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Effects of different lighting system on growth and physiological parameters of nerium (*Nerium oleander* L.)

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Abstract

Nerium (Nerium oleander) is an important evergreen shrub grows upto height of six meters which has a profuse flowering habit throughout the year. Flowers of nerium is mainly used for making garlands and also used in temples for worshipping. It is one of the most preferred plant in urban and highway landscaping and avenue planting. Due its unusual flower opening behavior, the harvesting of flowers should be done during early morning hours *i.e.* before 5.30 a.m. Hence, the present investigation was aimed to study the different lighting system on growth, physiological and flower yield of nerium. The results of the different lighting system showed profound influence on growth, physiological and yield parameters of nerium. The maximum plant height (294.0 cm) was observed in plants illuminated with Blue light for overnight + water spray (Fog) 15 min. for every one hour (T₄) and the minimum plant height (219.0 cm) was noted in the treatment with Red light for overnight. The highest number of primary branches (11.0) was registered in the plants illuminated with red light + water spray (fog) 15 min. for every one hour (T₅). The maximum plant spread in north-south direction (145.00 cm) and east-west direction (140.50 cm) was recorded by the illumination with Blue light for overnight (T₁). The maximum (50.53) and minimum (42.23 cm²) leaf area was recorded in Red light for overnight (T₂) and Blue light for overnight + water spray (Fog) 15 min. for every one hour (T₄) respectively. The maximum total chlorophyll content (7.43 mg g⁻¹) was registered in white light for overnight + water spray (Fog) 15 min. for every one hour (T₆). The maximum flower yield (332.6 g/plant) and minimum flower yield (226.3 g/plant) was observed in Water spray (Fog) 15 min. for every one hour (T₇) and Control (T₈) (farmers practice).

Keywords: Nerium, growth, physiological parameters, yield and shelf life

Introduction

Nerium (Nerium oleander) belongs to the family *Apocynaceae* (Oleander family). *Nerium* is an evergreen shrub (or small tree) grows upto height of six meters. It has a profuse flowering habit throughout the year. Flowers of nerium is mainly used for making garlands and also used in temples for worshipping. It is one of the most preferred plants in urban and highway landscaping and avenue planting. This plant possesses medicinal properties *viz.*, antibacterial, anticancerous and antiplatelet aggregation activity. This has a variety of flower colours that meet the demand in the domestic markets. The most preferred colours are pink, red, white, and yellow, which are mostly used for making strings, garland, and veni making. It is drought tolerant crop and withstand heat and dust and ability to grow with little quantity of water.

In India, *Nerium* is distributed throughout the country but the commercial cultivation takes place only in Tamil Nadu. In Tamil Nadu, *Nerium* is cultivated in Nilakottai, Trichy, Madurai and Salem districts. It is growing in an area of 1408 ha with a production of 33780 MT accounting to 24% of productivity. Flower opens in the early morning hours before the sun rise and hence the harvesting of flowers should be done during early morning hours *i.e.* before 5.30 a.m. (Parashuram *et al.*, 2019^[7], Sadhu Prabhakaran *et al.*, 2021a and Sadhu Prabhakaran *et al.*, 2021b)^[8, 9]. Due its unusual flower opening behavior, the experiment was programmed to study the effect of different lighting system on growth and physiological parameters of *Nerium*.

Materials and Methods

The experiment was carried out to understand the "Effect of different lighting system on system on growth and physiological parameters of *Nerium*". The experiments was laid out in Randomized Block Design (RBD) in three years old plants of variety pink flowered type at Salem District.

Treatment details

T₁: Blue light for overnight

T₂: Red light for overnight

T₃: White light for overnight

T₄: Blue light for overnight + water spray (Fog) 15 min. for every one hour

T₅: Red light for overnight + water spray (Fog) 15 min. for every one hour

T₆: White light for overnight + water spray (Fog) 15 min. for every one hour

T₇: Water spray (Fog) 15 min. for every one hour

T₈: Control (farmers practice)

(Lighting time and water spray (fog) will be carried out from 10.0 P.M to 4.00 A.M- 6 hours)

Growth parameters**Plant height**

The height of the plant from the ground level to the terminal end of the plants was measured at bi-monthly intervals. The mean of observed plant height was calculated expressed in centimetre (cm).

Plant spread

The plant spread was measured from East to West and North to South with the help of measuring scale at bi-monthly intervals and the mean was calculated and expressed in centimetre (cm).

Number of primary branches per plant

The number of branches arising from the ground was considered as primary branches. The number of primary branches per plant was counted at bi-monthly intervals and the mean of observations was expressed in numbers.

Physiological parameters**Area of leaf (LA)**

A sample of 10 random leaves from each plot was collected and their leaf area was estimated using leaf area meter and expressed in cm².

Chlorophyll

The total chlorophyll content was estimated by adopting the method of Yoshida *et al.* (1971) [11] and the contents were expressed as mg g⁻¹ of fresh weight.

Flower yield

The yield of flowers from each treatment was weighed and the mean values were calculated and expressed in grams (gram plant⁻¹).

Shelf life

Fifty number of matured flowers buds in each treatment was harvested and stored in polythene cover of 100 gauge thickness with 1% vent and the mean values was expressed in days.

