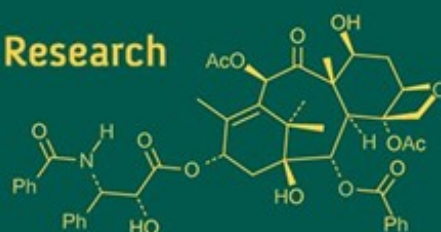
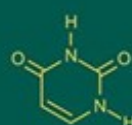
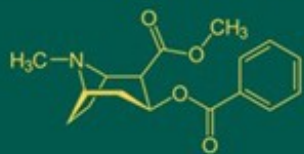


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Influence of LED light spectrum and photoperiod on flowering, fruit set and morphological traits of cherry tomato (*Solanum Lycopersicum var Cerasiforme*) lines under indoor controlled conditions

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ABSTRACT

Light spectrum and photoperiod are most important environmental factors which influence the growth and flowering of plants under indoor vertical farming. The present investigation was carried out to evaluate the response of cherry tomato lines to different combinations of red and blue LED light spectra and photoperiods under an indoor condition. The plants were exposed to two red-to-blue light ratios (2R:1B and 1R:2B) under 14 hr and 16 hr photoperiods under indoor system. The parameters which included number of flowers per cluster, number of fruits per cluster, number of fruits per plant, fruit length and fruit diameter. The two cherry tomato lines (UK1 and UK2) exhibited variation in their reproductive and fruit characteristics under different light environments. The UK2 line exhibited superior reproductive performance under 2R:1B spectrum combined with a 16-hour photoperiod resulting in higher flower and fruit production in the better-performing line. Fruit characteristics like fruit length and fruit diameter, also varied among the lines and light treatments, UK2 combined with 2R:1B spectrum and 16-hour photoperiod providing favourable conditions for greater fruit development. Overall, the study demonstrated that the interaction of LED light spectrum and photoperiod influenced growth, flowering and fruiting performance of cherry tomato lines under an indoor vertical production system.

Keywords: Cherry tomato, LED illumination, Flowering, Reproductive performance, Morphological traits, Controlled environment

1. Introduction

Cherry tomatoes (*Solanum lycopersicum* var. *cerasiforme*) are developing milestone of modern agriculture which belongs to Solanaceae family. In worldwide, cherry tomatoes (*Solanum lycopersicum* var. *cerasiforme*) are gaining significant popularity due to their small size, short life cycle and vivid appearance. Netherlands, Spain, Italy and Canada are major producing countries grown under high tech greenhouse and indoor infrastructure conditions. Cherry tomatoes are rich in vitamins, minerals, fibers and also having high concentration of antioxidants like carotenoids, flavonoids and phenolic compounds. Cherry tomatoes which having health benefits such as heart disease protection, cancer prevention and skin damage reduction from the UV light (Baek *et al.*, 2024; Dong *et al.*, 2024) [1, 2]. Nowadays, crops are growing under indoor controlled environment like green house and vertical farming units to protect the plants from external sources like abiotic and biotic factors and also year-round food production for the global demand. Vertical farming grows crops in vertically stacked layers within controlled indoor environments, using significantly less land and water than conventional agriculture (Van *et al.*, 2021)[3]. Meanwhile, modern LED developments have transformed indoor farming by enabling exact customization of light quality, photoperiod and spectrum. Unlike traditional lighting sources, LEDs emit customizable light spectra that can be optimized to match specific plant photoreceptors. In particular, red and blue wavelengths play the most critical roles in plant physiology: red light drives photosynthetic activity and supports reproductive development while blue light is essential for chloroplast development, stomatal opening and compact morphological growth (Izzo *et al.*, 2020)[4]. Despite widespread recognition of the importance of spectral quality, significant research gaps remain regarding how light spectrum interacts with photoperiod (day length) across different genetic lines of cherry tomatoes. Most existing studies focus on general vegetative responses leaving a lack of detailed understanding on how specific combinations of light spectrum and photoperiod alter the balance between morphological development and reproductive performance such as flowering, fruit set and yield metrics in distinct cherry tomato lines. To address these knowledge gaps, the present study evaluates the interactive effects of various light spectra and photoperiodic regimes on the morphological traits and reproductive outcomes of selected cherry tomato lines under controlled indoor conditions. By clarifying these physiological responses,

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this research aims to establish optimized lighting protocols modified to specific genotypes in commercial vertical farming systems.

