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Effect of light and temperature on leaf yield, seed yield and quality trait of coriander (*Coriandrum sativum* L.) under indoor conditions

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ABSTRACT

The present study, entitled “Effect of light and temperature on line selection and seed multiplication in coriander (*Coriandrum sativum* L.) under indoor conditions,” was undertaken at Urban Kisaan Private Limited, Gundlapochampally, in academic collaboration with the Department of Horticulture, School of Agricultural Sciences, Malla Reddy University, Hyderabad, during the academic year 2025–26. The experiment was conducted under controlled indoor conditions using a Completely Randomized Design (CRD) comprising seven treatments and three replications. The study was aimed at assessing the effects of different LED light spectra, photoperiods and temperature regimes on the growth, yield and quality characteristics of coriander.

Significant differences were recorded among the treatments for the growth, yield, seed production and quality parameters of coriander grown under indoor conditions. The treatment T_4 (2 Red:1 Blue LED light ratio with a 16 h photoperiod) resulted in the maximum plant height (26.2 cm) and number of leaves (79), whereas the greatest leaf length (19.0 cm) was observed in the control (T_1). The highest number of branches (14) was recorded with T_7 (18–20 °C), while T_6 (24–20 °C) produced the longest root length at harvest (12.5 cm). With respect to yield and seed production,

T_3 (2 Red:1 Blue LED light ratio with a 16 h photoperiod) showed the highest values for leaf yield (15.8 g plant⁻¹), dry weight (1.96 g plant⁻¹), number of umbels per plant (32), seeds per umbellet (12), umbellets per umbel (16), and seed yield per plant (8.59 g). Among the quality parameters, the maximum chlorophyll content (30.6) was recorded under T_3 , whereas the highest total soluble solids (4.4 °Brix) were observed in T_5 (2 Blue:1 Red LED light ratio with a 16 h photoperiod). Overall, the study revealed that a 2 Red:1 Blue LED light spectrum combined with a 16 h photoperiod promoted favourable growth, seed production and quality attributes in coriander under indoor cultivation. The results further emphasize the importance of optimizing light spectrum, photoperiod and temperature for improving coriander growth and seed multiplication in controlled-environment production systems.

Keywords: Coriander, (*Coriandrum sativum* L.), LED light spectrum, Red and blue light, Photoperiod, Temperature, Indoor cultivation, Seed multiplication, Seed yield, Controlled environment

Introduction

Coriander (*Coriandrum sativum* L.) is an important herb and seed spice whose growth and productivity are strongly influenced by environmental conditions. Under indoor cultivation, light intensity, photoperiod and temperature can be precisely regulated to provide suitable conditions for vegetative growth and reproductive development. Light is particularly important because it affects plant morphology, photosynthetic activity, biomass accumulation and yield. Wang *et al.* (2024) reported that different light intensities and photoperiods significantly influenced the morphological development, photosynthetic characteristics and yield of coriander grown under controlled-environment conditions. Their study indicated that a 16-hour photoperiod with an appropriate light intensity supported better growth and production than shorter photoperiods. These findings highlight the importance of optimizing light conditions for efficient indoor coriander cultivation and provide a basis for evaluating different light regimes in combination with temperature management.

In controlled indoor production systems, environmental factors such as light spectrum, photoperiod and temperature can be manipulated to regulate plant growth, biomass production and quality. In particular, the spectral composition of artificial light plays an important role in determining plant morphology and productivity. Akter *et al.* (2024) [1] evaluated different combinations of red, blue and far-red light in indoor-grown cilantro and observed differences in plant height, leaf area and yield under different spectral treatments. Their findings demonstrated that modifying the light spectrum can substantially influence the growth and productivity of coriander under indoor conditions. Therefore, optimization of light quality and other environ-

mental conditions is important for developing efficient indoor production systems for coriander and for improving biomass and yield characteristics.

is an important environmental factor in indoor coriander production because the quality and spectral composition of light can influence plant morphology, photosynthetic activity, biomass and quality traits. LED technology allows specific wavelengths such as red and blue light to be supplied in controlled proportions. McAusland *et al.* (2020) found that different LED spectra significantly affected the morphology, photosynthetic characteristics and aromatic compounds of coriander. Red light produced greater leaf area, whereas red + blue light produced shorter plants with a higher leaf-to-shoot ratio. The study also showed that changing the spectral composition could modify the aromatic profile of coriander. Therefore, evaluating different red and blue light combinations is important for optimizing growth and quality under indoor cultivation conditions.

