



Comparison of Efficacy of Different Bio-Enzyme on Acidic Soil

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

An increase in population increases the demand for food sources, which creates pressure on agriculture. As a result, more synthetic fertilizers are used. Because of the inevitable use of synthetic fertilizer, the nutrient content in soil decreases. Bio-enzymes are a good alternative to synthetic fertilizers, As they increases the micro and macronutrients of the soil. Bio-enzyme works as a stimulator that stimulates the plant growth. It is cost-effective and helps in breaking down the complex compound into simple ones. In this experiment, acidic soil is treated with citrus, mixed fruits, vegetable bio enzyme, and organic fertilizer. The test is done in six samples such as control (C), BE1(C), BE1(D), BE2(C), BE2(D), and OF (Organic fertilizer). After the treatment, the pH of the soil increases from 4.5 to 6.5. the NPK value of soil also increases Kg/acre in 40 days. The organic carbon (OC) content of the soil increases from 0.4 to 0.9%. The moisture content of the soil increases gradually. Adding the bio enzyme into the acidic soil helps to maintain the pH of soil between 6.2 to 6.8 for proper growth of plants. Besides also increases the NPK value of soil and also maintains the percentage of OC.

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Keywords: Synthetic fertilizer; acidic soil; Bio-enzyme; organic waste material; growth stimulator.

1. INTRODUCTION

The growing population puts pressure on agricultural production to fulfill the increasing demand for food. To fulfill the food demands more quantity of synthetic fertilizers are used. If meat and food consumption in developed countries is matched by the rest of the world by the mid-21st century, the grain and nutrient demand is expected to triple [1]. The amount of land used for agriculture slightly changed over the past few decades [2] and also decreased in some parts of the world due to urbanization [1]. The nutrient load per unit area increases rapidly. Thus, an increase in production rate per unit area builds pressure on soil, to fulfill the demand for food. A greater number of chemical fertilizers are used which leads to environmental pollution, a decrease in food quality, soil degradation, micronutrient deficiency in the soil, and toxicity to different beneficial living organisms present above and below the soil [3,4,5]. To deal with this condition bio-enzymes are a good alternative [6]. Bio-enzyme improves the status and quality of soil by

enriching it with nutrients that it lacks [3]. Bio-enzymes are organic molecules that act as catalysts in various biological and chemical processes. The formation of bio enzymes in the future will not only contribute to minimizing trash sent to landfills but also the development of bio enzymes to provide a substitute for the chemical fertilizer that is bad for both humans and the environment [7]. The bio enzymes prepared from citrus peels are used as plant growth enhancers [8].