2. Materials and Methods

An indoor vertical experiment was conducted during 2025-2026 at the Urban Kissan private limited, Gundlapochampally, Hyderabad. The experimental location was situated at latitude 17°34' N and longitude

78°28' E with an elevation of 15.0 m above the mean sea level. The experimental facility comprised a vertical growing system equipped with LED lighting units and maintained under controlled environmental conditions. Cherry tomato lines (UK1 and UK2) used as the planting material. The seeds used in the experiment were obtained from Urban Kisaan Research and development.

Table 1. Treatment details for the experiment

Treatment details	Cherry tomato Lines	
	C ₁ (UK1 line)	C ₂ (UK2 line)
P ₁ (1R:2B+14h photoperiod)	T ₁ -UK1+1R:2B+14hour	T ₆ - UK2+1R:2B+ 14hour
P ₂ (1R:2B+16h photoperiod)	T ₂ -UK1+1R:2B+16hour	T ₇ - UK2+1R:2B + 16hour
P ₃ (2R:1B+14h photoperiod)	T ₃ -UK1+2R:1B +14hour	T ₈ - UK2+2R:1B + 14hour
P ₄ (2R:1B+16h photoperiod)	T ₄ -UK1+2R:1B+16hour	T ₉ - UK2+2R:1B + 16hour
P ₅ (control)	T ₅ -UK1+Control	T ₁₀ -UK2+Control

Experimental design

To evaluate the flowering and reproductive responses of indoor-cultivated cherry tomatoes under varied illumination regimes, a Factorial Completely Randomized Design (FCRD) was employed. The study evaluated two primary factors: cultivar line and lighting conditions. Two distinct cherry tomato genotypes (UK1 and UK2) were subjected to five light regimes (P₁ to P₅), which incorporated different red-to-blue spectral ratios (2R:1B and 1R:2B) across two photoperiod durations (14-h and 16-h daylengths). The factorial combination of these two factors yielded ten distinct treatment groups (T₁-T₁₀). Each treatment combination was replicated in three times within a controlled vertical farming environment to systematically assess its impact on floral transition and reproductive performance.

3. Results and Discussion

3.1 Number of flowers per cluster

Table 2. Effect of different light treatments on number of flowers per cluster

LED light regimes	UK1 (C ₁)	UK2 (C ₂)	Mean
P ₁ - 1R:2B + 14 hr	5.48	6.40	5.94
P ₂ - 1R:2B + 16 hr	6.40	7.12	6.76
P ₃ - 2R:1B + 14 hr	7.33	8.00	7.67
P ₄ - 2R:1B + 16 hr	8.20	8.73	8.47
P ₅ - Control	4.43	4.77	4.60
Mean	6.37	7.00	
Comparison of means	Lines (C)	Light (P)	Interaction (C x P)
SE _{m±}	0.183	0.289	0.409
CD (p = 0.05)	0.544	0.860	1.207

The number of flowers per cluster varied significant between the lines of cherry tomato and applied across the different light spectrum-photoperiod combinations (Table 2). Overall, UK 2 line (7.00) which produces more flower count per cluster compared to UK 1 line (6.37). Among the light regimes, 2Red:1Blue spectrum combined with 16 hours photoperiod (P₄) recorded maximum number of flowers (8.47) whereas 1Red:2Blue with 14 hours and control having lowest mean values of flower production. Best treatment combination recorded in UK2 and 2R:1B with 16 hours (T₉) which achieved highest flower density (8.73) compared to all other treatments. These results demonstrate that red-dominated light spectrum paired with an extended photoperiod enhances floral production in cherry tomatoes. Similar findings which align with the current study was supported by Zhang *et al* (2025)^[5] who reported increase in flowers count per cluster observed in tomatoes subjected to balanced red-blue light regimes with longer photoperiods.