Material and methods

The present research, titled “Effect of Light and Temperature on Line Selection and Seed Multiplication In Coriander (*Coriandrum sativum* L.) Under Indoor Conditions. was carried out during the academic year 2025–2026 at the Urban Kisaan Research and Development Unit, Hyderabad, in academic coordination with the Department of Horticulture, School of Agricultural Sciences, Malla Reddy University. The experiment was carried out in a controlled indoor cultivation facility to evaluate the response of coriander to different light spectra, photoperiod and temperature regimes. A single coriander variety ukco -7 was used for the study. Different combination treatment involved red and blue LED light ratios, photoperiods, and temperature levels. The details of the experimental materials, treatment structure, cultural practices, and methods adopted for the data collection are described in the followings sections.

Table 1. Treatment details

T_1	Control
T_2	2R:1B+18 Hr duration
T_3	2R:1B+16 Hr duration
T_4	2B:1R +18 Hr duration
T_5	2B:1R+16 Hr duration
T_6	24-26° C Temperature
T_7	18-20°C Temperature

Experimental design

The experiment was conducted in a Completely Randomized Design (CRD) consisting of seven treatments with three replications. Each treatment included 21 plants arranged on an NFT (Nutrient Film Technique) stand. The plants were placed in an alternate arrangement to maintain uniform plant density. Planting was carried out during the second week of November, and all recommended cultural practices were followed uniformly for all treatments. In each replication, five plants from each treatment were randomly selected and tagged for

recording observations. The data recorded from the tagged plants were used to calculate the mean values.

Results and discussion

Fresh weight (gm/plant)

Fresh weight of coriander plants was significantly influenced by the different light and temperature treatments imposed under indoor growing conditions. Among all the treatments, T_3 (2 Red : 1 Blue + 16 h duration) recorded the highest fresh weight at 30 DAT (14.10 g plant⁻¹). The superior fresh biomass accumulation under this treatment may be attributed to the favorable effect of red and blue light combination on photosynthetic activity, resulting in enhanced vegetative growth and greater production of plant tissues. On the other hand, the T_7 (18–20 °C temperature) treatment registered the lowest fresh weight (8.36 g plant⁻¹) at 30 DAT. The reduced biomass production under this temperature regime could be due to comparatively slower growth and lower accumulation of photosynthates. The observed differences among treatments indicate that the interaction of light quality and environmental conditions plays a vital role in determining fresh biomass production in coriander. The findings suggest that a 2 Red: 1 Blue light combination with a 16-hour photoperiod is more effective for maximizing fresh weight under controlled indoor cultivation conditions. Similar findings were observed by (Lin *et al.*, 2018) in coriander.

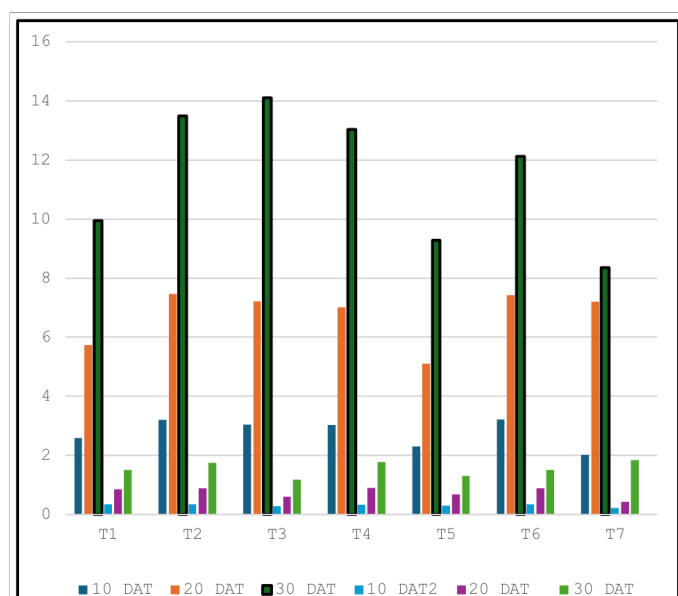
Dry weight (gm/plant)

