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Article

Evaluation of Fertilizer Efficiency on Eggplant and Okra Fruits

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Abstract: Fertilizers of all kinds, chemical, organic, and bio, are among the essential elements to improve soil fertility and promote plant growth, which supports sustainable agriculture. Our research aims to evaluate the efficiency of fertilizers on Eggplant and Okra Fruits. The study included planting eggplant and okra seedlings and adding a concentration of 10 grams of chemical, organic, and bio fertilizers to the soil. The studied traits (weight and number of fruits) were calculated. According to the results obtained, it can be said that the effect of adding fertilizers to the eggplant plant had very highly significant differences between the type of fertilizer and its effect on the number and weight of fruits when statistically analyzed at a significant level (5%); chemical fertilizer treatment outperformed the organic fertilizer treatment, followed by bio-organic fertilizer treatment and control treatment. The effect of fertilizers added to the okra plant is that there were very highly significant differences between the type of fertilizer and its effect on the number of fruits when statistically analyzed at a significant level (5%); all the fertilizer treatments outperformed the control treatment. In measuring the weight of fruits, chemical fertilizer treatment outperformed all the treatments as well as the control treatment.

Keywords: Fertilizer, Eggplant, Okra, Fruits

1. Introduction

Fertilizers, whether organic, biological, or chemical, represent the very core towards amending fertility levels in soils and triggering plant growth for the fulfillment of sustainable agriculture. They vary and include features and benefits under each type of compound toward the ultimate realization of sustainable agricultural production. Microorganisms such as bacteria and fungi are involved in the fixation of nitrogen and solubilization of phosphates in the soil, to enable the plant to acquire effective nutrients. One of the organisms, Pseudomonas and Bacillus bacteria are more important as phosphate-solubilizing organisms than has been observed in the study of Abhilash et al. (2016) [1,2,3].Bio-fertilizers are environmental sound sustainable alternatives since they reduce the application of chemical fertilizers, which are environmentally hazardous. These mainly depend on natural materials like compost manure and animal excreta. Such fertilizers enhance the plant by improving the soil structure, increasing the nutrient content, and giving the soil water-retention capacity to help the plants for a green and healthy growing environment. Besides, organic fertilization is efficient in controlling erosion and runoff and is, therefore, a fundamental part of sustainable agricultural practices [4,5].

Chemical fertilizers are a very quick and effective medium of providing the nutrients that are needed for the plants to grow. They have played an important part in enhancing agriculture and eventually feeding the entire world population. The main advantage of

these fertilizers is that they are very simple to apply and can be found in several forms, typically granular and liquid which are easy to carry and store [6,7].

The Solanaceae plant, regularly referred to as the "black eggplant" or the "purple eggplant" is an eggplant, which is a principal vegetable in the majority of world cuisines[8]. In fact, the growing of eggplant is one of the imperative factors in the attainment of sustainable development. It has large leaves and white or purple flowers, and a wide range of fruits varying in shape and color from dark purple to white [9]. A powerhouse of Vitamins C and K, minerals, and fiber, eggplant also abounds in anthocyanin (antioxidants) that support heart health and decrease the likelihood of chronic diseases. Okra is a plant from the Malvaceae family, known as a base vegetable in numerous cultures due to its distinct taste and high nutritional content. The paper evaluates the effectiveness of several of the traced features of plants' responses to fertilizers on eggplants and okra. This is important to play a role inpromoting sustainable development [10,11,12]. Our research aims to evaluate the efficiency of fertilizers on some of the studied traits of eggplant and okra plants.

2. Materials and Methods

3.1 Seedling Planting

The study included eggplant seedlings of the SV1574EV variety of American origin, which were obtained from Company in Iraq, and okra seedlings of the local variety belonging to the Iraqi Company for Seed Production / Mosul Branch, which were obtained from local markets. Several agricultural service operations were carried out during the experiment period, starting from planting the eggplant and okra seedlings until the harvest time for all treatments in a similar manner, and according to the recommendations followed in vegetable cultivation, including irrigation according to the plant's need. As for the manual hoeing process, it was done twice, the first after a week of planting and the second after three weeks of planting, then weeding was done continuously whenever the need arose for it and on a regular basis.

3.2 Fertilization

In the study, three types of fertilizers were used (chemical, organic and bio), as 10 grams of each type of fertilizer were added to the soil and during (10-15) days and three times with taking readings before each process is carried out, including (weight and number of fruits), while the control treatment was without adding any type of fertilizer [13,14].

3.3 Harvesting

The indicators of eggplant and okra maturity, as well as the method of harvesting them, differ. Okra began production after about 40-45 days of planting. It was harvested when the fruits were 5-7 cm long and before they became hard. It is harvested every 2-3 days in the early stages of production. As the plant progresses in growth, the interval between harvests can be increased to 3-5 days. As for eggplant, it is picked when the color becomes a stable and ripe black, and eggplant begins to ripen after 60-65 days of planting, and harvesting was done every 5-7 days depending on the rate of fruit ripening.