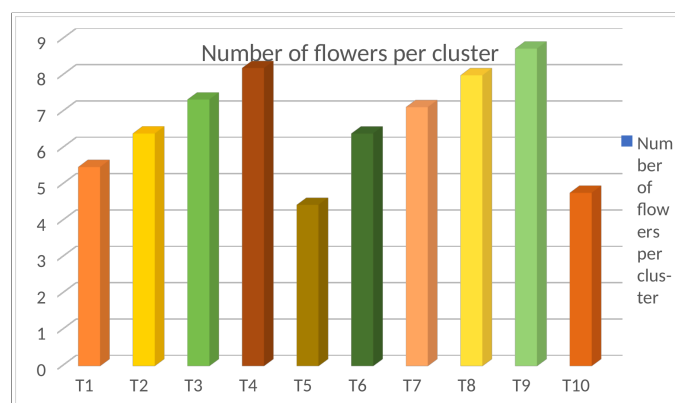


Figure 1. Treatment-wise variation in number of flowers per cluster

3.2 Number of fruits per cluster

Table 3. Effect of different light treatments on number of flowers per cluster

LED light regimes	UK1(C ₁)	UK2 (C ₂)	Mean
P ₁ - 1R:2B + 14 hr	5.73	5.90	5.82
P ₂ - 1R:2B + 16 hr	6.03	6.23	6.13
P ₃ - 2R:1B + 14 hr	6.77	6.90	6.83
P ₄ - 2R:1B + 16 hr	7.23	7.73	7.48
P ₅ - Control	5.07	5.27	5.17
Mean	6.17	6.41	
Comparison of means	Lines (C)	Light (P)	Interaction (C x P)
<i>SEm</i> _±	0.074	0.117	0.165
CD (<i>p</i> = 0.05)	0.219	0.347	0.487

Fruit set per cluster which show significant variation influenced by genetic and lighting conditions. UK2 line consistently produced more fruits (6.41) than the UK1 line (6.17). The red-enriched spectrum (2Red:1Blue) under a 16-hour daylength promoted greater fruit set (7.48), whereas blue dominated spectrum (1Red:2Blue) with 14 hours photoperiod and control recorded the less fruit production. Across all

treatment combinations, superior performance in fruit set was recorded under UK2 and 2R:1B with 16 hours (T₉) as 7.73. The current findings are consistent with previous observations of palmitessa *et al* (2020) [6] who recorded the more fruit set per truss in Juanita tomato cultivar exposed to supplemental light treatments.

