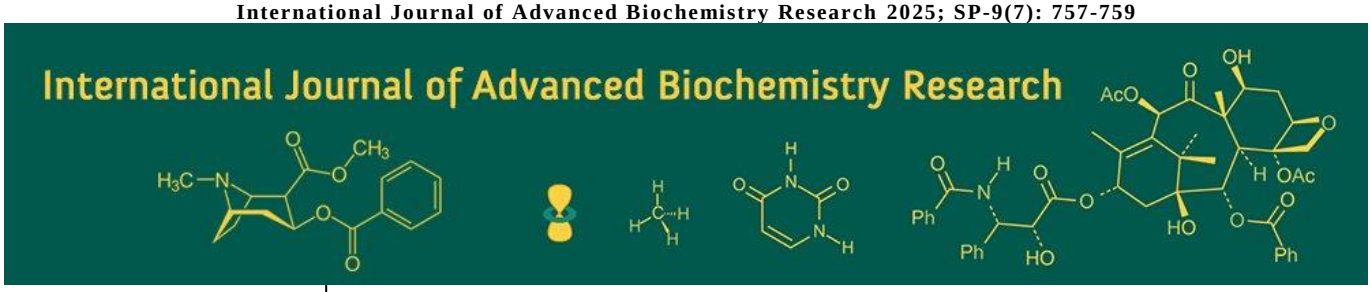

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(7): 757-759
www.biochemjournal.com
Received: 08-07-2025
Accepted: 25-07-2025

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Influence of different growing media on quality of tomato (*Solanum lycopersicum* L.) cultivars under terrace polyhouse system

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i7Sj.4981

Abstract
A field experiment was executed at the Research Farm, modular protected cultivation unit, Mewar University Gangrar, Chittorgarh (Rajasthan) during the *Rabi* season of 2024-25 to assess how different growing media compositions affect the quality parameters of tomatoes. The results showed a minor enhancement in these quality parameters. The experiment involved both determinate and indeterminate tomato cultivars and utilized growing media such as soil, cocopeat, vermiculite, perlite and soil. The study employed a media ratio of M_3V_2 Soil: cocopeat: vermiculite + perlite: vermicompost (1:2:0:1), which resulted in the highest TSS (5.20), chlorophyll content (37.66) and Vitamin C levels, highlighting the significant impact of the growing media on the quality of tomato cultivars in a terrace polyhouse setting.

Keywords: Growth media, cultivar, quality, tomato, polyhouse setting

Introduction
The tomato (*Lycopersicon esculentum* L), a member of the Solanaceae family, is among the top three significant annual fruit vegetables that originated in South and Central America. It ranks as one of the most widely consumed vegetables globally. Tomatoes can be eaten fresh or processed and are rich in minerals and vitamins (Eivazi *et al.* 2013) [7]. The red fruit contains lycopene, a carotenoid known for its role in preventing various diseases.

Tomatoes are not only delicious and easy to digest, but their vibrant color also enhances appetite, similar to other vegetables. They are crucial in human nutrition as they provide essential nutrients found in other foods. The tomato fruit is abundant in minerals, calories and serves as an excellent source of iron and vitamins A, B and C (Biwasi, 1999) [6]. Additionally, tomatoes are recognized as a significant source of the antioxidant lycopene, which is linked to reducing the risk of various cancers and heart diseases (Barker and Bryson, 2006) [5]. The antioxidant properties of tomatoes are influenced by factors such as the type of cultivar, growing conditions and the stage of harvesting and ripening, whether on or off the vine. The term "growing media" refers to the material used in containers to cultivate plants, which affects their growth.

Other than soils, growing media are substrates used to grow plants. These include inorganic elements like clay, perlite, vermiculite and mineral wool (Grunert *et al.*, 2008) [8], as well as organic materials like peat, compost, tree bark, coconut (*Cocos nucifera* L.) coir and poultry feathers, as well as mixtures like peat and perlite, coir and clay or peat and compost. Seed germination, seedling emergence, seedling growth and seedling quality at the nursery stage are all directly impacted by growing material. Plant fertilisers and seeds are both sown in growing media. In addition, it helps the plant's root system endure (Abad *et al.*, 2005) [1].

