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COMPARATIVE STUDY ON GROWTH PERFORMANCE AND PHYTOCHEMICAL CHARACTERISTICS OF SELECTED VEGETABLE CROPS GROWN UNDER ORGANIC AND INORGANIC FARMING SYSTEMS

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ABSTRACT

The growing concern for environmental sustainability and food quality has increased interest in organic farming practices. The present study aimed to compare the growth performance and phytochemical characteristics of tomato (Solanum lycopersicum) and green chilli (Capsicum annuum) cultivated under organic and inorganic farming systems. The experiment was conducted using a randomized block design with two treatments: organic (T_1) and inorganic (T_2). Growth parameters such as plant height, days to flowering, and yield were recorded. Phytochemical analyses including total phenols, total flavonoids, and antioxidant activity were assessed using standard biochemical assays. The results revealed that inorganic farming significantly enhanced vegetative growth and yield in both crops. However, organically grown plants exhibited higher concentrations of phytochemicals and greater antioxidant activity. The findings suggest that while inorganic farming improves productivity, organic farming plays a vital role in enhancing the nutritional quality of vegetable crops, thereby supporting sustainable agricultural practices.

Keywords: Organic Farming, Inorganic Farming, Solanum Lycopersicum, Capsicum Annuum, Phytochemicals, Antioxidant Activity

INTRODUCTION

Modern agricultural practices are largely dependent on inorganic fertilizers to enhance crop productivity and meet the increasing food demand. Although such practices contribute to higher yields, excessive use of synthetic fertilizers often results in soil degradation, environmental pollution, and reduced nutritional quality of produce. In contrast, organic farming systems emphasize the use of natural inputs such as farmyard manure and vermicompost, which improve soil structure, microbial activity, and long-term fertility.

Vegetable crops such as tomato (Solanum lycopersicum) and green chilli (Capsicum annuum) are widely consumed and are known to be rich sources of bioactive compounds including phenols, flavonoids, and antioxidants. These phytochemicals play an important role in preventing oxidative stress-related diseases. The present study was undertaken to evaluate the influence of organic and inorganic farming systems on growth performance, yield, and phytochemical composition of selected vegetable crops.

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MATERIALS AND METHODS

EXPERIMENTAL DESIGN

The experiment was conducted at the Department of Botany, Justice Basheer Ahmed Sayeed College for Women, Chennai. A randomized block design (RBD) was followed with two treatments:

T_1 (Organic): Farmyard manure (25 t ha^{-1}) + Vermicompost (5 t ha^{-1})

T_2 (Inorganic): NPK chemical fertilizers (120:80:60 kg ha^{-1})

Tomato and green chilli plants were cultivated under both treatments following standard agronomic practices.

GROWTH AND YIELD PARAMETERS

Growth parameters including plant height (cm) and days to flowering were recorded at appropriate growth stages. Yield per plant (kg) was measured at harvest.

Table 1

Table 1 Growth and Yield Parameters

S.No	Parameter	Tomato (Organic) T1	Tomato (Inorganic) T2	Green Chilli (Organic) T1	Green Chilli (Inorganic) T2	*p*-value
1	Plant Height (cm)	65.4	82.1	48.2	62.5	< 0.05
2	Days to Flowering	48	40	52	44	< 0.05
3	Yield (kg $plant^{-1}$)	1.45	2.1	0.55	0.82	< 0.05

Interpretation: All Growth and Yield Parameters Showed Statistically Significant Differences Between Organic and Inorganic Treatments At P

Table 2

Table 2 Bioactive Compounds and Antioxidant Capacity

S.No	Parameter	Tomato (Organic) T1	Tomato (Inorganic) T2	Green Chilli (Organic) T1	Green Chilli (Inorganic) T2	*p*-value
1	Total Phenols (mg GAE/100g^{-1})	48.5	34.2	115.6	88.4	< 0.01
2	Total Flavonoids (mg QE/100g^{-1})	18.2	12.5	42.1	30.5	< 0.01
3	Antioxidant Activity (%)	78.4	62.1	85.2	72.8	< 0.01

Interpretation: Phytochemical Content and Antioxidant Activity Showed Highly Significant Differences Between Treatments At $P \leq 0.01$.

PHYTOCHEMICAL ANALYSIS

Fresh samples were collected for biochemical analysis.

Total phenolic content was estimated using the Folin–Ciocalteu method and expressed as mg gallic acid equivalents (GAE) per 100 g fresh weight.

Total flavonoid content was determined using the aluminium chloride colorimetric method and expressed as mg quercetin equivalents (QE) per 100 g.

Antioxidant activity was evaluated using the DPPH radical scavenging assay and expressed as percentage inhibition.

STATISTICAL ANALYSIS

The data were analyzed statistically, and significance was determined at $p \leq 0.05$.

