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Evaluating the impact of using compost from different plant residues on the quantitative and qualitative performance of strawberries

Marzieh Faizipour[1], Ebrahim Fataei*[2], Shahrazad Khorramnejadian[1]

[1]Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran

[2]Department of Environment, Ardabil Branch, Islamic Azad University, Ardabil, Iran

*Corresponding Author: eafataei@gmail.com

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Extended Abstract

Introduction: In recent years, environmental degradation, particularly soil pollution due to excessive chemical fertilizers and pesticides, has become a significant challenge in agricultural production. As a result, sustainable agricultural practices, including the use of organic fertilizers such as compost derived from plant residues, have gained importance. Composting agricultural waste not only improves soil structure but also helps reduce the reliance on chemical fertilizers, ensuring better environmental sustainability. This study focuses on evaluating the impact of bio-compost, enriched with zinc and manganese, on the growth, quality, and yield of strawberries, especially under drought stress conditions.

Methods: This descriptive-analytical field study was conducted in the summer of 2024, with plant residues collected from greenhouses and agricultural fields in the Jiroft region of Iran. The residues were processed into bio-compost using a windrow composting method, followed by nutrient analysis (C/N ratio, nitrogen, phosphorus, potassium, and trace elements like zinc and manganese). Strawberry plants of the Paros variety were cultivated in greenhouses under controlled conditions, with drought stress applied at 65% of field capacity. Fourteen different treatment combinations were applied, including various formulations of bio-compost (from wheat, cucumber, eggplant, and canola), enriched with zinc and manganese at a rate of 1 kg per square meter. The effects of these treatments were evaluated based on parameters like plant height, fruit yield, vitamin C content, antioxidant activity, phenolic compounds, and total anthocyanins.

Results: The results showed that bio-compost enriched with zinc and manganese significantly enhanced both the qualitative and quantitative parameters of strawberry growth. Among the treatments, the bio-compost derived from canola and enriched with zinc and manganese (treatment 5) resulted in the highest improvements in plant height, fruit yield, and quality indicators such as vitamin C, total phenolics, antioxidant activity, and anthocyanin content. This treatment also outperformed other combinations under both normal and drought conditions. Notably, the bio-compost treatments consistently increased plant growth indicators like root and shoot fresh weight, number of branches, and stem diameter. In terms of quality, treatment 5 demonstrated the highest vitamin C content (9.51 mg/100 ml) and total phenolics (75.23 gallic acid equivalent/100g fresh weight), outperforming other treatments.

Discussion: This study highlights the potential of using bio-compost derived from agricultural residues to improve the growth and quality of strawberries. The positive effects observed with the inclusion of trace elements such as zinc and manganese suggest that these micronutrients play a critical role in enhancing plant resilience, especially under drought stress. The improved plant growth and fruit quality indicate that bio-compost not only serves as an effective organic fertilizer but also provides an environmentally friendly alternative to chemical fertilizers. These findings align with previous research that emphasizes the benefits of incorporating organic waste into agricultural practices, reducing dependency on synthetic fertilizers, and mitigating environmental risks. Additionally, the study demonstrated that bio-compost can effectively supplement chemical fertilizers, leading to sustainable agricultural practices that promote both productivity and environmental health.

Conclusion: The study concludes that bio-compost enriched with zinc and manganese significantly improves both the quantity and quality of strawberries, especially under drought conditions. Treatment 5 (canola bio-compost enriched with zinc and manganese) was the most effective, enhancing plant growth, yield, and fruit quality. The use of bio-compost from agricultural residues offers a sustainable and economically viable approach to enhancing strawberry production, reducing environmental impacts, and improving soil health. These results suggest that bio-compost, when properly enriched with essential nutrients, can serve as a valuable tool for enhancing agricultural productivity and sustainability, particularly in regions facing water scarcity and environmental challenges.

Keywords: Strawberry, Crop Waste, Compost