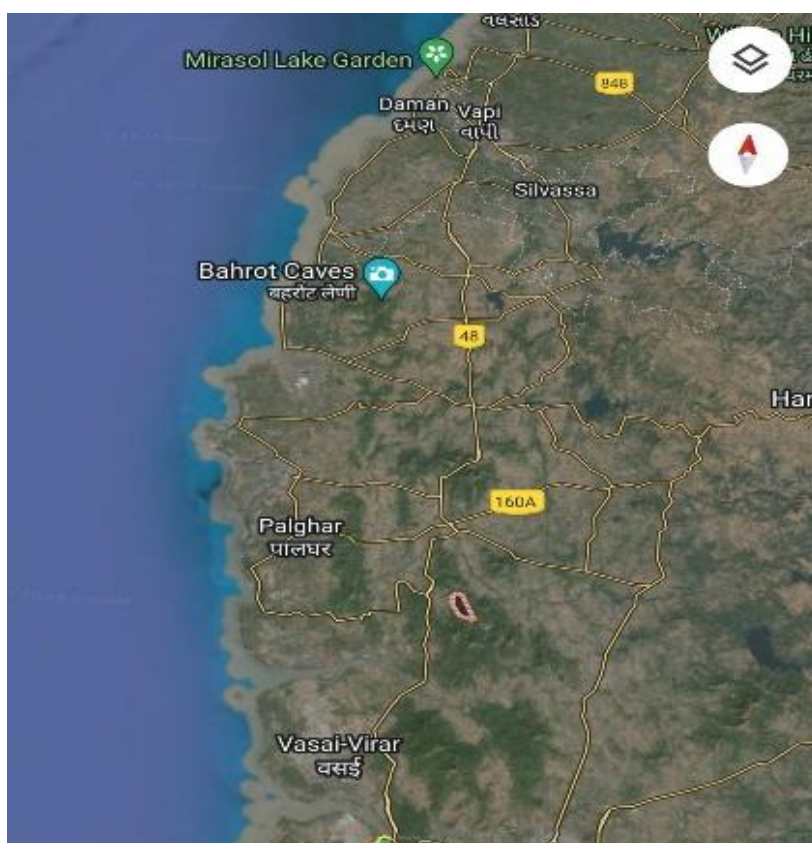
2. MATERIALS AND METHODS

2.1 Collection of Acidic Soil Sample

The acidic land soil sample was collected from Palghar, Maharashtra.

2.2 Preparation of Bio-Enzymes

Bio enzyme was prepared with the methods given by [4,9,10,1,11,12,13,14,15,16,17] such as citrus and mixed fruit and vegetable.



Map 1. Study area

Image: Google map

2.3 Soil Analysis

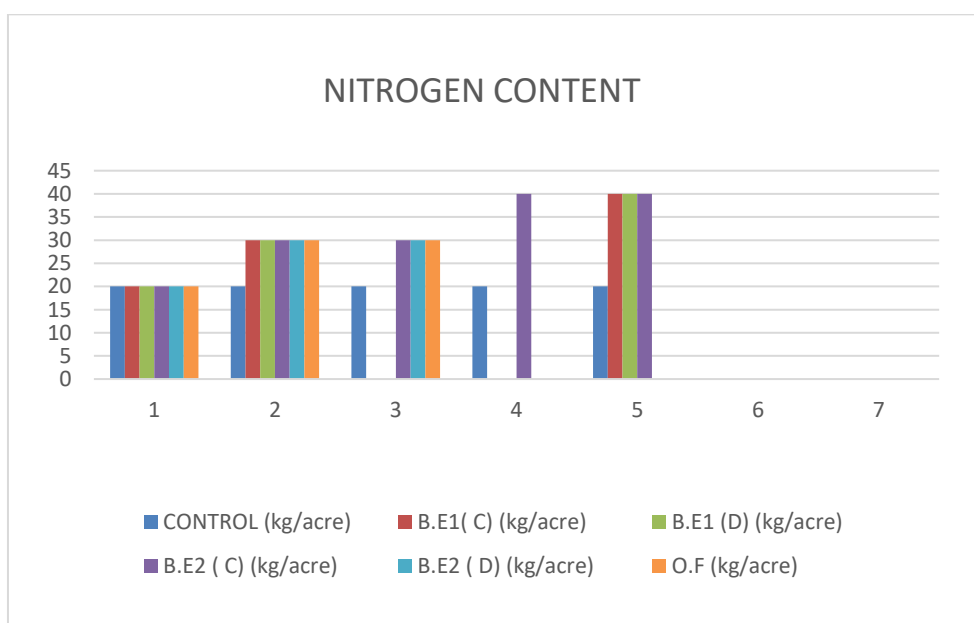
The research was carried out at the laboratory in the Department of Zoology at Bhavan's College. The materials used in this study were a soil sample, bio enzyme, soil analysis kit Agrinex soil doctor 40 capsules (rapid N-P-K-pH soil testing kit), and soil organic carbon detection test kit. Two types of bio-enzymes are taken such as citrus and mixed fruits and vegetables in concentrated and diluted form. Six small plastic containers were taken and each 1kg of soil sample was transferred. The first soil sample was labeled as control (C), the second soil sample was treated with concentrated citrus bio enzyme [B.E1(C)], the third soil sample was treated with diluted citrus bio enzyme [B.E1(D)], the fourth soil sample was treated with concentrated mix fruits and vegetables bio enzyme [B.E2 (C)], and fifth soil sample was treated with diluted fruits and vegetable bio enzyme [B.E2 (D)], and sixth soil sample was treated with organic fertilizer (O.F).

