neutral	23.43
Slightly alkaline	1.75
Moderately alkaline	1.39

Source: Field survey, computed by the author.

pH is simply a measure of how acidic or alkaline a substance is. Soil acidity or alkalinity (soil pH) is important because it identifies how easily plants can take up nutrients from the soil.

pH is a scale that chemists use to measure acidity. Values below 7 are considered acidic, values above 7 are alkaline (the opposite of acidic) and 7 is neutral, totally 23.43 percent of area having neutral pH value. Most plants can tolerate a wide pH range in solution culture, but they cannot tolerate a wide range of acidity in the soil. When soil acidity changes, the solubility of a number of metal ions also changes.

Under alkaline conditions, the solubility of minerals decreases to the point that nutrient deficiencies occur. Plant growth is, therefore, limited when there are deficiencies in iron, manganese, zinc, copper and boron. Phosphorus is also less available in alkaline soils and high levels of calcium may inhibit the uptake of potassium and magnesium. In the study region two kinds of alkaline soil can be find i.e., slight and moderate alkaline, some alkaline soils can be acidified using sulfur or acid forming fertilizers, but soils with free calcium carbonate cannot be easily acidified. It is often easier to manage the nutrient deficiencies that occur on alkaline soils than to acidify the soil.

Organic Carbon

Organic matter in soils and sediments is widely distributed over the earth's surface occurring in almost all terrestrial and aquatic environments (Schnitzer, 1978). Soils and sediments contain a large variety of organic materials ranging from simple sugars and carbohydrates to the more complex proteins, fats, waxes and organic acids. Important characteristics of the organic matter include their ability to: form water-soluble and water insoluble complexes with metal ions and hydrous oxides; interact with clay minerals and bind particles together; absorption of both naturally-occurring and anthropogenically-introduced organic compounds; absorb and release plant nutrients; and hold water in the soil environment. As a result of these characteristics, the determination of total organic carbon is an essential part of any site characterization since its presence or absence can markedly influence how chemicals will react in the soil or sediment (Brain.A.Schumachre. 2002). SOC is one of the most important constituents of the soil due to its capacity to affect plant growth as both a source of energy and a trigger for nutrient availability through mineralization. SOC fractions in the active pool, previously described, are the main source of energy and nutrients for soil microorganisms. Humus participates in aggregate stability and nutrient and water holding capacity. Table 3 and Figure 4 show the organic carbon in the study area, organic carbon can be divided into three class i.e., low, medium and high. 10.39 percent of the area had low levels of the organic carbon, the maximum was covered by medium levels of organic carbon i.e., 62.39 percent, 27.23 percent of the area recorded high levels of organic carbon.

Table 3. Hemavathi Watershed: Organic Carbon

Classes	Total area (in %)
Low	10.39
Medium	62.39
High	27.23

Source: Field survey, computed by the author.

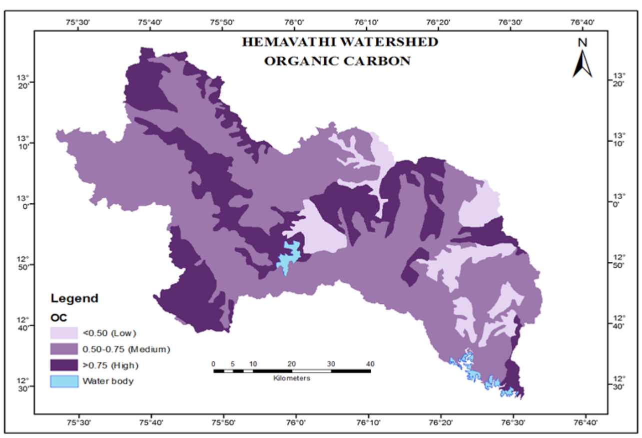

Fig. 4. Hemavathi Watershed: Organic Carbon

Phosphorus

Phosphorus is highly mobile in plants, and when deficient, it may be translocated from old plant tissue to young, actively growing areas. Consequently, early vegetative responses to phosphorus are often observed. As a plant matures, phosphorus is translocated into the fruiting areas of the plant, where high-energy requirements are needed for the formation of seeds and fruit. The availability of phosphorus (P_2O_5, Kg/ha) in the soil can be classified into three classes i.e., low, medium and high. In the Hemavathi watershed 20.06% of area is having Low level of Phosphorus, 33.30% of area is having Medium and 46.62% of area having High level of Phosphorus. Phosphorus deficiencies late in the growing season affect both seed development and normal crop maturity. The percentage of the total amount of each nutrient taken up is higher for phosphorus late in the growing season than for either nitrogen or potassium.