The dry weight of coriander plants was markedly influenced by the different light quality and temperature treatments. Among all the treatments, T_7 (18–20 °C temperature) recorded the highest dry weight at 30 DAT (1.84 plant⁻¹), indicating that a lower temperature favored greater biomass accumulation by creating suitable conditions for plant growth and efficient utilization of photosynthates. In contrast, the lowest dry weight was observed in T_3 (2R:1B + 16-hour photoperiod), which recorded 0.25, 0.61, and 1.18 g plant⁻¹ during the experimental period, suggesting that this light combination with a shorter photoperiod was comparatively less effective in promoting dry matter production. Among the light treatments, T_4 (2B:1R + 18-hour photoperiod) consistently produced higher dry weight values (0.36, 0.91, and 1.79 plant⁻¹) than the other light combinations, indicating that a higher proportion of blue light combined with a longer photoperiod enhanced biomass accumulation. The control treatment and the remaining treatments showed intermediate dry weight values, demonstrating that both light quality and environmental conditions played an important role in regulating plant growth. Overall, the findings indicate that coriander dry matter production was strongly affected by the applied treatments. The maximum dry weight (1.84 g plant⁻¹) was obtained under T_7 (18–20 °C), while the minimum dry weight (1.18 g plant⁻¹ at 30 DAT) was recorded under T_3 (2R:1B + 16-hour photoperiod). Similar findings were observed by (Lin *et al.*, 2020) in coriander.

Effect of light and temperature on fresh weight and dry weight 10, 20 & 30 of coriander

Treatment Details		Fresh weight (gm/plant)			Dry weight (gm/plant)		
		10DAT	20DAT	30DAT	10DAT	20DAT	30DAT
T ₁	Control	2.59	5.74	9.94	0.38	0.85	1.51
T ₂	2R:1B+18 Hr duration	3.20	7.47	13.49	0.36	0.88	1.71
T ₃	2R:1B+16 Hr duration	3.04	7.22	14.10	0.25	0.61	1.18
T ₄	2B:1R +18 Hr duration	3.03	7.02	13.03	0.36	0.91	1.79
T ₅	2B:1R+16 Hr duration	2.31	5.11	9.28	0.30	0.68	1.31
T ₆	24-26° C Temperature	3.22	7.43	12.12	0.37	0.89	1.51
T ₇	18-20°C Temperature	2.02	7.20	8.36	0.22	0.43	1.84
SEm (+)		0.26	0.44	0.20	0.49	0.41	0.03
CD (<i>p</i> = 0.05)		0.87	1.34	0.62	0.01	0.12	0.09

Graphical representation on leaf yield dry weight of Coriander

T₁ ControlT₂ 2R:1B + 18 Hr duration T₃ 2R:1B + 16 Hr duration T₄ 2R:1B + 18 Hr duration T₅ 2B:1R + 16 Hr duration T₆ 24 -26 °C Temperature T₇ 18-20 °C Temperature**Seed yield per plant**

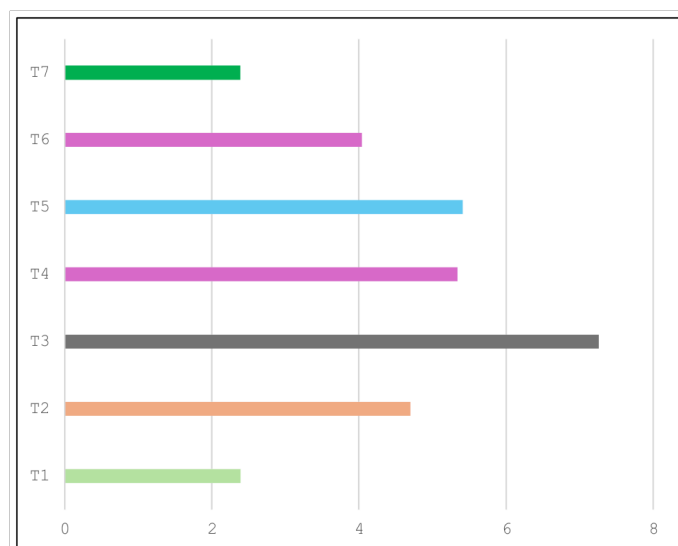
The seed yield per plant was markedly influenced by the different light quality and temperature treatments. Among all the treatments, the highest seed yield per plant (7.26 g) was recorded under the treatment receiving the red- and blue-light combination with a 16-hour photoperiod (T₃). This improvement in seed yield may be attributed to enhanced photosynthetic efficiency, better assimilate production, and effective partitioning of photosynthates towards reproductive structures under the optimized light environment. The favourable light conditions likely promoted flower development, seed setting, and seed filling, resulting in greater seed yield per plant. In contrast,