- i. Ratio of diluted citrus bio-enzyme- 1:10 (50ml of concentrated citrus bio-enzyme dissolved in 450ml of water).
- ii. Ratio of diluted mix fruits and vegetables bio-enzyme – (50ml of concentrated mix fruits and vegetable bio-enzyme dissolve in 450ml of water).

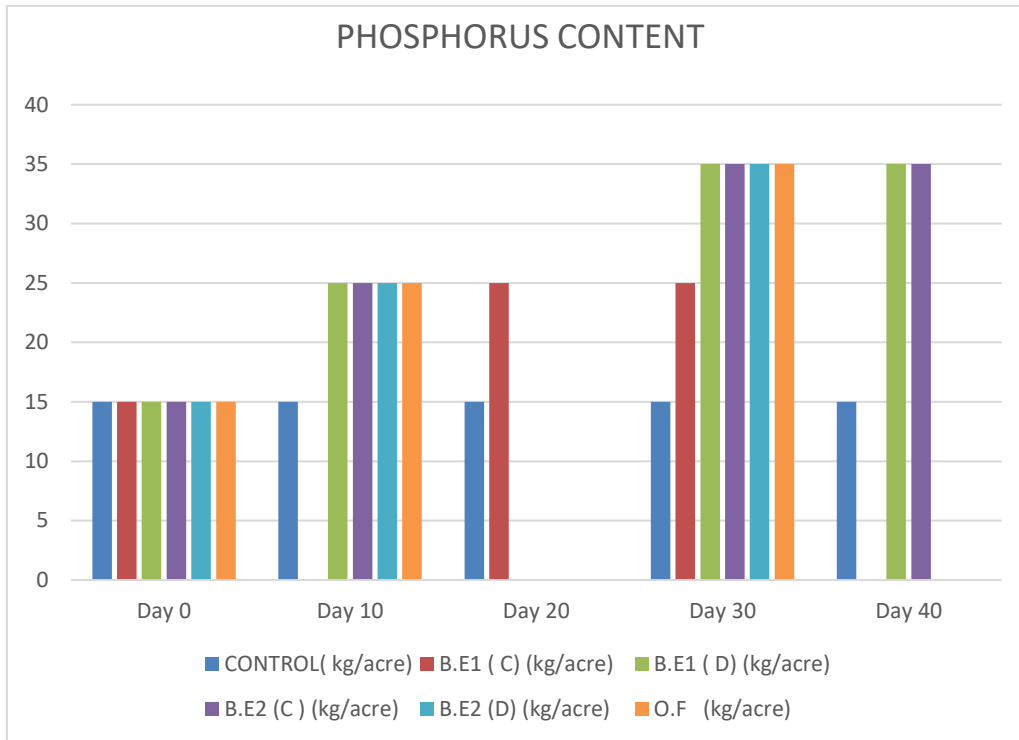
3. RESULTS and DISCUSSION

3.1 Analysis of Acidic Soil Sample with the Help of Different Bio Enzymes

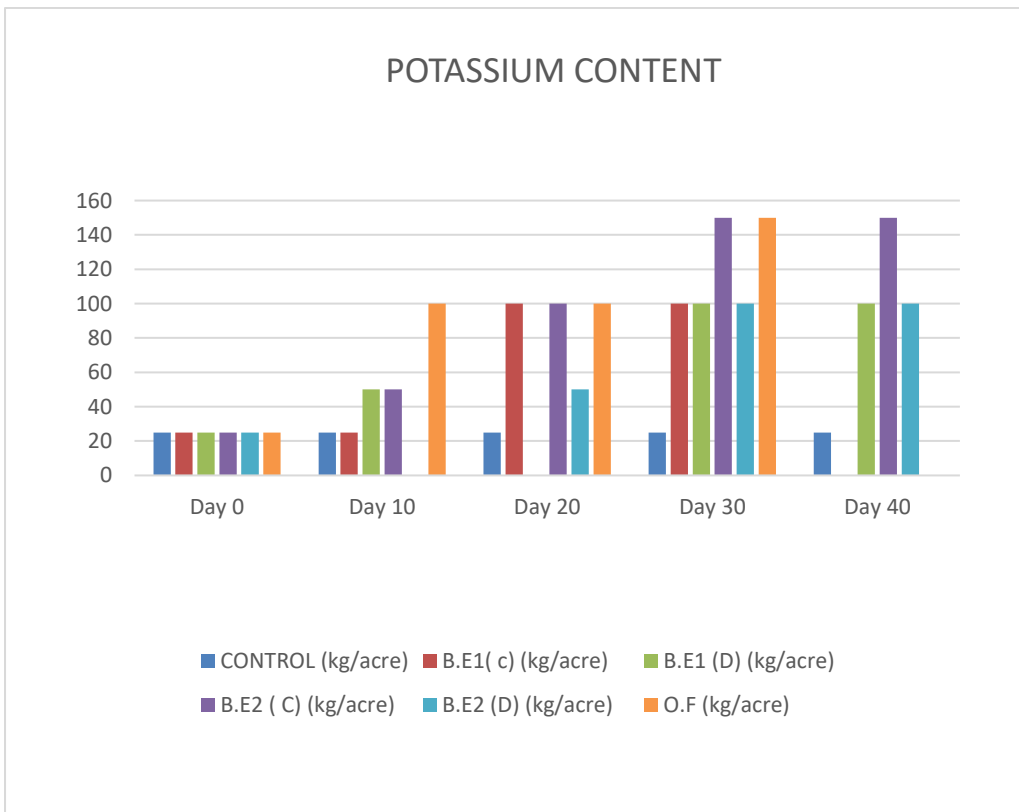
In recent years the production of fruits and vegetables has increased rapidly, out of which 30 to 40 % of fruits and vegetables are wasted annually, which leads to economic loss every year (APEDA 2019-20). These wasted fruits and vegetables are good sources of organic material, phytochemicals, and substances with beneficial nutraceutical qualities and can make value-added products [18]. Most of these wastes are nutrient and enzyme-rich, containing cellulases, amylases, pectases, proteases, etc, [19]. According