Eco. Env. & Cons. 29 (October Suppl. Issue) : 2023; pp. (S427-S430)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i05s.075

The study utilized the Greener Method to evaluate the soil composition of Phosphorous, Potassium and alkaline earth metals in certain soil samples from the district of Thiruvarur, Tamilnadu, India

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(Received 3 June, 2023; Accepted 27 August, 2023)

ABSTRACT

An eco-friendly method is used in this study to analyze the Phosphorous, Potassium, and Alkalinity levels in various soil samples from the Thiruvarur district. Ten distinct locations provide soil sample collection. Alkalinities (Carbonates, Bicarbonates) are evaluated by acidimetric titration, while the amounts of Phosphorous and Potassium are assessed by simple titration (EDTA method). This study intends to evaluate the Phosphorous, Potassium, and soil alkalinities of the samples gathered in and around the Thiruvarur district. In order to avoid issues with soil alkalinity, reclamation, and preventive actions are recommended. Appropriate fertilization activity ensures a balanced nutrition in the soils under consideration.

Key words: *Alkalinity, EDTA technique, Phosphorous, Potassium and Soil.*

Introduction

Soil can be described as a substance established as a consequence of pedogenic procedures that occur during and after rock weathering and in which plants and other forms of life can thrive. Soil is mostly constituted of mineral (Ladwani *et al*., 2012) materials, with a trace of organic substance. It also contains water, certain gases, and many organisms in addition to these two. The two most abundant alkaline earth cations in soils are Phosphorous and Potassium. The two types of ions present in soil solutions are soluble and adsorbed ions, and the other type is non-enriched ions present (Kumar Niraj *et al.,* 2014) in primary or secondary minerals and organic materials (Poongodi *et al.,* 2023). Different areas and field of soil from arid regions have ranges phosphorous (15 to 26.9mEqL^{-1}), potassium (110 to 170mEqL^{-1}) and alkalinity (5 to 9.2 mEqL^{-1}).

Study Area

The district of Thiruvarur was carved out as a separate district by detaching Valangaiman Taluk from Thanjavur District and Thiruvarur, Nannilam, Kudavasal, Needamangalam, Mannargudi, Thiruthuraippoondi Taluks from Nagappatinam

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District on 01.01.1997. It lies between 10° 20′ and 11° 07′ North latitude and 79° 15′ and 79° 45′ East longitude. The total area of the district is 2,377 sq.km.

Materials and Methods

Sampling and Methods

The process of collecting, preserving, and analysing soil samples was conducted according to accepted protocols. The soil sample collection was conducted in the months of February and March, 2019. The topsoil was first cleaned and then samples were taken between 0 and 30 cm in depth. A fresh plastic bag was used to collect the soil samples. The sample was then spread on a tray and allowed to dry naturally, followed by manual crumpling. The sample was filtered with a 2 mm sieve. Physico-chemical parameters of the collected soil samples, including alkali, potassium, and phosphorus, were analyzed.

Preparation of Soil Sample Extract

Each soil sample consists of 40g and is placed in reagent bottles that have been washed and re-rinsed. Subsequently, 200ml of water is added to the reagent bottles (Magizharasan *et al*., 2015). The reagent bottles are placed in a shaker to dissolve all soluble salts. After a period of 30 minutes of shaking, the resulting mixture is filtered using Whatmann's No 42 filter paper in a second reagent bottle. The soil extracts are graded from 1 to 10.

Estimation of Phosphorous and Potassium

A porcelain plate is filled with 5 milliliters of the soil extract. Eriochrome black-T indicator and eight drops of ammonium chloride-hydroxide buffer are added. The soil extract is titrated against a burette filled with N/100 EDTA. The turning of the color from reddish pink to purplish violet marks the finish (Rasith Ali *et al.,* 2020). To obtain concordant readings, repeat the titration. For each soil sample, the same process is carried out in order to identify the end points that correspond to each sample.

Estimation of Carbonate and Bicarbonate

A porcelain dish is filled with 5 milliliters of the soil extract. Next, add two drops of phenolphthalein indicator. Because the solution's color hasn't changed, there are no carbonates present (Rasith Ali *et al.,* 2019). Two drops of methyl-orange indicator are added to this colorless solution, causing the color to become yellow (Veeravelan *et al.,* 2022). Once a reddish tint (endpoint) developed, the titration was continued with vigorous stirring. To obtain concordant readings, repeat the titrations (Veeravelan *et al*., 2016).

Results and Discussion

The present study determined the alkalinities due to carbonates (CO_3^{2-}), bicarbonates (HCO_3^-), and phosphate and potassium contents of ten different soil samples of Thiruvarur district using the acidimetric titration method for alkalinity and the complexometic EDTA titration method for phosphorus and potassium.