the lowest seed yield per plant (2.08 g) was observed under the 18–20 °C temperature treatment (T₇), which was even lower than the control. The reduced yield under this condition may be associated with slower metabolic activity, limited photosynthesis, and reduced translocation of assimilates to developing seeds under comparatively lower temperature conditions. Such environmental conditions may have adversely affected reproductive growth and seed development, leading to poor seed yield. Overall, the results indicate that an appropriate combination of red and blue light with a 16-hour exposure period was more effective in enhancing seed yield than the other environmental treatments evaluated. These findings suggest that optimizing light quality and photoperiod can substantially improve reproductive performance and seed productivity in coriander under controlled growing conditions. Similar findings were observed by (Shen *et al.*, 2014) [2] in lettuce.

Effect of light and temperature on seed yield per plant of coriander

Treatment Details		Seed yield per plant(g)
T1	Control	2.39
T2	2R:1B+18 Hr duration	4.70
T3	2R:1B+16 Hr duration	7.26
T4	2B:1R +18 Hr duration	5.34
T5	2B:1R+16 Hr duration	5.41
T6	24-26° C Temperature	4.04
T7	18-20°C Temperature	2.08
SEm (+)		0.32
CD (<i>p</i> = 0.05)		0.97

Graphical representation on seed yield per plant of coriander



T₁ Control

T₂ 2R:1B + 18 Hr duration T₃ 2R:1B + 16 Hr duration T₄ 2R:1B + 18 Hr duration T₅ 2B:1R + 16 Hr duration T₆ 24 -26 °C Temperature T₇ 18-20 °C Temperature

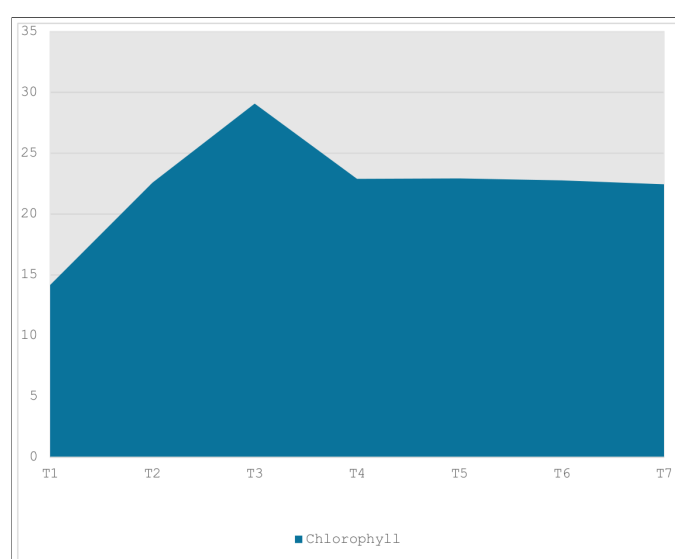
Chlorophyll (a & b)

Chlorophyll (a & b) content of coriander was markedly influenced by different light quality and temperature treatments. Among all the treatments, T₃ (2R:1B light spectrum with 16-hour photoperiod) recorded the highest chlorophyll (a & b) content (29.07), indicating that this light combination and photoperiod created the most favorable conditions for chlorophyll synthesis and photosynthetic pigment accumulation. The enhanced chlorophyll content under T₃ suggests improved light utilization efficiency and a greater capacity for photosynthesis, which may have contributed to better vegetative growth and overall plant performance. In contrast, the least chlorophyll (a & b) content was observed in the control treatment (T₁) with a value of 14.16, indicating that the absence of controlled light and temperature conditions limited chlorophyll biosynthesis. The reduced pigment concentration in the control reflects comparatively lower photosynthetic potential, emphasizing the beneficial effect of optimized environmental conditions on chlorophyll accumulation. Similar findings were observed by (Atif *et al.*, 2020) [3] in garlic and onion.

