

## Effect of light intensity on leaf scorching in nursery seedlings of cardamom (*Elettaria cardamomum* Maton)

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### Abstract

Studies on leaf scorching in nursery seedlings of cardamom (*Elettaria cardamomum*) grown at Thadiyankudisai (Tamil Nadu, India) indicated that total biomass, chlorophyll and protein contents, and photochemical activities were adversely affected in leaf scorched seedlings grown under full light (100% of total sunlight), when compared to healthy seedlings grown under medium light (45-55% of total sunlight).

**Key words** : biomass, cardamom, *Elettaria cardamomum*, light intensity, photochemical activities.

Leaf scorching is a serious problem in nursery seedlings of cardamom (*Elettaria cardamomum* Maton). Excessive sunlight during growth of seedlings in the nursery which causes breakdown of chlorophyll, is one of the main reasons for leaf scorching. Hence, a preliminary experiment was conducted at Indian Cardamom Research Institute, Thadiyankudisai (Tamil Nadu, India) to find out the optimum light regimes to prevent leaf scorching in cardamom seedlings in the nursery. Two month old healthy cardamom seedlings of uniform size were transferred to two different light regimes namely, full light (100% of total sunlight ie,  $1500 \mu\text{E m}^{-2} \text{s}^{-1}$ ) and medium light (45-55% of total sunlight ie,  $675\text{-}825 \mu\text{E m}^{-2} \text{s}^{-1}$ ). Observations on various parameters were

made after 100 days of growth. Light intensities were measured with Li-Cor 188 radiometer (Li-Cor Inc., USA). Leaf area was determined by using a Li-Cor (Lambda Instrument Corporation, USA) area meter, model LI-3100. Chlorophyll was extracted with 80% acetone and its concentration was determined according to Arnon (1949). Total leaf soluble protein was estimated by the method of Lowry *et al.* (1951). Mesophyll cells were isolated from leaves according to the method of Gnanam & Kulandaivelu (1969). Photochemical activities such as whole chain electron transport ( $\text{H}_2\text{O} \rightarrow \text{MV}$ ), PS II electron transport ( $\text{H}_2\text{O} \rightarrow \text{BQ}$ ) and PS I electron transport ( $\text{DCPIP} \rightarrow \text{MV}$ ) were measured by following the method of Izawa *et al.*, (1969).

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**Table 1.** Effect of light intensity on growth and biomass of cardamom seedlings grown under medium<sup>1</sup> and full<sup>2</sup> sunlight

Growth parameter	Medium sunlight	Full sunlight	t-value
Fresh weight (g/plant)	28.40 ± 2.45	21.51* ± 1.85	8.689
Dry weight (g/plant)	3.20 ± 0.35	2.40* ± 0.21	7.589
Leaf area (cm <sup>2</sup> )	476.00 ± 38.45	310.00* ± 28.35	13.454
Shoot length (cm/plant)	31.00 ± 2.30	22.00* ± 1.98	11.482
Root length (cm/plant)	45.00 ± 3.81	42.00 ± 4.10	2.075
Internode length (cm/plant)	7.80 ± 0.67	5.70* ± 0.55	9.380

Values are mean ± SD; n=15

<sup>1</sup>675-825  $\mu\text{Em}^{-2}\text{s}^{-1}$  (45-55% sunlight) <sup>2</sup>1500  $\mu\text{Em}^{-2}\text{s}^{-1}$  (100% sunlight)

\* Significant at 5% level

Seedlings grown under medium light (45-55% of total sunlight) were healthy and showed better performance in growth (t-8.689; P=0.05) and biomass production than leaf scorch affected seedlings which were grown under full light level (100% of total sunlight). Fresh and dry weights, leaf area, shoot and internode lengths were higher in healthy seedlings than leaf scorch affected seedlings. However, there was no significant difference in root length (t-2.075; p=0.05) of healthy and leaf scorch affected seedlings.

Total chlorophyll (t-7.562; p=0.05) and protein (t-4.574; p=0.05) levels were also affected in leaf scorch affected seed-

lings. The loss of chlorophyll content may be due to the breakdown of chlorophyll molecules due to excessive sunlight. The rate of whole chain (t-9.13; P=0.05), photosystem I (t-7.23; P=0.05) and photosystem II (t-5.81; P=0.05) photochemical activities were higher in healthy seedlings grown under medium light than that of leaf scorch affected seedlings grown under full light (Table 3). The reduction in photosynthetic rate could also be related to the drastic reduction in chlorophyll and soluble protein contents. Leach *et al.* (1983) observed a similar trend in virus infected tobacco plants. The results of the present study indicates that medium light regime was suitable for growth

**Table 2.** Effect of light intensity on total chlorophyll and soluble protein contents of leaves of cardamom seedlings grown under medium<sup>1</sup> and full<sup>2</sup> sunlight

Light intensity	Total chlorophyll (mg/g fr. wt)	Soluble protein (mg/g fr. wt)
Medium sunlight	2.640 ± 0.220	16.820 ± 1.420
Full sunlight	1.720* ± 0.160	13.120* ± 1.120
t-value	7.562	4.574

Values are mean ± SD; n=5

<sup>1</sup>675-825  $\mu\text{Em}^{-2}\text{s}^{-1}$  (45-55% sunlight); <sup>2</sup>1500  $\mu\text{Em}^{-2}\text{s}^{-1}$  (100% sunlight)

\* Significant at 5% level

**Table 3.** Effect of light intensity on whole chain, PS I and PS II reactions in leaves of cardamom seedlings grown under medium<sup>1</sup> and full<sup>2</sup> sunlight

Light intensity	Whole chain ( $\mu$ moles $O_2$ uptake/mgchl/h)	Photosystem I ( $\mu$ moles $O_2$ uptake/mgchl/h)	Photosystem II ( $\mu$ moles $O_2$ evolved/ mgchl/h)
Medium sunlight	67.0 $\pm$ 4.8	131.0 $\pm$ 9.6	172.0 $\pm$ 12.7
Full sunlight	42.0* $\pm$ 3.8	91.0* $\pm$ 7.8	128.0* $\pm$ 11.2
t-value	9.13	7.230	5.810

Values are mean  $\pm$  SD; n=5

<sup>1</sup>675-825  $\mu E m^{-2}s^{-1}$  (45-55% sunlight) <sup>2</sup>1500  $\mu E m^{-2}s^{-1}$  (100% sunlight)

\* Significant at 5% level

and development of healthy cardamom seedlings in the nursery.

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