RESULTS AND DISCUSSION

EFFECT OF FARMING SYSTEMS ON GROWTH AND YIELD

The results showed a significant influence of farming systems on growth and yield parameters. Inorganic treatment (T2) resulted in increased plant height and earlier flowering in both tomato (Solanum lycopersicum) and green chilli (Capsicum annuum) when compared to organic treatment (T1). Yield per plant was also higher under inorganic conditions, with tomato (Solanum lycopersicum) and green chilli (Capsicum annuum) recording 2.10 kg and 0.82 kg per plant, respectively. The enhanced growth under inorganic farming may be attributed to the immediate availability of nutrients supplied by chemical fertilizers.

PHYTOCHEMICAL CHARACTERISTICS

Organically grown plants exhibited significantly higher phytochemical content than inorganically grown plants. Tomato (Solanum lycopersicum) and green chilli cultivated under organic conditions showed increased levels of total phenols, flavonoids, and antioxidant activity. Green chilli (Capsicum annuum) grown organically recorded the highest phenolic content (115.6 mg GAE/100 g-1). The elevated phytochemical levels under organic farming may be due to nutrient stress, which stimulates the synthesis of secondary metabolites as a defense mechanism.

DISCUSSION

The findings support the Growth–Differentiation Balance Hypothesis, which suggests that plants grown under limited nutrient conditions allocate more resources toward secondary metabolite production rather than vegetative growth. Although inorganic farming enhances yield, organic farming contributes significantly to improved nutritional and functional quality of crops.

CONCLUSION

The present study demonstrates that inorganic farming systems enhance growth and yield of tomato and green chilli, whereas organic farming significantly improves phytochemical composition and antioxidant activity. Therefore, organic farming practices are recommended for producing nutritionally superior vegetables while ensuring environmental sustainability. A balanced approach integrating productivity and nutritional quality may be beneficial for sustainable agriculture.

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REFERENCES

Arah, I. K., Kumah, E. K., Anku, G. C., and Amaglo, H. (2015). An Overview of Post-Harvest Losses in Tomato Production in Africa: Causes and Strategies for Reduction. Journal of Biology, Agriculture and Healthcare, 5(4), 13–29.

Borguini, R. G., and Torres, E. A. (2009). Tomatoes and Tomato Products as Dietary Sources of Antioxidants. Food Reviews International, 25(4), 313–325. https://doi.org/10.1080/87559120903155859

Carbonaro, M., Mattera, M., Nicoli, S., Bergamo, P., and Cappelloni, M. (2002). Modulation of Antioxidant Compounds in Organic vs. Conventional Fruit (Peach, Prunus Persica L., and Pear, Pyrus Communis L.). Journal of Agricultural and Food Chemistry, 50(19), 5458–5462. https://doi.org/10.1021/jf0202584

Chassy, A. W., Bui, L., Renaud, E. N., Van Horn, M., and Mitchell, A. E. (2006). Three-Year Comparison of the Content of Antioxidant Micro-Constituents and Several Quality Characteristics in Organically and Conventionally Managed Tomatoes and Bell Peppers. Journal of Agricultural and Food Chemistry, 54(21), 8244–8252. https://doi.org/10.1021/jf060950p

Hallmann, E. (2012). The Influence of Organic and Conventional Cultivation Systems on the Nutritional Value and Antioxidant Activity of Ground Tomato Fruits. Scientia Horticulturae, 141, 137–143.

Magkos, F., Arvaniti, F., and Zampelas, A. (2003). Organic Food: Nutritious, Food Safety or Few Persuasive Health Benefits? Food Reviews International, 19(4), 357–371. https://doi.org/10.1080/09637480120092071

Mitchell, A. E., Hong, Y. J., Koh, E., Barrett, D. M., Bryant, D. E., Denison, R. F., and Kaffka, S. (2007). Ten-Year Comparison of the Flavonoid Contents of Tomatoes, Corn, and Broccoli Grown in Organic and Conventional Agricultural Systems. Journal of Agricultural and Food Chemistry, 55(15), 6154–6159. https://doi.org/10.1021/jf070344+

Pieper, J. R., and Barrett, D. M. (2008). Effects of Organic and Conventional Production Systems on Quality and Nutritional Parameters of Processing Tomatoes. Journal of the Science of Food and Agriculture, 89(2), 177–194. https://doi.org/10.1002/jsfa.3437

Reganold, J. P., and Wachter, J. M. (2016). Organic Agriculture in the Twenty-First Century. Nature Plants, 2(2), 1–8. https://doi.org/10.1038/nplants.2015.221

Saini, R. K., Zamany, A. J., and Keum, Y. S. (2014). Ripening-Dependent Changes in Carotenoids, Soluble Sugar, and Organic Acid Contents in Five Plant-Grown Ripening Stages of Cherry Tomato. Food Research International, 56, 102–109.

Singleton, V. L., Orthofer, R., and Lamuela-Raventós, R. M. (1999). Analysis of Total Phenols and Other Oxidation Substrates and Antioxidants by Means of Folin–Ciocalteu Reagent. Methods in Enzymology, 299, 152–178. https://doi.org/10.1016/S0076-6879(99)99017-1

Young, C. E., and Kantor, L. S. (1999). Moving Toward the Food Guide Pyramid: Implications for U.S. Agriculture. Amber Waves, 12(2), 24–33.