Effect of light and temperature on Chlorophyll (a & b) of coriander

Treatment Details		Chlorophyll (a & b)
T1	Control	14.16
T2	2R:1B+18 Hr duration	22.56
T3	2R:1B+16 Hr duration	29.07
T4	2B:1R +18 Hr duration	22.88
T5	2B:1R+16 Hr duration	22.90
T6	24-26° C Temperature	22.76
T7	18-20°C Temperature	22.44
SEm (+)		0.51
CD (<i>p</i> = 0.05)		1.57

Graphical representation on chlorophyll (a & b) of Coriander



T₁ Control

T₂ 2R:1B + 18 Hr duration T₃ 2R:1B + 16 Hr duration T₄ 2R:1B + 18 Hr duration T₅ 2B:1R + 16 Hr duration T₆ 24 -26 °C Temperature T₇ 18-20 °C Temperature



Figure 1. seed yield T₁ Fig 2 : seed yield T₃



Figure 3. Chlorophyll content

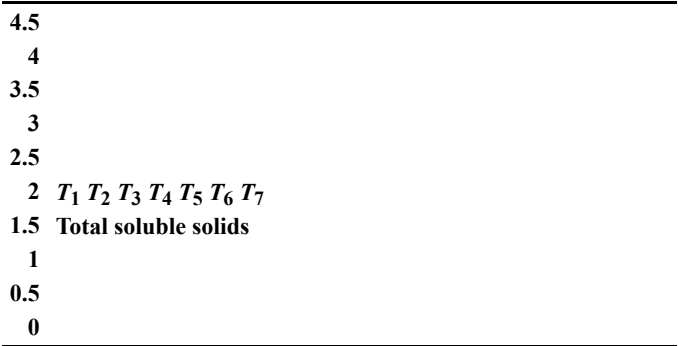
Total soluble solids

The results revealed that the different light spectra and temperature treatments had a marked influence on the total soluble solids (TSS) content of coriander. Among all the treatments, T_5 (2B:1R + 16 h duration) recorded the highest TSS value of 4.08 °Brix, indicating that this treatment was the most effective in enhancing the accumulation of soluble sugars and other dissolved solids in the plant tissues. The higher TSS under this treatment may be attributed to the greater proportion of blue light combined with an optimum photoperiod, which could have promoted photosynthetic efficiency, carbohydrate synthesis, and translocation of assimilates. The next highest TSS values were observed in T_7 (18–20 °C temperature) with 3.31 °Brix, followed closely by T_4 (2B:1R + 18 h duration) with 3.26 °Brix and T_3 (2R:1B + 16 h duration) with 3.21 °Brix. These findings suggest that both balanced light quality and favourable temperature conditions enhanced the production and accumulation of soluble metabolites compared to the untreated control. Treatment T_6 (24–26 °C temperature) recorded a moderate TSS value of 2.98 °Brix, while T_2 (2R:1B + 18 h duration) produced 2.50 °Brix. The lowest TSS value (2.37 °Brix) was recorded in the control (T_1), indicating that the absence of controlled light and temperature treatments resulted in comparatively lower synthesis and accumulation of soluble solids. Overall, the results demonstrate that manipulating light quality and exposure duration significantly improved the TSS content of coriander. In particular, the combination of a higher proportion of blue light (2B:1R) with a 16-hour photoperiod (T_5) proved to be the most effective treatment for enhancing soluble solids, suggesting its potential application for improving the quality and market value of coriander under controlled environmental conditions. Similar findings were observed by (Clercq *et al.*, (2021) [4] in purple basil, coriander and parsley.

Effect of light and temperature on total soluble solids of coriander

Treatment Details		Total Soluble Solids (° Brix)
T1	Control	2.37
T2	2R:1B+18 Hr duration	2.50
T3	2R:1B+16 Hr duration	3.21
T4	2B:1R + 18 Hr duration	3.26
T5	2B:1R+16 Hr duration	4.08
T6	24-26° C Temperature	2.98
T7	18-20°C Temperature	3.31
SEm (+)		0.13
CD ($p = 0.05$)		0.39

Graphical representation on total soluble solids



T_1 Control
 T_2 2R:1B + 18 Hr duration
 T_3 2R:1B + 16 Hr duration
 T_4 2B:1R + 18 Hr duration
 T_5 2B:1R + 16 Hr duration
 T_6 24 -26 °C Temperature
 T_7 18-20 °C Temperature

Conclusion

Based on the current investigation's findings, it can be concluded that the treatment T_2 2Red:1 blue + 18 hr duration can be attributed to the combined effect of light regime was produced highest growth parameter, yield parameter T_3 -2Red 1blue +16 hr duration and including of chlorophyll quality parameter of coriander under indoor farming conditions.

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