Another way to describe it is the science of growing plants without soil by using a solution of appropriate nutrients (Wahome *et al.*, 201111) [9]. Some of these issues might be resolved by soilless production, which also gives the farmer more control over part-time farming operations (Wahome *et al.*, 2011) [9]. Some of these issues might be resolved by soilless production, which also gives the farmer more control over part-time farming operations (Wahome *et al.*, 2011) [9].

In contrast to conventional field and greenhouse production, soilless vegetable growing enables the crop to use water and nutrients efficiently. Numerous growing media or substrates, including sawdust, rice husk and coco peat, have been utilised to cultivate a wide variety of crops in soilless production systems. Thus, the study's goal was to ascertain how various growing medium affected tomato development and yield; more precisely, it sought to find which growing media was most appropriate and productive for producing a high tomato yield.

Materials and Methods

The current study was conducted in the summer of 2024-25 at the experimental farm, Department of Horticulture, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). Three replications and a Factorial Randomised Block Design (FRBD) were used to set up the experiment. A total of twelve treatment combinations were assessed: (V-Variety, M-Media) both determinate and indeterminate tomato varieties, growth media (soil, cocoa peat, vermiculite, perlite and vermi-compost), pots, rope, a measuring tape and other supplies were employed in this investigation.

For the experiment, determinate and indeterminate tomato varieties were employed. In the nursery, seeds were sown at a rate of 150/ha and tomato plants were planted in pots spaced 45 x 30 cm apart. To guarantee ideal growing circumstances, all additional procedures, including irrigation, weeding and pest control, were applied consistently during all treatments in accordance with accepted guidelines for tomato protected farming.

Statistical Analysis

A suitable statistical software program was used to do an adequate statistical analysis on the acquired data. The significance of treatment effects was evaluated using Analysis of Variance (ANOVA). Critical Difference (C.D.) was used to compare treatment means at a 5% level of significance (P=0.05). To assess the accuracy and dependability of the experimental findings, the Standard Error of Mean (SEm) and Coefficient of Variation (C.V.) were also computed.

Data Collection

Numerous growth factors, yield metrics, actual yield, and economic returns were all the subject of meticulous data collection.

- **Growth Parameters:** Number of branches per plant, plant height, No. of leaves per plant, Appearance of 50% flower.
- **Yield parameters:** Number of fruits per plant, Length of the fruit (cm), Average fruit weight (g), Average fruit yield (q/ha), Number of fruit picking.
- **Quality parameters:** Leaf Chlorophyll content (µml/g), TSS (^{0}Brix), Vitamin C (µml/g).
- **Economics:** Gross return (₹/ha), cost of cultivation (₹/ha), net profit (₹/ha) and benefit-cost (B:C) ratio were calculated based on prevailing market prices of inputs and produce.

Result and Discussion

According to the data in Table 2, tomato plants grown in various growth media exhibited a significant response in terms of leaf chlorophyll, TSS and vitamin C when compared to other growing media on quality parameters.

A portable leaf chlorophyll meter was used to measure the amount of chlorophyll in the leaves. The germination percentage was multiplied by the seedling dry weight to determine the vigour of the seedlings (Abdul Bakki and Anderson, 1973). M_3: Soil: cocopeat: vermiculite + perlite: Vermicompost (1:2:0:1) is the total chlorophyll content. The appropriate media combination in the V_2 Myla (35.08) variety is 35.44. Index of chlorophyll content (CCI) CCI is an important metric that indicates the amount of chlorophyll in a leaf. The amount of chlorophyll, a green pigment essential to photosynthesis, in leaves is measured by the leaf chlorophyll index. Chlorophyll index levels can reveal information about illumination, nutrient intake and other environmental factors that typically and primarily affect leaf photosynthetic activity. In order to monitor the nutritional status, this measurement is typically carried out using a non-destructive diagnostic equipment. Greater efficiency in absorbing solar energy and generating food through photosynthesis is indicated by a higher chlorophyll index value. The current results supported the findings that the TSS of cultivated tomatoes accounted for 4.0-7.5% of their fresh weight. However, it was noted that TSS ranged from 3.60 to 3.83% for various tomato cultivars cultivated in protected conditions. In addition to environmental factors, the genetic composition of the variety has the biggest impact on tomato fruit TSS. Higher recovery product yield is associated with higher TSS levels. The saaho variety had the greatest TSS (5.14) and the highest TSS (4.94) in the media M_2: Soil: cocopeat: vermiculite + perlite: Vermicompost (1:0:2:1)..