to [20] fruits and vegetable peels are also wasted; people eat only flesh from it. The more we eat fruits and vegetables more waste will be produced. The zero-waste the idea focuses more on the steps or strategies for managing waste so that nothing is wasted and pollutes the environment [21]. The production of eco-enzyme or bio-enzyme in the future is to not only minimize waste but also the production of bio-enzyme reduces the use of synthetic fertilizers that are bad for humans and the environment [7]. Bio-enzymes are produced by the fermentation processes. Vegetable protein components break down into nitrogen, which is good for enriching the soil [22]. Bio-enzyme contains living microorganisms and when applied to soil promotes growth by increasing nutrient availability [23].



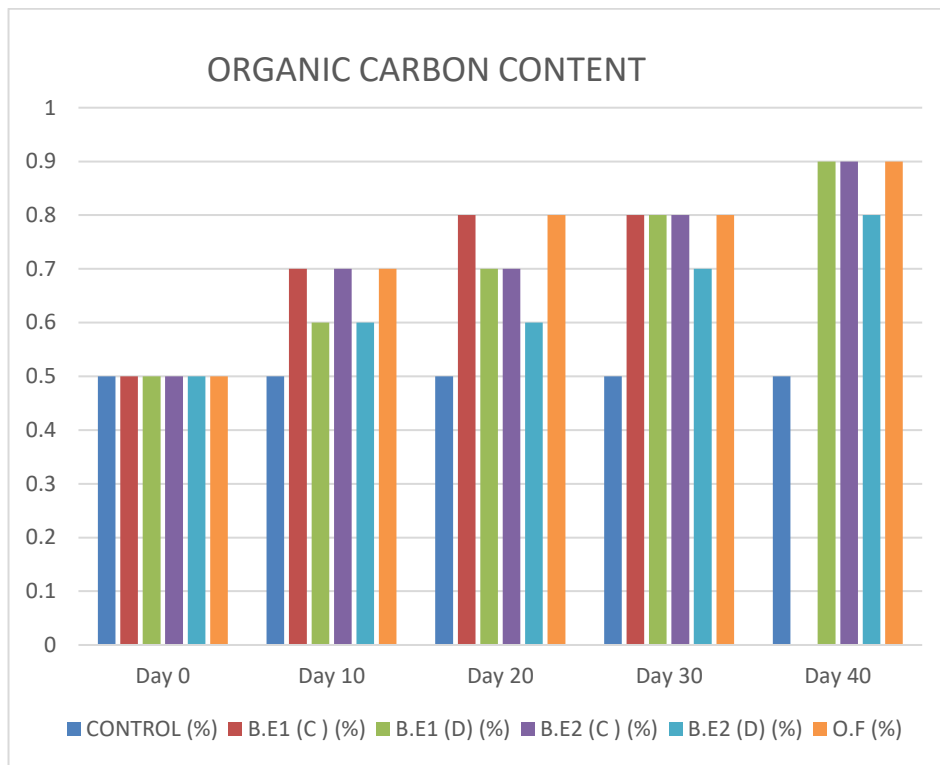
Graph 1. Nitrogen content w.r.t increase in concentration of bio-enzymes



