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Comparative Study of Soil Analysis and Identification of Soil Invertebrates in Organic and Chemical Farming System

Keerthana P S Jiji Thomas Sabitha Chacko

Lecturer Associate Professor Lecturer

Department of Zoology

(St. Mary's College, Manarcaud, Kottayam, Kerala, India)

Abstract

Soil as a natural body is an important abiotic factor on Earth. Soil invertebrates are integral part of the soil. This study was intended to disclose the influence of organic farming method by comparing the parameters of soil taken from an organic farming field and an chemical farming field. The chemical analysis of soil samples taken from the two selected sites revealed notable changes in chemical parameters such as organic Carbon, Potassium, Phosphorus, Calcium and Magnesium. Considerable change in the number of invertebrates was also evident from the study.

Key words: Chemical field farming, Bio fertilizer, Bio pesticides, Soil invertebrates

Introduction

Soil is formed through the combined influence of various natural processes. Soil formation is governed by biogeochemical and physical processes influenced by soil organisms. Soil is inhabited by a wide range of organisms which provide a variety of ecosystem services. They are actively involved in nutrient cycling, regulating the dynamics of soil organic matter, soil carbon sequestration and greenhouse gas emission, modifying soil physical structure and water regims. Soil invertebrates act as soil engineers to make the soil a critically important provider of ecosystem services (Dominati *et al*., 2010). The most pertinent physical properties of soil that is relevant to plant growth include soil colour, texture, moisture content and various nutrients present (Phogat *et al*.,2015). Soil fauna that includes soil microbes, earthworms, rodents, soil arthropods etc. maintain the physical as well as chemical properties of the soil through their activities. Soil physical and chemical function can be modified where disturbances affect the activities of soil invertebrates (Blanchart *et al*.,2016).

Materials and Methods

The study was intended to assess the quality of soil taken from two different sites, namely an organic and a chemical farming land, and also to identify soil vertebrates.

Site of Study

Site 1: Organic farming field

This selected site (Thannikkapady) was totally devoid of chemical fertilizers and pesticides. In spite, in this site bio fertilizers and bio pesticides are used. The soil colour was brownish black. Compared to chemical farming land, this site carries a large number of soil invertebrates.

Site 2 : Chemical farming field

This selected site (Maalam) was polluted because of the complete usage of chemical fertilizers. Here, the soil colour was light red. Soil fauna and flora were comparatively lesser than organic farming land.

Method of sample collection

Six soil samples were randomly collected. Three samples from organic site and three from chemical farming site. The sample selection was random. Surface litter, grass, and debris were removed from the sampling spot. A 'V' shaped cut was made to a depth of about 15 cm in the sampling spot using a spade. The thick slice of the soil was then removed from top to bottom of the exposed face of the 'V' shaped cut. The samples were then transferred to a clean polythene bag, and dried in shade for the analysis of various physico-chemical properties of the soil. Organisms were separated from the samples using Berlese funnel extraction method. The collected organisms were then identified with the help of an expert, reference books and Internet.

Colour of the soil samples were analyzed through mere inspection. Potentiometric method was used to detect the pH of the samples. A conductivity meter was used to check the salinity and electrical conductivity of the soil. Moisture content was measured using a desiccator. Walkley and Black's rapid titration method was used to detect the organic Carbon content in the sample. Available Phosphorus in the soil sample is estimated using Bray and Kurtz method. Flame photometric method was used to detect the amount of available Potassium in the soil. Calcium and Magnesium were detected using EDTA method and Versante method respectively.

Result and Discussion

Figure 1 shows the number of soil invertebrates collected from the organic farming field and Figure 2 indicates the number of organisms collected from chemical farming field. The physico-chemical characteristics of the two different types of soils were analysed using standard techniques. Ten parameters were tested including soil colour. Soil taken from organic farming field showed the highest level of moisture content (Fig.3) than that collected from the chemical farming field. A study conducted by Easton et al suggested that the pores created by various types of soil invertebrates increase the moisture content of the soil. pH and salinity or electrical conductivity of the soil were high in organic field. The pH of the organic field was around 6.12 and that of inorganic field was 4.74 (Fig.4). Electrical conductivity is also high for organic farming field.