3.4 Studied Traits

Number of fruits: The ripe fruits on each plant were counted after harvest or during the ripening stage.

Measuring fruit weight: The weight of the fruits was measured as an additional criterion to evaluate productivity [15,16].

3.5 Statistical Analysis

The Statistical Analysis System(2003) program was used to analyze the data and test for significance using Duncan's Multiple Range Test to determine significant differences between treatments at a probability level ($P \leq 0.05$).

3. Results and Discussion

3.6 Effect of Fertilizers on the Number of Eggplant Fruits

Figure 1 shows the effect of adding fertilizers to the eggplant plant. It was observed that there were significant differences between the type of fertilizer and its effect on the plant when analyzed statistically at a significant level (5%). The chemical fertilizer treatment outperformed the organic fertilizer treatment, followed by the bio-fertilizer treatment and the control treatment. The reason for this may be that it contains a high percentage of nitrogen (46%), which is an essential element that stimulates cell division and the growth of green tissues. Stimulating the photosynthesis process and increasing vital activity of the plant lead to enhanced formation of lateral buds and hence new branches.

This is in contrast to when it takes relatively long for organic fertilizer to decompose and release nutrients leading to a delayed effect on plant growth and development. The study showed that there was an increase in the number, weight, and yield of fruits when organic fertilizer was applied, but much less as compared to chemical fertilizers [17,18,19].

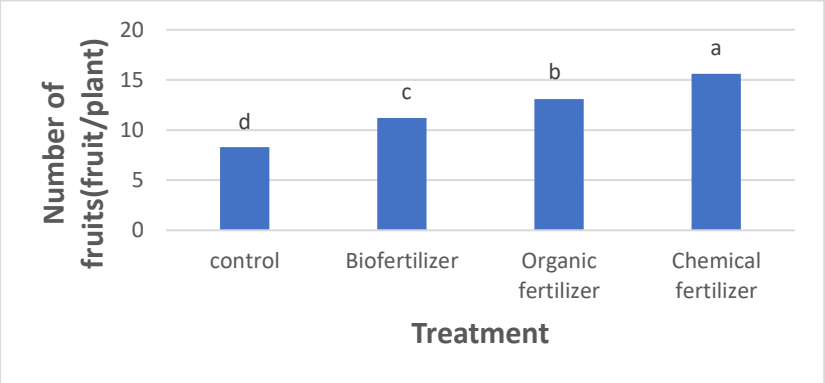

Figure 1. Effect of Fertilizers on the Number of Eggplant Fruits

3.7 Effect of Fertilizers on the Weight of Eggplant Fruits

Figure 2. Effect of Fertilization on Eggplant Plant. Anova analysis showed a significant difference between the type of fertilizer and the effect of fertilizer on the plant at a significance level of 5%. Chemical fertilizer treatment was observed to be better than organic fertilizer. This was followed by bio-fertilizer treatment, further improving fruit nutrition compared to control. This is explained by the high percentage of nitrogen content that can fertilize the process of photosynthesis and protein and sugar formation within the plant. In return, this improves the nutritional value of the fruits by increasing their size and weight through promoting cell growth and accumulation of organic matter within the fruit [20, 21].

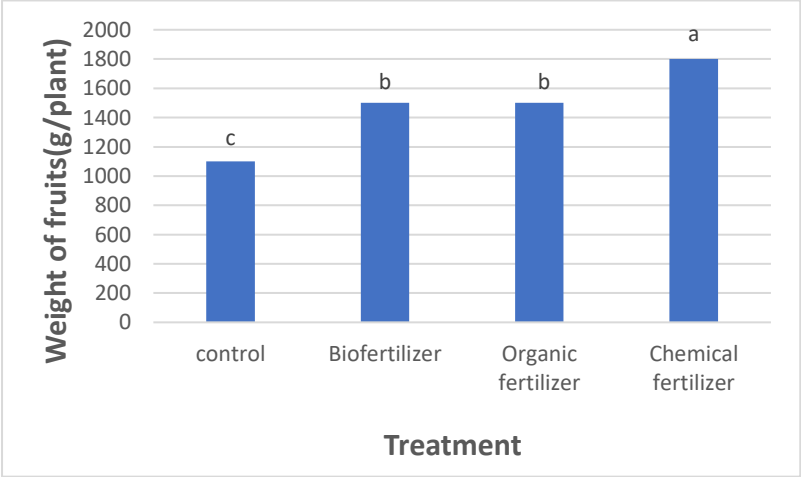

Figure 2. Effect of Fertilizers on the Weight of Eggplant Fruits

3.8 Effect of Fertilizers on the Number of Okra Fruits

Looking at Figure 3, it is very clear that the difference takes place between the type of fertilizer and its effect on the number of fruits when analyzed statistically at a significance level of 5%. A significant increase was found for all fertilizer treatments compared to the control treatment. This is because chemical fertilizers provide essential nutrients in high concentrations and are rapidly absorbed, which enhances fruit production. As for organic fertilizers, they work to improve soil structure and increase its fertility and water retention capacity, creating a suitable environment for plant growth. As well as activating microorganisms that enrich the soil with beneficial organisms that improve plant absorption of nutrients, which leads to increased flowering and number of fruits. As for the role of bio-fertilizers, they increase nitrogen fixation and improve the availability of phosphorus and make it available to the plant, and also stimulate plant hormones such as auxins and gibberellins that promote flowering and increase the number of fruits [22].