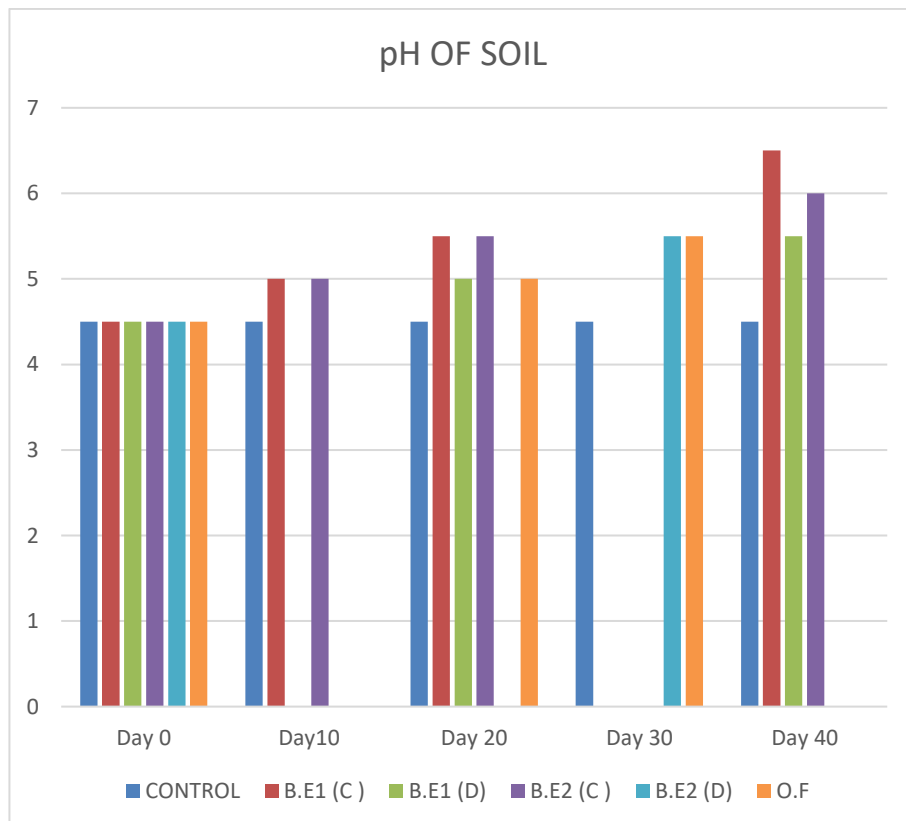
Graph 2. Phosphorus content w.r.t increase in concentration of bio-enzymes



