"Bioactives and Phytonutrients: Exploring the Synergistic Potential of Vermicomposting and Organic Farming for Sustainable Food Production"

Abstract

The pursuit of sustainable food production systems has led to increased interest in organic farming practices and their potential benefits for human health. Organic farming emphasizes the use of natural inputs and environmentally friendly methods to promote soil fertility, crop productivity, and overall ecosystem health. Among the various organic farming techniques, vermicomposting has emerged as a promising approach that not only enhances soil fertility but also contributes to the production and natural enhancement of bioactive and phytonutrient compounds in plants. Vermicomposting involves controlled decomposition of organic materials using earthworms and has gained attention as an effective means of nutrient recycling and organic waste management. Through vermicomposting, organic waste materials such as agricultural residues, kitchen scraps, and animal manure are transformed into nutrient-rich compost, teeming with beneficial microorganisms and earthworm-produced enzymes. This vermicompost, when applied to soils, has been shown to increase the levels of bioactive compounds in plants. One important bioactive compound that has received significant attention is β carotene, a precursor of vitamin A. Carrots cultivated with vermiwash, a byproduct of vermicomposting, demonstrated significantly higher β carotene content (2439 µg 100-1g) than the standard set by the National Institute of Nutrition (1890 µg 100-1g). This finding highlights the remarkable potential of vermiwash as a powerful fertilizer for significantly enhancing the β carotene content of carrots, contributing to their nutritional value and potential health benefits. Furthermore, vermicompost application has been linked to an increase in the calcium content of crops. In the context of carrot production, vermicompost-amended soils showed notable improvements in calcium levels. However, it is worth noting that the highest calcium content (267.77 mg 100g) was observed in carrots cultivated with chemical fertilizers. Despite this, the calcium content of organically grown carrots was still significant and represented a 66.17 percent increase compared to conventionally grown counterparts. These findings suggest the influence of different fertilizers on the calcium levels in crops and highlight the potential of vermicomposting as a valuable component of organic farming for nutrient enrichment. The combination of organic farming practices and vermicomposting offers a unique opportunity to produce food sustainably while simultaneously enhancing the nutritional value of

crops. Moreover, the reduced reliance on synthetic fertilizers and pesticides in organic farming systems contributes to environmental sustainability and the preservation of ecosystem services. Further research and widespread adoption of these practices hold promising prospects for sustainable food production systems that prioritize both human health and environmental well-being as a whole.

Keywords: vermicomposting, organic farming, sustainable food production, soil fertility, nutrient recycling, carotenoids, nutritional quality