Statistical analysis

The mean data was calculated and statistically analysed and the critical differences were computed with 5% probability based on the method suggested by Panse and Sukhatme (2000) [6].

Result and Discussion**1. Growth parameters**

The plant height, plant spread and number of primary branches are important growth parameters which directly influence the flower yield of nerium. The maximum plant height (294.0 cm) was observed in plants illuminated with Blue light for overnight + water spray (Fog) 15 min. for every one hour (T₄) and the minimum plant height (219.0 cm) was noted in the treatment with Red light for overnight (T₂). The highest number of primary branches (11.0) was registered in the plants illuminated with red light + water spray (fog) 15 min. for every one hour (T₅). The maximum plant spread in north-south direction (145.00 cm) and east-west direction (140.50 cm) was recorded by the illumination of plants with Blue light for overnight (T₁). This might be due to the reason that photons of blue lights might have triggered the photosynthetic process in crop plants especially crops like nerium. The Present study is in corroboration with the earlier finding of Terfa *et al.* (2013) [10] in Rose. The variation in the number of primary braches could be due to the fact that red light might have produced a promising effect on the induction of axillary buds which ultimately resulted in more number of primary branches. This is in corroboration with the findings of Chung *et al.* (2010) [2]; Kamelia *et al.* (2018) [4] in *Oncidium* and *Chrysanthemum* plants.

2. Physiological parameters, flower yield and shelf life

The maximum (50.53 and minimum (42.23 cm²) leaf area was recorded in Red light for overnight (T₂) and Blue light for overnight + water spray (Fog) 15 min. for every one hour (T₄) respectively. The maximum total chlorophyll content (7.43 mg g⁻¹) was registered in white light for overnight + water spray (Fog) 15 min. for every one hour (T₆) and minimum total chlorophyll content (6.08 mg g⁻¹) was registered in Blue light for overnight (T₁). The maximum flower yield (332.6 g/plant) and minimum flower yield (226.3 g/plant) was observed in Water spray (Fog) 15 min. for every one hour (T₇) and Control (T₈) (farmers practice). Among the different lighting systems, there was no significant difference on the shelf life of flowers. The lack of water in leaves influences chlorophyll synthesis and promotes the decomposition of chlorophyll and accelerates leaf yellowing (Hogewoning *et al.*, 2010) [3]. Therefore, the water spray as fog to the Nerium plants might have significantly influenced the synthesis of chlorophyll. It is probable that the high carbohydrate production might have accelerated the floral bud development in Nerium which inturn might have triggered the yield of flowers. This is in corroboration with the earlier findings Autio (1998) [1]; Llewellyn *et al.* (2020) [5] in Gerbera.

Table 1: Effect of lighting system on physiological parameters and flower yield parameters of Nerium

Treatments	Plant height (cm)	Number of primary branches per plant	Plant spread N-S (cm)	Plant spread E-W (cm)	Leaf area (cm ²)	Total chlorophyll (mg g ⁻¹)	Flower yield (g/plant)	Shelf life (days)
T ₁	220.5	9.5	145.0	140.5	49.33	6.08	251.8	2.5
T ₂	219.0	8.0	121.5	110.5	50.53	6.52	268.2	2.0
T ₃	241.5	7.0	135.0	119.5	46.05	6.90	301.1	1.5
T ₄	294.0	7.0	132.5	110.0	42.23	7.20	284.6	2.8
T ₅	248.5	11.0	120.5	104.0	45.15	7.27	302.5	2.9
T ₆	230.5	6.0	137.0	123.0	44.08	7.43	293.1	2.7
T ₇	277.0	8.5	140.0	128.0	47.60	7.00	332.6	3.1
T ₈	250.0	10.0	127.5	113.5	46.00	6.22	226.3	2.0
S.Ed	12.09	0.98	6.71	5.61	2.13	0.42	14.52	NS
CD (p=0.05)	24.56	2.01	13.46	11.24	4.29	0.89	29.40	

Conclusion

The different lighting system showed profound influence on growth, physiological and yield parameters of nerium. The maximum plant height (294.0 cm) was observed in plants illuminated with Blue light for overnight + water spray (Fog) 15 min. for every one hour (T₄) and the minimum plant height (219.0 cm) was noted in the treatment with Red light for overnight. The highest number of primary branches (11.0) was registered in the plants illuminated with red light + water spray (fog) 15 min. for every one hour (T₅). The maximum plant spread in north-south direction (145.00 cm) and east-west direction (140.50 cm) was recorded by the illumination of plants with Blue light for overnight (T₁). The maximum (50.53 and minimum (42.23 cm²) leaf area was recorded in Red light for overnight (T₂) and Blue light for overnight + water spray (Fog) 15 min. for every one hour (T₄) respectively. The maximum total chlorophyll content (7.43 mg g⁻¹) was registered in white light for overnight + water spray (Fog) 15 min. for every one hour (T₆). The maximum flower yield (332.6 g/plant) and minimum flower yield (226.3 g/plant) was observed in Water spray (Fog) 15 min. for every one hour (T₇) and Control (T₈) (farmers practice).

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