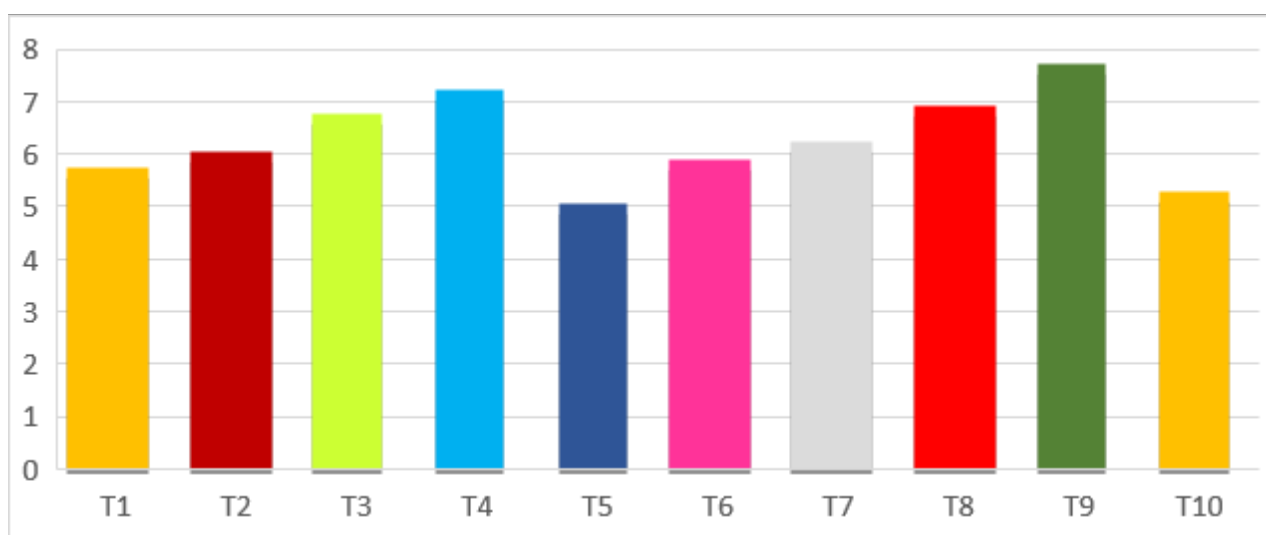


Figure 2. Treatment-wise variation in number of fruits per cluster

3.3 Number of fruits per plant

Table 4. Effect of different light treatments on Number of fruits per plant

LED light regimes	UK1 (C ₁)	UK2 (C ₂)	Mean
P ₁ - 1R:2B + 14 hr	27.36	30.09	28.73
P ₂ - 1R:2B + 16 hr	33.165	36.13	34.65
P ₃ - 2R:1B + 14 hr	40.56	43.37	41.97
P ₄ - 2R:1B + 16 hr	49.88	55.65	52.77
P ₅ - Control	17.71	15.78	16.75
Mean	33.73	36.20	
Comparison of means	Lines (C)	Light (P)	Interaction (C x P)
<i>SEm</i> _±	0.236	0.373	0.528

LED light regimes	UK1 (C ₁)	UK2 (C ₂)	Mean
CD (<i>p</i> = 0.05)	0.701	1.108	1.568

Fruit production per plant which show clear response towards the quality and duration of artificial light regimes. From the evaluated data, UK2 line (36.20) produces more number of fruits than UK1 line (33.73). Among the light treatments, 2Red:1Blue with 16-hour photoperiod recorded maximum number of fruits per plant (52.77) compared to the control treatment. The interaction between light quality and photoperiod markedly influenced reproductive development which leads to maximum fruit count as 55.65 under UK2 and 2R:1B with 16 hours (T₉). The increased fruit number under extended photoperiod was comparable with findings of Gomez *et al* (2016) [7] who observed enhanced highest fruit production in tomato crop grown under more dominant red-light spectra and 16-hour day length.

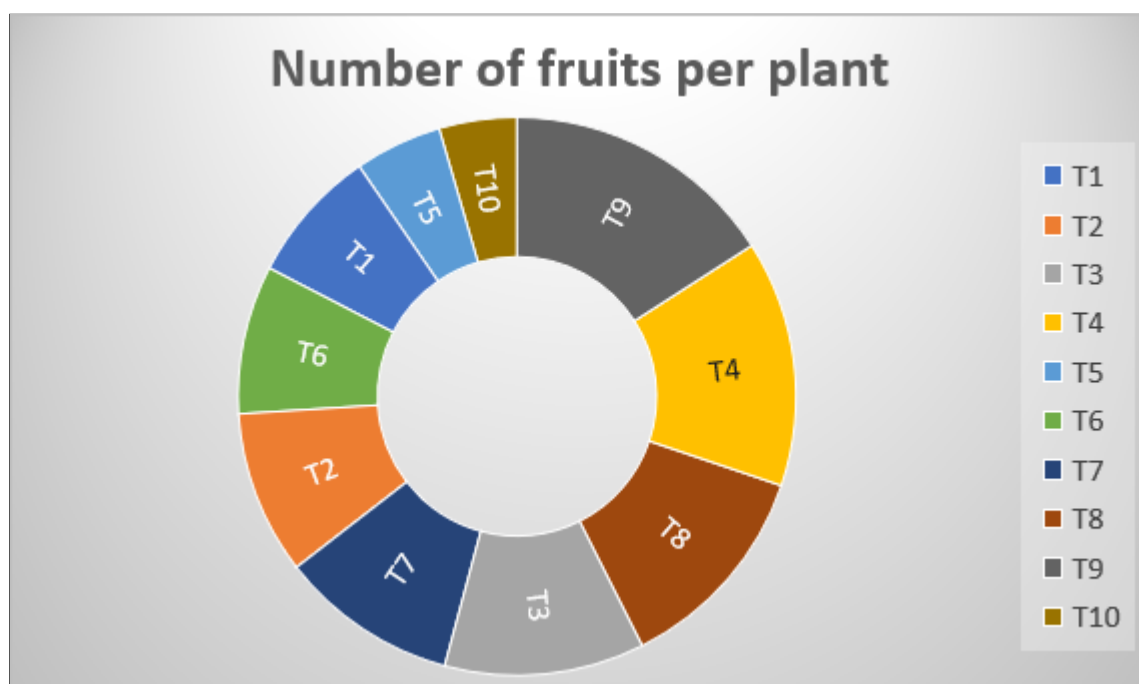


Figure 3. Treatment-wise variation in number of fruits per plant

3.4 Fruit length (cm)

Table 5. Effect of different light treatments on Fruit length (cm)