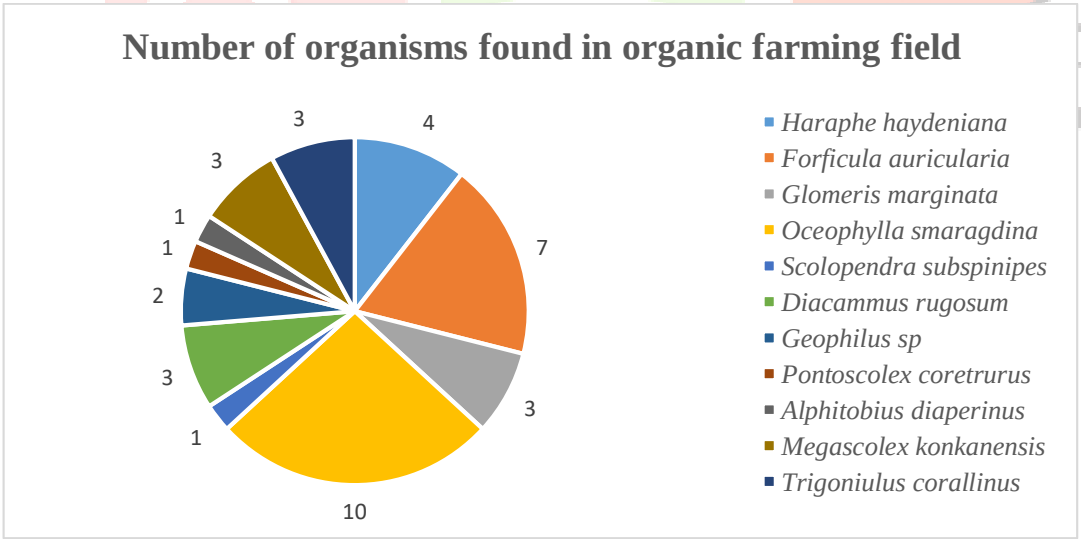

Fig. 1: Organisms found in organic farming field

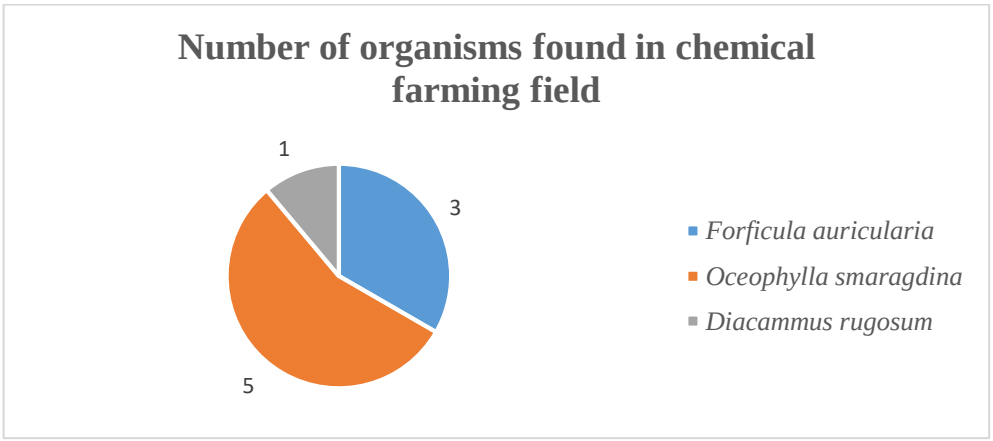

Fig. 2: Organisms found in chemical farming field

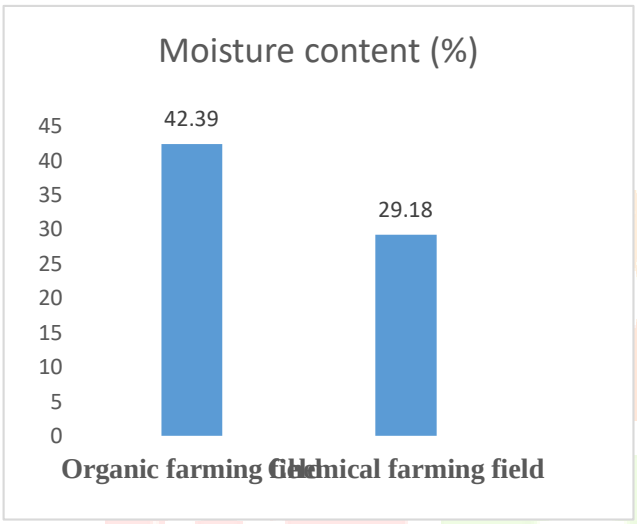

Fig. 3: Comparison of moisture content

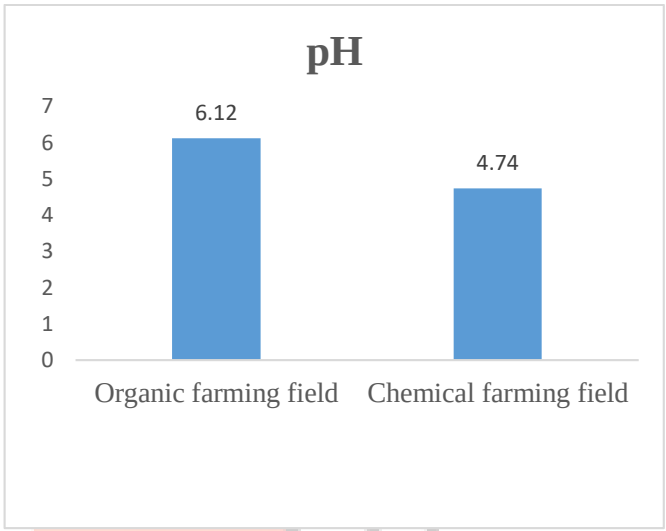

Fig. 4: Comparison of pH

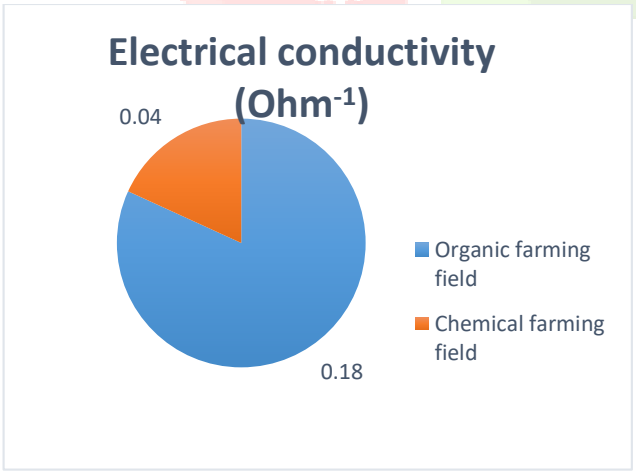

Fig. 5: Comparison of Electrical conductivity

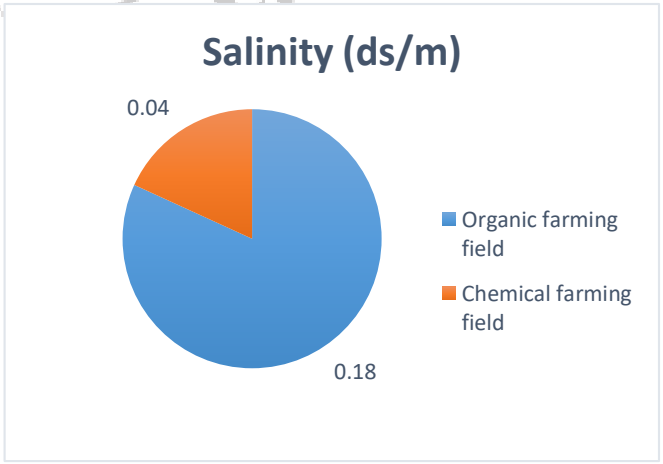

Fig. 6: Comparison of salinity

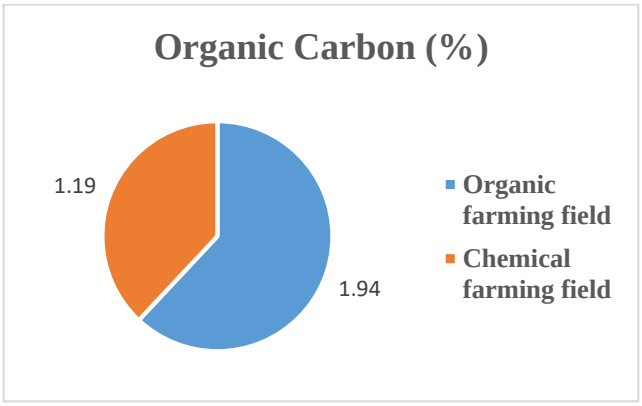

Fig. 7: Comparison of Organic carbon

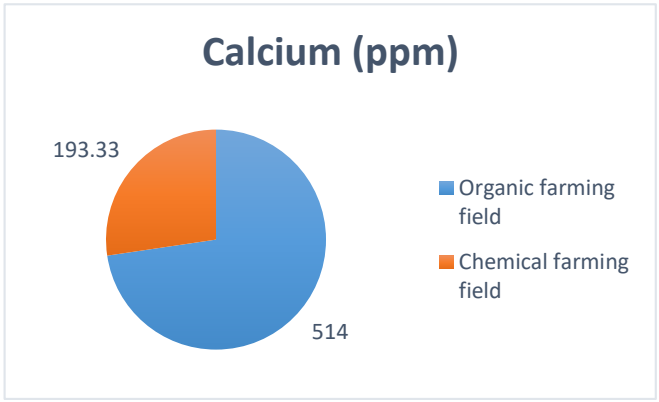

Fig. 8: Comparison of Calcium

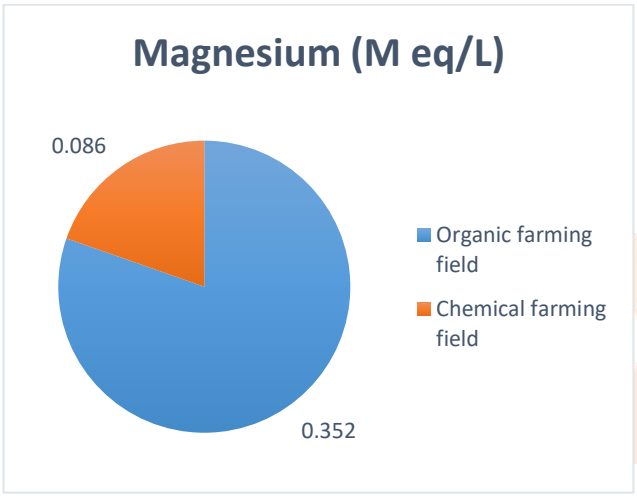

Fig. 9: Comparison of Magnesium

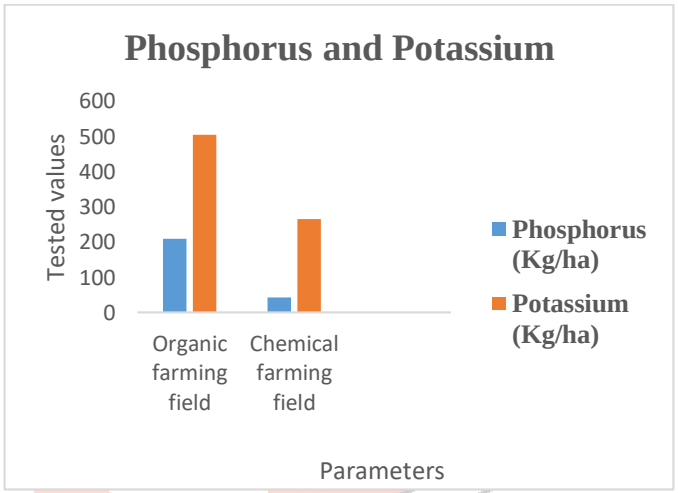

Fig. 10: Comparison of Phosphorus and Potassium