After careful analysis of the above results, it is evident that the soil sample range has the highest phosphorous content (from 15 to 26.9 $mEqL^{-1}$), and potassium content (from 110 to 170 $mEql^{-1}$) of the ten soil samples studied. From the table below, it is clear that bicarbonate concentration ranges are almost homogeneous within a very small range (from 6.2 to 7.6 $mEqL^{-1}$), whereas there is no presence of hy-

Table 1. Phosphorous, Potassium and alkalinities of different soil samples of Thiruvarur District

Sl. No.	Soil Sample	Total Alkalinity mEq/L	Phosphorous mEq/L	Potassium mEq/L	pH
1	Paddy Soil Field	5.6	26.9	140	7.1
2	Cow Dung Pit Soil	6	20	170	7.2
3	Cotton Field Soil	6	20.6	130	7.6
4	Plantain Field Soil	6	19.4	135	7
5	Pond Soil	6	15	110	7.6
6	Organic Garden Soil	7	25	110	7.2
7	Fertile Soil	9.2	18.1	120	6.6
8	Garbage Depot soil	5	17.5	125	6.2
9	Mango Garden Soil	8.4	24.4	115	6.8
10	Sesame Garden Soil	8.2	23.1	140	7.4

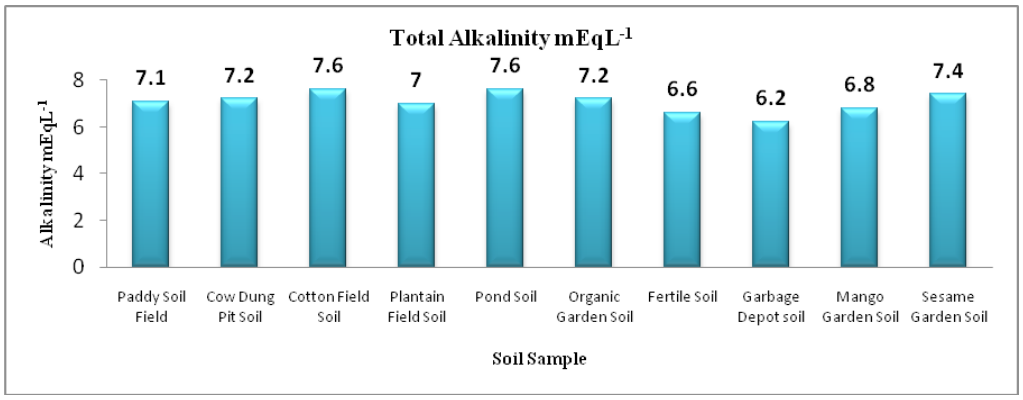

Fig. 1. Variation of total alkalinities of soil samples

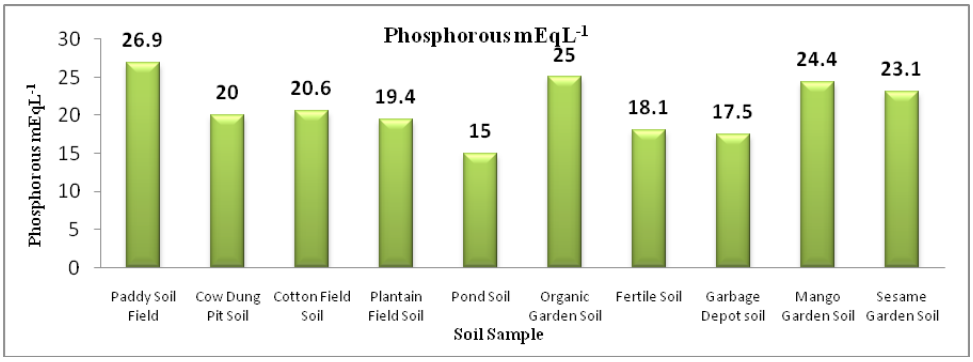

Fig. 2. Variation of Phosphorous of soil samples

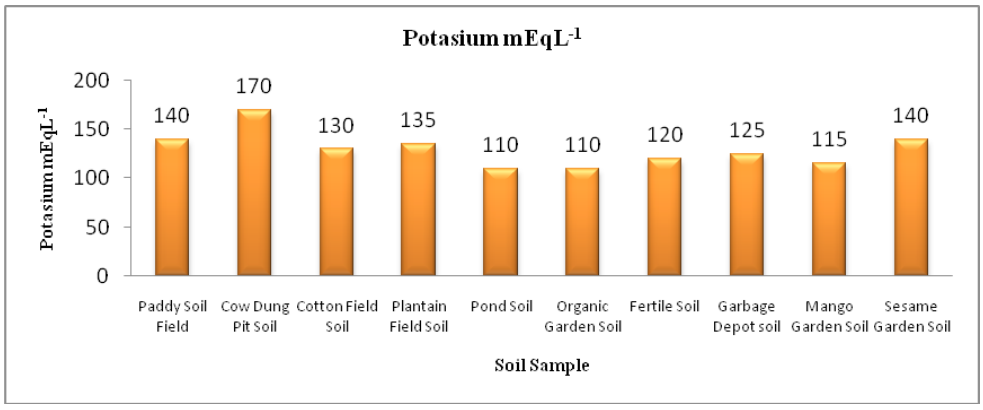

Fig. 3. Variation of Potassium of soil samples

droxyl or carbonate in any of the test samples. Therefore, nutrient availability and uptake, and hence plant growth in the soils studied, are very high.

Conclusion

An innovative technique has been used to assess the alkalinities, phosphorus, and potassium contents of ten soil samples that were taken from the Thiruvarur district. It is discovered that the alkalinities of the soil samples under investigation, owing to carbonates, bicarbonates, and overall alkalinities, are well within the tolerance level. Therefore, no reclamation is advised. The investigation's soil samples' phosphorus and potassium levels are determined to be well within the productive range. It is not advised to fertilize the soil samples undergoing analysis due to the anticipated balanced nutritional availability and uptake by plants.

Acknowledgement

I am appreciative of Thiru. Vi. Ka. Government Arts College, Thiruvarur and my research advisor for providing the required resources.

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