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SHORT COMMUNICATION

GROWTH RESPONSE OF MINT (*MENTHA SPICATA* L.) TO LIGHT AND SHADE REGIME

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Mint (*Mentha spicata* L.) creeping stems were grown vegetatively under shade and sunlight. Shaded plants showed a decrease in biomass production, even though leaf number and area increased. Total chlorophyll and carotenoid contents were more whereas the chlorophyll a/b ratio was lower in plants grown under shade than in those grown in light. Growth parameters such as AGR, LAI and SLW were higher in sunlight plants, whereas LAR and SLA were higher in shade plants. The present study suggests that *Mentha spicata* can be well adapted to high light intensities; although capable of growing under shade, its biomass production was higher under full normal light conditions.

***Key words*: Growth parameters, *Mentha spicata*, shade.**

The growth and development of plants are influenced by the solar radiation as the light energy is the main input of the photosynthetic process in green plants (Zelitch 1971, Yoshida 1972, Biscoe and Gallagher 1977, Noggle and Fritz 1979). The effect of light intensity on dry matter production has been well established (Mc Whorter and Jordon 1976). Shaded plants often develop thin leaves with a lower fresh weight per leaf area, higher content of total chlorophyll on a weight basis (Muthuchelian *et al.* 1989). Low light intensity increased the leaf area in potato (Singh 1988) and reduced dry matter production in rice (Singh *et al.* 1988). Though different crop species have differential growth and yield response to light intensity (Zelitch 1971) during their ontogeny but higher growth and yield stability of a crop under low light condition have a great importance from the view point of physiological adaptability.

Mint (*Mentha spicata* L.), a unique medicinal herb, is widely cultivated for its medicinal aromatic leaves. It is a creeping stem but growing obliquely upwards giving rise to a leafy shoot. It is also a species of kitchen garden. The present study investigates the plant's performance under light and shade conditions.

The experiments were conducted in earthen pots (30x 30 cm) at the experimental site of Botanic Garden, Berhampur University, Berhampur during January, 2002. Soils were collected from a garden and adequately fertilized with compost. Uniform vegetative cut parts of creeping shoot were raised in the prepared pots. Out of twenty pots, ten received normal sun light until the end of experiment whereas other ten were shifted to shade conditions created by the tree canopies. Pots were watered daily throughout the experiment. Observations on number of increased leafy shoots, length of leafy shoots and number of leaves were recorded in each pot on the 30th day of planting. Three representative plants from each pot were uprooted randomly and leafy shoots were then separated into stem and leaves. Having recorded the fresh weights of these stem and leaves, these were dried in a hot air oven at 80°C for 24 h and dry weights were recorded. Leaf area was calculated by tracing the area of leaf on the graph sheet.

The chlorophyll and carotenoid in leaves were estimated according to the methods of Arnon (1949). Growth parameters such as absolute growth rate (AGR), leaf area ratio (LAR), leaf area index (LAI), specific leaf weight (SLW) and specific leaf area (SLA) were calculted by the method of Fakorede and Mock (1980) and Clipson (1994).

The chlorophyll a, b and total chlorophyll content in leaf were higher in shade than in sun when expressed on fresh weight basis (Table 1). The reduction in chlorophyll a/b ratio in shade-grown plants was less than in sun-grown plants. This has been also reported by Masarovicova and Elias (1981) in deciduous broad-leaved trees and by Lewandowska and Jarvis (1977) in *Picea sitchensis*. Shade plants have a higher content of carotenoid than the sun plants. The increased chlorophyll a and b pigments of shade leaves in attributed to the increase in the number and size of chloroplasts, the amount of chlorophyll per chloroplast and better grana development (Boardman 1977). Higher light intensities have a damaging effect on the chlorophyll both on weight as well as area basis. This is substantiated by a sequential reduction in chlorophyll content as the intensity of light increase (Naidu and Swamy 1993, Laing *et al.* 1995). Remarkable increase in the quantity of chlorophyll in differnt crop leaves under low light condition has also been stated (Janardhan and Murty 1980, Naya and Murthy 1980, Parumal and Rao 1991). Decrease in the chlorophyll content may be because the leaves mature rapidly and fall earlier under sunny conditions.

Table 1. Pigment concentration in the leaves of *Mentha spicata* grown under sun and shade conditions. Values are mean ± SE of 10 replications.

Pysiological parameters	Light regime	
	Sun	Shade
Chlorophyll a (mg g^{-1} fw)	0.80 ± 0.04	0.89 ± 0.05*
Chlorophyll b (mg g^{-1} fw)	0.31 ± 0.02	0.04 ± 0.02*
Chlorophyll a/b	2.58	2.22
Total chlorophyll (mg g^{-1} fw)	1.11 ± 0.06	1.29 ± 0.07*
Carotenoid (mg g^{-1} fw)	0.25 ± 0.01	0.30 ± 0.02*

* : Significant at 0.05 level.

More number of leaves were observed in plants grown in shade than in full light plants (Table 2). The total leaf area of shade plants was also higher in comparison with full sun light plants. However, the dry weights of the stem and leaves were more in the sun light than in the shade plants, and so were the fresh weight too. The drop in the shoot length observed in the shade plants of the present study was in conformity with some earlier reports (Muthuchelian *et al.* 1989). The increased leaf area in the shade grown plants was due to leaf expansion as well as increased leaf number (Singh 1988). Thick leaves contain more photosynthetically active cells resulting in higher photosynthetic rates. Such changes consequently lead to a high biomass production in the grown plants (Fetcher *et al.* 1983). Reduction in dry matter production of leaf and stem in shade grown plants has also been reported (Singh *et al.* 1988).

Table 2. Growth and biomass production of leafy shoots grown under sun and shade conditions. Values are mean ± SE of 10 replications.

Growth Parameters	Light regime	
	Sun	Shade
Number of leaf/leafy shoot	12.2 ± 0.44	14.5 ± 0.49*
Total leaf area/leafy shoot	25.25 ± 0.67	29.00 ± 0.70*
Leaf fresh weight (g./leafy shoot)	0.52 ± 0.09	0.49 ± 0.08
Leaf dry weight (g./leafy shoot)	0.112 ± 0.02	0.100 ± 0.01*
Stem fresh weight (g./leafy shoot)	0.320 ± 0.03	0.300 ± 0.02
Stem dry weight (g./leafy shoot)	0.036 ± 0.005	0.026 ± 0.004*
Leafy shoot length (cm/leafy shoot)	18. ± 1.2	16 ± 1.0*

Significant at 0.05 level.

The absolute growth rate (AGR) of sun light plants was more than that of the shade plants (Table 3), whereas the leaf area ratio (LAR) was higher in shade plants. Likewise leaf area index (LAI) and specific leaf are (SLA) were much more in sun light plants but the specific leaf weight (SLW) was higher in full sun light plants. Thus, the present study suggests that *Mentha spicata* can be well adapted to high light intensities; although capable of

Table 3. Growth rate in *Mentha spicata* under light and shade.

Growth Rate**	Light regime	
	Sun	Shade
AGR ($g.m^{-1}$)	0.840	0.790
LAR ($cm^{-2}.g^{-1}$)	30.05	36.70
LAI	11.31	2.88
SLW ($g.cm^{-2}$)	0.02	0.016
SLA ($cm^{2}.g^{-1}$)	25.25	29.00

**Data are average of 5 replicates.

growing under shade, its biomass production was higher under full normal light conditons.

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