LED light treatments	UK1 (C ₁)	UK2 (C ₂)	Mean
P ₁ - 1R:2B + 14 hr	2.13	2.15	2.14
P ₂ - 1R:2B + 16 hr	2.18	2.19	2.19
P ₃ - 2R:1B + 14 hr	2.26	2.28	2.27
P ₄ - 2R:1B + 16 hr	2.32	2.38	2.35
P ₅ - Control	1.94	2.05	1.99
Mean	2.16	2.21	
Comparison of means	Lines (C)	Light (P)	Interaction (C x P)
<i>SEm</i> _±	0.015	0.024	0.035
CD (<i>p</i> = 0.05)	0.046	0.073	0.102

The variation in fruit length across treatments indicated a differential response of the two lines to the imposed light regimes. UK2 line showed slightly greater fruit length (2.21 cm) than UK1 line (2.16 cm). Among light conditions, 2Red:1Blue combined and 16-hour light duration led to longest fruit (2.35 cm). From interaction ef-

fects, UK2 line grown under 2R:1B and 16 hours (T₉) records longest fruit (2.38 cm) whereas control treatment resulted in the shortest fruit. The results obtained in the present study are comparable with those of Watjanatepin (2019)^[8] who observed increased fruit elongation under extended exposure of red enriched light spectrum.

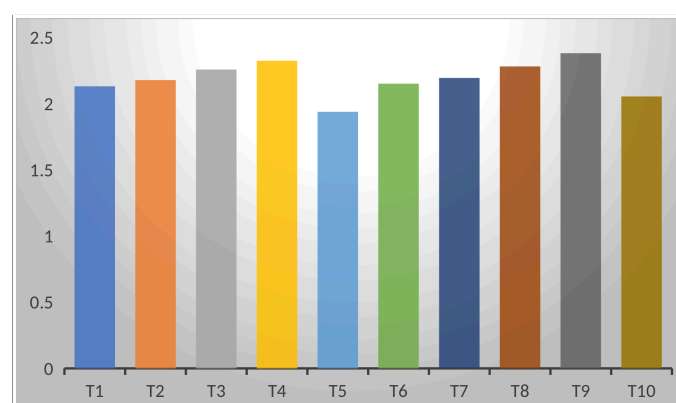


Figure 4. Treatment-wise variation in Fruit length (cm)

3.5 Fruit diameter (cm)

5 Effect of different light treatments on Fruit diameter (cm)

LED light treatments	UK1 (C ₁)	UK2 (C ₂)	Mean
P ₁ - 1R:2B + 14 hr	2.20	2.23	2.22
P ₂ - 1R:2B + 16 hr	2.26	2.28	2.27
P ₃ - 2R:1B + 14 hr	2.32	2.37	2.34
P ₄ - 2R:1B + 16 hr	2.41	2.45	2.43
P ₅ - Control	2.06	2.11	2.09
Mean	2.25	2.29	
Comparison of means	Lines (C)	Light (P)	Interaction (C x P)
<i>SEm</i> _±	0.003	0.004	0.006
CD (<i>p</i> = 0.05)	0.008	0.012	0.017

Fruit diameter was significantly influenced by lines and lighting treatments. Among these two lines, UK2 line (2.29 cm) which is having

more fruit diameter than UK1 line (2.25 cm). The 2Red:1Blue spectrum under 16-hour photoperiod recorded highest mean value for fruit

diameter (2.43) compared to other light treatments. The UK2 and 2R:1B spectrum along with 16 hr (T_9) achieved maximum fruit diameter as 2.45 cm compared to control treatment recorded as smallest fruit diameter is 2.06 cm. These measurements of results greatly supported by Son *et al* (2018)^[9] experimented on the cherry tomato plant recorded highest fruit diameter under 65Red:25Blue spectrum over 16-hour photoperiod.