Table 4. Hemavathi Watershed: Phosphorus

Classes	Total area (in %)
Low	20.06
Medium	33.30
High	46.62

Source: Field survey, computed by the author.

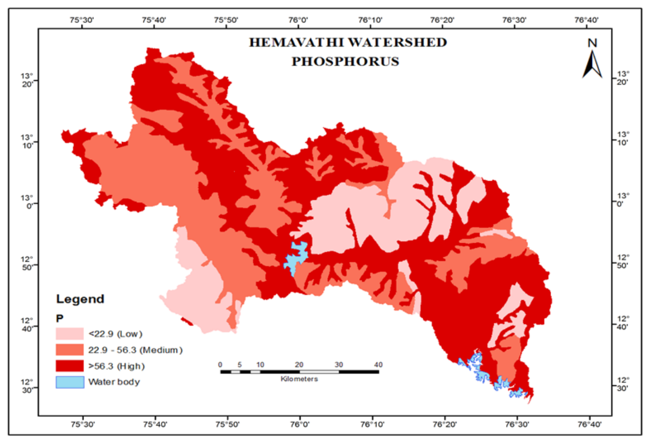

Fig. 5. Hemavathi Watershed: Phosphorus

Potassium

Potassium is an essential plant nutrient and is required in large amounts for proper growth and reproduction of plants. Potassium is considered second only to nitrogen, when it comes to nutrients needed by plants, and is commonly considered as the "quality nutrient." It affects the plant shape, size, color, taste and other measurements attributed to healthy produce. Plants absorb potassium in its ionic form, K+. Protein and starch synthesis in plants require potassium as well. Potassium is essential at almost every step of the protein synthesis. In starch synthesis, the enzyme responsible for the process is activated by potassium.

The availability of potassium in soil can also divided into three classes i.e., low, medium and high. In the study region is having 10.33% of Low level of Potassium, 27.73% of medium

Table 5. Hemavathi Watershed: Potassium

Classes	Total area (in %)
Low	10.33
Medium	27.73
High	61.92

Source: Field survey, computed by the author.

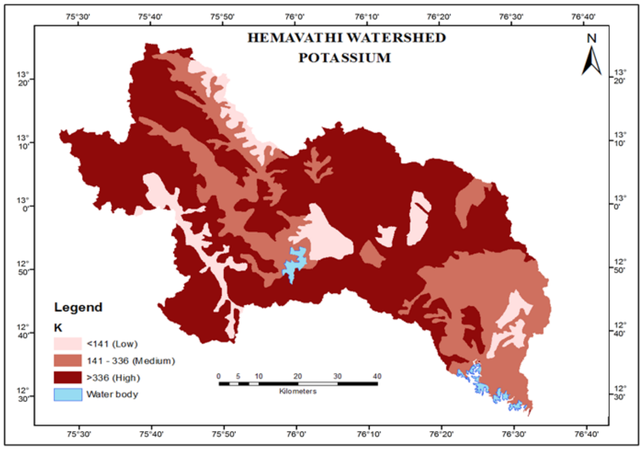

Fig. 6. Hemavathi Watershed: Potassium

level and 61.92% of area is having High level of Potassium. Potassium is absorbed by plants in larger amounts than either magnesium or calcium; in fact, nitrogen is the only nutrient absorbed in larger amounts than potassium. Potassium is a vital component of numerous plant functions, including nutrient absorption, respiration, transpiration, and enzyme activity.

Conclusion

The chemical condition of soils are related to each other, availability of phosphorus is controlling by three factors i.e., soil pH, amount of organic carbon and proper placement of fertilizer phosphorus. Organic matter maintenance is an important factor in controlling phosphorus availability. Available soil potassium is found associated with the clay complex and soil solution. The soil pH is neutral (6.6-7.3) suites for all crops.. Each crop id required different level of soil parameters for example: Moderately acid and slightly acid soils is highly suitable for paddy crop, pH value from 5.5 to 7.5 is highly suitable for ragi and if pH value is 6.6 to 7.3 (Natural) is suitable for all crops. Organic carbon is one of the important criteria for jower, maize and coffee etc., but not for paddy, ragi and sugarcane. In the study area more than 90 percent of the area having low (<0.80) electrical conductivity of soil. Phosphorus is an essential element classified as macronutrient because of large amount of Phosphorus required by plants and its one of the nutrient generally added to soils in fertilizers.

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