Table 1: Treatment Details

Treatments	Combination
M_1V_1	Soil: cocopeat: vermiculite + perlite: vermicompost (0:1:1:2) Saaho
M_1V_2	Soil: cocopeat: vermiculite + perlite: vermicompost (0:1:1:2) Myla
M_1V_3	Soil: cocopeat: vermiculite + perlite: vermicompost (0:1:1:2) Virang
M_2V_1	Soil: cocopeat: vermiculite + perlite: vermicompost (1:0:2:1) Saaho
M_2V_2	Soil: cocopeat: vermiculite + perlite: vermicompost (1:0:2:1) Myla
M_2V_3	Soil: cocopeat: vermiculite + perlite: vermicompost (1:0:2:1) Virang
M_3V_1	Soil: cocopeat: vermiculite + perlite: vermicompost (1:2:0:1) Saaho
M_3V_2	Soil: cocopeat: vermiculite + perlite: vermicompost (1:2:0:1) Myla
M_3V_3	Soil: cocopeat: vermiculite + perlite: vermicompost (1:2:0:1) Virang
M_4V_1	Soil: cocopeat: vermiculite + perlite: vermicompost (2:1:1:0) Saaho
M_4V_2	Soil: cocopeat: vermiculite + perlite: vermicompost (2:1:1:0) Myla
M_4V_3	Soil: cocopeat: vermiculite + perlite: vermicompost (2:1:1:0) Virang

Table 2: Influence of growing media on quality attributes of tomato cultivars in terrace polyhouse

Treatment	Leaf Chlorophyll	TSS	Vitamin C (µml/g)
Media			
M1: Soil: cocopeat: vermiculite+perlite: vermicompost (0:1:1:2)	35.33	4.50	25.00
M2: Soil: cocopeat: vermiculite+perlite: vermicompost (1:0:2:1)	34.78	4.94	27.44
M3: Soil: cocopeat: vermiculite+perlite: vermicompost (1:2:0:1)	35.44	4.85	26.33
M4: Soil: cocopeat: vermiculite+perlite: vermicompost (2:1:1:0)	33.22	4.57	25.33
SE(M)	0.81	0.06	0.89
SE(D)	1.14	0.08	1.29
CD 5%	N/A	0.18	N/A
Variety			
V1:Saaho	34.42	5.14	25.16
V2:Myla	35.08	4.59	26.08
V3:Virang	34.58	4.42	27.16
SE(M)	N/A	0.05	0.77
SE(D)	N/A	0.07	1.09
CD 5%	4.15	0.16	2.29

Table 3: Interaction effects of growing media and varietal combinations on quality parameters of tomato (*Solanum lycopersicum* L.)

Interaction	Leaf Chlorophyll	TSS	Vitamin C(µml/g)
M1V1	35.00	5.20	25.00
M1V2	36.66	4.17	25.33
M1V3	34.33	4.13	26.00
M2V1	36.00	5.07	26.33
M2V2	34.00	4.57	26.66
M2V3	34.33	5.17	29.66
M3V1	36.66	5.17	26.66
M3V2	37.66	5.20	22.66
M3V3	32.66	4.17	29.66
M4V1	30.66	5.10	22.66
M4V2	32.00	4.40	29.66
M4V3	37.00	4.20	23.66
SE(M)	1.40	0.10	1.55
SE(D)	1.98	0.15	2.19
CD 5%	4.15	0.32	N/A

The type and growing environment of fresh tomatoes affect their vitamin C (L-ascorbic acid) concentration. Because of improved respiration, ascorbic acid (vitamin C) levels may rise with ripening. By doing this, the fruit keeps its firmness and extends its shelf life. While there was no discernible pattern in the ripening of the various cultivars under investigation, statistically significant variations were discovered between them. The vitamin C levels varied from M_2: Soil: cocopeat: vermiculite + perlite: Vermicompost (1:0:2:1) range in 27.44 when the media composition is appropriate and in 27.16 when the V3 Virang variety is used.

Conclusion

Different growing media had varying effects, according to the study's findings about their effects on tomato performance and quality. Because of its high mean values in Leaf Chlorophyll and Total Soluble Solids (TSS), M3: Soil: cocopeat: vermiculite + perlite: vermicompost (1:2:0:1) outperformed other growth media. Additionally, vitamin C had a significant impact on the quality of tomato cultivars under the terrace polyhouse system when compared to other growing media.

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