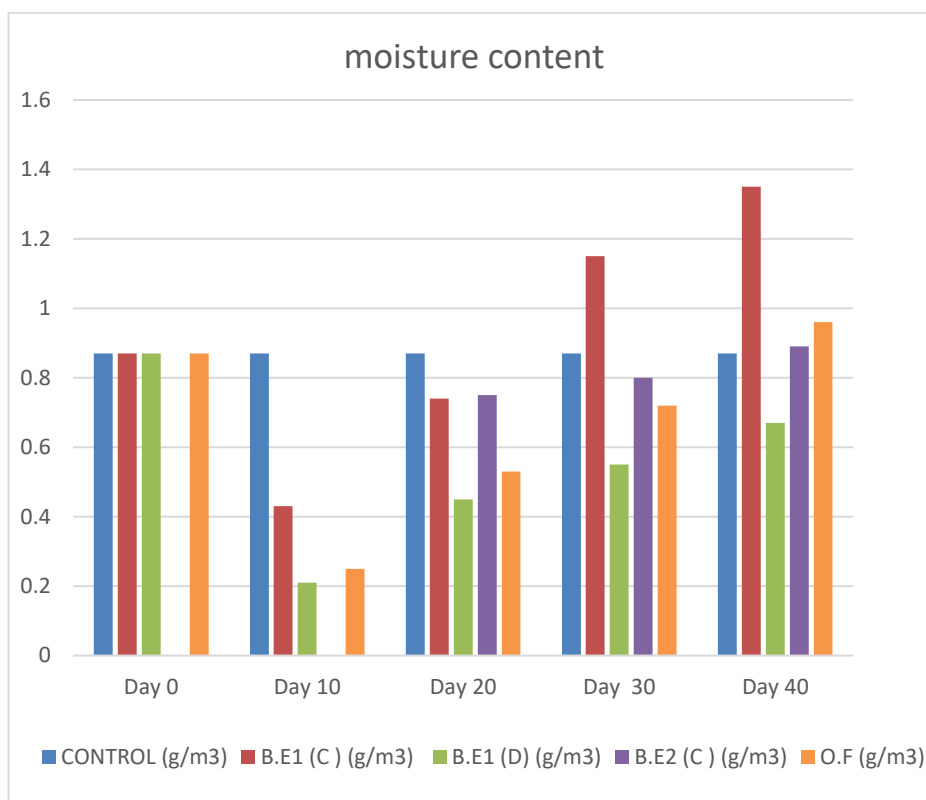
Graph 3. Potassium content w.r.t increase in concentration of bio-enzymes



Graph 4. Organic carbon content w.r.t increase in concentration of bio-enzymes



Graph 5. pH of soil w.r.t increase in concentration of bio-enzymes



Graph 6. Moisture content w.r.t increase in concentration of bio-enzymes

4. CONCLUSION

In recent years the production of fruits and vegetables has increased rapidly, out of which 30 to 40 % of fruits and vegetables are wasted annually, which leads to economic loss every year (APEDA 2019-20). These wasted fruits and vegetables are good sources of organic material, phytochemicals, and substances with beneficial nutraceutical qualities and can make value-added products [18]. Most of these wastes are nutrient and enzyme-rich, containing cellulases, amylases, pectases, proteases, etc, [19].

This study concluded that the increase in concentration of bio-enzyme positively increases the NPK value and improves the pH of acidic soil. After the treatment, the pH of the soil increases from 4.5 to 6.5. the NPK value of soil also increases Kg/acre in 40 days. The organic carbon (OC) content of the soil increases from 0.4 to 0.9%. The moisture content of the soil increases gradually. Adding the bio enzyme into the acidic soil helps to maintain the pH of soil between 6.2 to 6.8 for proper growth of plants.

Conversion of waste fruits peel and vegetables peels to a useful product is the key demand of

current time. This paper mainly focused on the significant application of waste fruits and vegetables peels into valuable products, enhancing the general awareness among people to use waste as a valuable product.

CONFERENCE DISCLAIMER

Some part of this manuscript was previously presented and published in the conference: An International Conference on Coastal and Marine Conservation CMC-2024 dated from 1st and 2nd March, 2024 in Mumbai, India. Web Link of the proceeding: <https://mithibai.ac.in/wp-content/uploads/2024/02/CMC2024-CONFERENCE-brochure.pdf>

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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