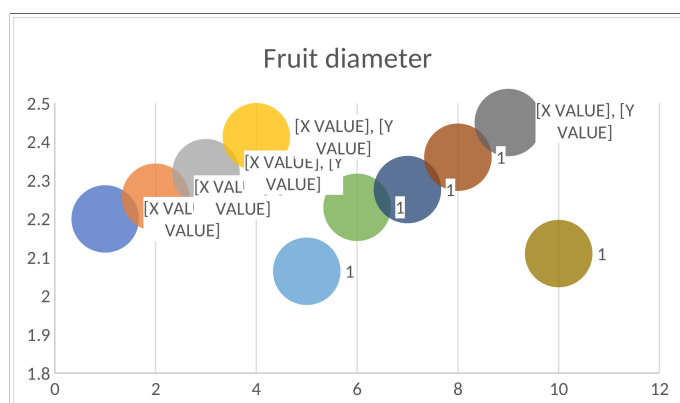


Figure 5. Treatment-wise variation in Fruit Diameter (cm)

4. Conclusion

The results obtained under experimental conditions clearly demonstrated that the interaction between LED light spectrum and photoperiod significantly influenced that flowering and reproductive performance of cherry tomato lines present in an indoor vertical controlled system. The two cherry tomato lines exhibited variation in their growth and reproductive characteristics, indicating the importance of genotype-specific responses to controlled light environments. Among the treatment combination, UK2 and 2R:1B spectrum combined with a 16-hour photoperiod (T_9) generally promoted best performance in the flowering, fruit setting and also fruit characteristics particularly in terms of number of flowers per cluster, number of fruits per cluster, number of fruits per plant, fruit length and fruit diameter. These outcomes illustrate that red-dominant light regimes combined with extended daylengths facilitate efficient floral development and yield formation. Overall, the findings indicate that optimizing LED spectral composition and photoperiod can be an effective approach for improving cherry tomato production in indoor vertical farming systems. The combination of 2R:1B LED spectrum with a 16-hour photoperiod showed promising performance under the conditions of the present study.

References

1. Baek MW, Lee JH, Yeo CE, Tae SH, Chang SM, Choi HR. Antioxidant profile, amino acids composition, and physicochemical characteristics of cherry tomatoes are associated with their color. *Antioxidants*. 2024;13(7):785.
2. Dong S, Zhang J, Ling J, Xie Z, Song L, Wang Y. Comparative analysis of physical traits, mineral compositions, antioxidant contents, and metabolite profiles in five cherry tomato cultivars. *Food Research International*. 2024;194:114897.
3. Van Gerrewey T, Boon N, Geelen D. Vertical farming: the only way is up? *Agronomy*. 2021;12(1):2.
4. Izzo LG, Mele BH, Vitale L, Vitale E, Arena C. The role of monochromatic red and blue light in tomato early photomorphogenesis and photosynthetic traits. *Environmental and Experimental Botany*. 2020;179:104195.
5. Zhang M, Cui J, Ju J, Hu Y, Liu X, He R. The Impact of Daily Light Integral from Artificial Lighting on Tomato Seedling Cultivation in Plant Factory. *Agronomy*. 2024;15(1):70.
6. Palmitessa OD, Paciello P, Santamaria. Supplemental LED increases tomato yield in Mediterranean semi-closed greenhouse. *Agronomy*. 2020;10(9):1353.
7. Gomez C, Mitchell CA. In search of an optimized supplemental lighting spectrum for greenhouse tomato production with intra-canopy lighting. *Acta Horticulturae*. 2016;1134:57-62.
8. Watjanatepin N. Effect of three specific spectra of LED light on the growth, yield, and fruit quality of *Sida tomato*. *International Journal of Advanced and Applied Sciences*. 2019;6(6):15-21.
9. Son K, Kim E, Oh M. Growth and Development of Cherry Tomato Seedlings Grown under Various Combined Ratios of Red to Blue LED Lights and Fruit Yield and Quality after Transplanting. *Protected Horticulture and Plant Factory*. 2018;27(1):54-63.

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