Organic carbon content of the organic farming field was improved by 63.03% as compared to chemical farming field. In chemical farming field, organic carbon was 1.19% where as in organic farming field it was 1.94% (Fig.7). Similar observations were made by Lal (2008) who established that humus decomposition by soil invertebrates increase the organic carbon content. An improvement in the available Potassium by 89.48% and total Phosphorus by 389.55% was found in organic field. Both Calcium and Magnesium shows an increase of 165.87% and 309.3% respectively (Fig.8 & Fig.9). From the study of Wilfried (2002), it was evident that Phosphorus increases through normal nutrient cycling. In this study also, soil sample from organic agricultural field showed the highest level of Potassium and Phosphorus (Fig.10) than the chemical field. Soil invertebrates' diversity was highest in organic soil compared with inorganic soil. This area contains earthworms, ants, beetles etc. In the opinion of Bardgett (2005) aerating and stirring the soil, thus increasing the stability of soil aggregates by these organisms help infiltration of water.

Conclusion

The comparative study of the soil quality indicates that the soil taken from the organic field is more fertile than that from chemical farming field. The organic field provides habitat for soil fauna. This is due to the presence of humus, organic carbon and the moisture content of the soil. This area contains diverse invertebrates such as ants, earth worms, ground beetles etc. and they play an important role in nutrient cycling which leads to increased productivity. Use of organic fertilizers also helps to maintain the soil fauna.

In chemical farming system, the number of soil invertebrates is comparatively reduced. This indicates the influence of chemical fertilizers applied to the soil. A reduction in the abundance of soil invertebrates can result in poor nutrient cycling followed by reduced productivity.

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