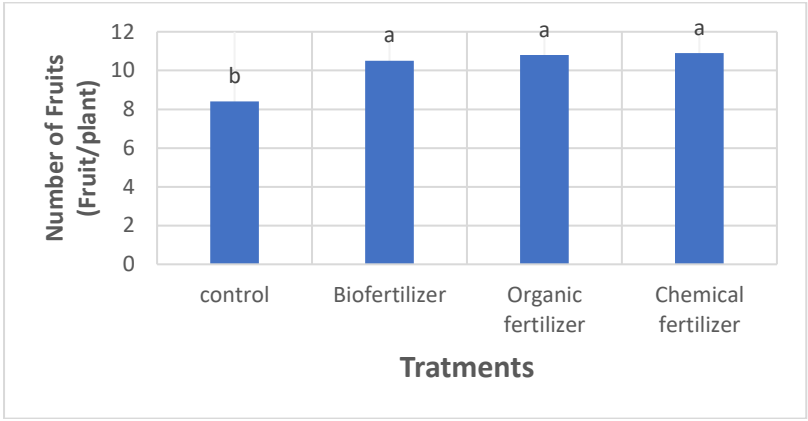

Figure 3. Effect of Fertilizers on the Number of Okra Fruits

3.9 Effect of Fertilizers on the Weight of Okra Fruits

Figure 4 shows the effect of adding fertilizers to the okra plant. It was observed that there were significant differences between the type of fertilizer and its effect on the plant when analyzed statistically at a significance level of 5%. The chemical fertilizer treatment outperformed the organic fertilizer treatment, followed by the bio-fertilizer treatment and the control treatment. This is because chemical fertilizers increase the weight of fruits by providing nitrogen to promote growth, phosphorus to support nutrient absorption, and potassium to improve photosynthesis and energy transfer, which helps in the formation of larger and heavier fruits. In addition, organic and bio-fertilizers require a longer time to decompose and release nutrients, which leads to a slower effect on plant growth and fruit production [16,21,22,23,24].

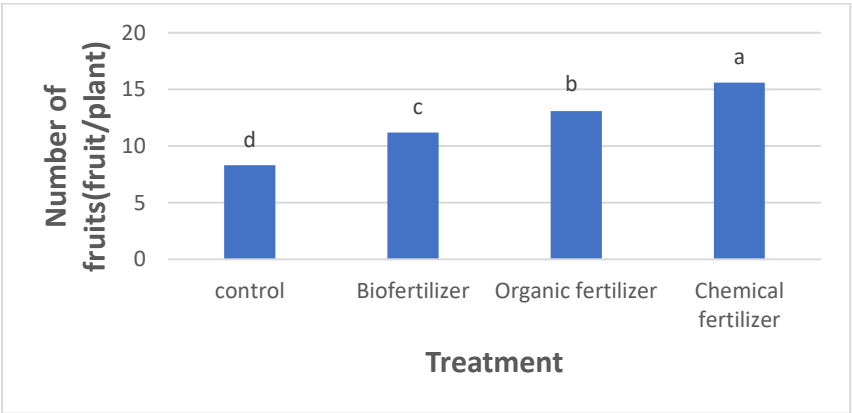

Figure 4. Effect of Fertilizers on the Weight of Okra Fruits

4. Conclusion

In general, chemical fertilizers showed a significant superiority in increasing both the number and weight of eggplant fruits compared to organic and bio-fertilizers, as well as compared to plants that were not fertilized (control group). This superiority is most likely due to the fact that chemical fertilizers contain a high percentage of nitrogen.

Organic and bio-fertilizers have a role, although their effect was less clear compared to chemical fertilizers, but organic and bio-fertilizers still contribute to improving eggplant growth. Organic fertilizers improve soil fertility and increase its content of nutrients, while bio-fertilizers enhance the activity of microorganisms in the soil that help convert nutrients into forms that can be absorbed by plants.

All types of fertilizers (chemical, organic, and bio) showed a positive effect on okra plants, as they increased the number of fruits compared to the control group. Regarding fruit weight, chemical fertilizers also outperformed all other treatments, including the control group. Fertilizer integration enhances growth. This indicates that the use of fertilizers, in their various forms, is an important matter to enhance the growth and productivity of okra plants. It is recommended to conduct more studies to evaluate the effect of other types of fertilizers, and different combinations of fertilizers, on different vegetable crops.

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