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INFLUENCE OF LIGHT INTENSITY ON GROWTH, YIELD AND LAWSONE CONTENT OF HENNA (*LAWSONIA INERMIS* L.)

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SUMMARY

A study was conducted to assess the effect of varying light intensities on henna (*Lawsonia inermis* L.), an important industrial crop, cultivated for orange-red dye present in leaves, for its adoption in agro-forestry system. Results indicate that decreasing light increased shoot growth and leaf yield but decreased dye concentration in leaf tissue. However, due to increased leaf growth, the lawsone yield increased in shaded plants. The results suggest suitability of this crop for adoption in agro-forestry system.

***Key words : Henna, lawsone content, light intensity*.**

INTRODUCTION

Light is an important abiotic factor which determines leaf area development. In agro-forestry systems the level of light received by under story crop decreases (Dwivedi 1992, Puri *et al.* 1994). This decrease in light intensity has diverse effect on leaf area development, plant growth and yield (Saini and Nanda 1989, Singh 1994, Vyas *et al.* 1996, Vyas and Nein 1999). In this regard, reports indicate that reduction in light intensity has positive effect in crops having leaves as their economic product (Patridge 1996, Vyas and Nein 1999). Henna (*Lawsonia inermis* L.), a crop having leaves of economic value, is cultivated in arid parts of Rajasthan having low rainfall and poor soil fertility status. Suitability of this crop in arid Gujarat has been reported (Vyas 2003b). Leaves of henna contain lawsone (2 Hydroxy- 1-4 naphthoquinone), the orange-red dye used for colouring hair, cloths, skin and leather. In the present study an attempt has been made to examine the effect of varying light intensities on yield and lawsone content, so as to assess its suitability in agro-forestry system.

MATERIALS AND METHODS

An experiment was conducted during *Kharif* season to examine the effect of varying light intensities on henna. Three month old seedlings were transplanted to earthen pots (12" X 12" X 9") filled with 10 kg of farm soil. Nitrogen was applied at the rate of 20 kg N ha^{-1} in the form of urea. The seedling were cut at 10 cm height above ground after establishment. There were three sets of twenty pots each. One set of pots was kept in direct sunlight and thus received 100% light intensity. In second set of plants, light intensity was reduced by 20% and thus only 80% of light intensity was incident on plants. In third set of plants only 60 per cent of light intensity was provided. The light intensity was decreased by using one or more layers of white fabric.

Observations were recorded on time taken for regrowth, plant height, branch per plant, number of nodes on main stem. Data on leaf growth, viz. leaf number per plant, leaf size and leaf area per plant were collected before harvest from ten plants under each treatment.

Wood and dry leaf weight was recorded from all pots after harvest (90 days after the start of treatment). Various growth parameters were computed following the formulae described by Evans (2002). Lawsone content in dried leaf samples was estimated according to Pratibha and Karwar (1999) and expressed on per unit dry weight and per plant basis.

RESULTS AND DISCUSSION

Shaded plant required less time to resprout compared to control plants (Table 1). The time required for regrowth was decreased by 22.2 and 33.3 per cent over control at 80 and 60 per cent light intensities, respectively. Sagwal (1982, 1994) observed similar results in a number of tree species. The decrease in light intensity also increased leaf growth, plant height, number of nodes and number of branches per plant. These observations are in line with those reported earlier (Singh 1984, 1994, Vyas *et al.* 1996, Vyas and Nein 1999, Patra *et al.* 2003, Vyas 2003). The observed increase in leaf growth under reduced light intensities assume importance in agro-forestry systems. Such promotion in leaf growth was also noticed in various grasses (Patridge 1960) and Senna (Vyas and Nein 1999) under shades of varying intensities.

Plants grown under lower light intensities display higher specific leaf area (SLA), specific leaf weight (SLW), leaf/stem ratio and absolute growth rate (AGR) in comparison to plants grown in direct sunlight (Table 2). Naidu and Swami (1994) also recorded similar effects under reduced light in these traits in *Pongamia pinnata.* Although leaves of shaded plants have poor photosynthetic efficiency (Muthuchelian *et al.* 1989, Patra *et al.* 2003), yet the observed promotory effect of reduced light on various traits could be due to variation in crop response to light (Zelitch 1971). Although, SLA, SLW, leaf/stem ratio

Table 1. Influence of light intensities on growth parameters of henna.

Parameter	Light intensity (% PAR)			CD at 5%
	100	80	60	
Regrowth time (days)	18	14	12	3.5
Plant height (cm)	41.6	50.3	53.9	7.4
Node number (main stem)	12.6	15.8	18.5	2.92
Branch/plant	21.0	24.7	29.6	2.1
Leaf/plant	160.5	187.8	209.4	22.6
Leaf area (cm^2/plant)	404.5	606.2	706.7	189.7
Leaf size				
a. Lenght (cm)	2.8	3.2	3.9	0.7
b. Breadth (cm)	1.1	1.4	1.3	NS
Leaf dry weight (g/plant)	4.9	6.7	7.6	1.6
Wood dry weight (g/plant)	9.4	8.7	9.0	NS
Total biomass (g/plant)	14.3	15.4	16.6	1.4

Table 2. Leaf characteristics and growth rate of henna under varying light intensities.

Parameter	Light intensity (% PAR)			CD at 5%
	100	80	60	
Specific leaf area ($cm^2 g^{-1}$)	3.08	4.48	5.07	1.3
Specific leaf weight ($mg\ cm^{-1}$)	30.5	33.9	36.3	2.8
Leaf/stem ratio	0.52	0.77	0.84	0.26
Leaf area ratio ($cm^2 g^{-1}$)	82.6	99.4	92.9	13.8
Absolute growth rate ($mg\ day^{-1}$)	101	106	108	3.2

was increased in shaded plants. Although, the LAR declined at higher levels of reduction in light intensity as compared to lesser decrease in light level yet it was mare than control. Similar results were observed in cluster bean and senna (Vyas *et al.* 1996, Vyas and Nein 1999).

In the present study, reduction of light intensity decreased the lawsone (orange-red colour) concentration in the dry leaf tissues (Fig. 1). However, due to increased leaf yield the per plant yield of dye was rather increased by 31.6 and 47.0 per cent at 20 and 40 per cent lower light intensities, respectively. The present study indicated that a decrease in light intensity has a positive effect on leaf yield of henna. The henna which is a perennial herb can, therefore, be adopted for cultivation in agro-forestry system to increase the land productivity in resource poor arid regions.

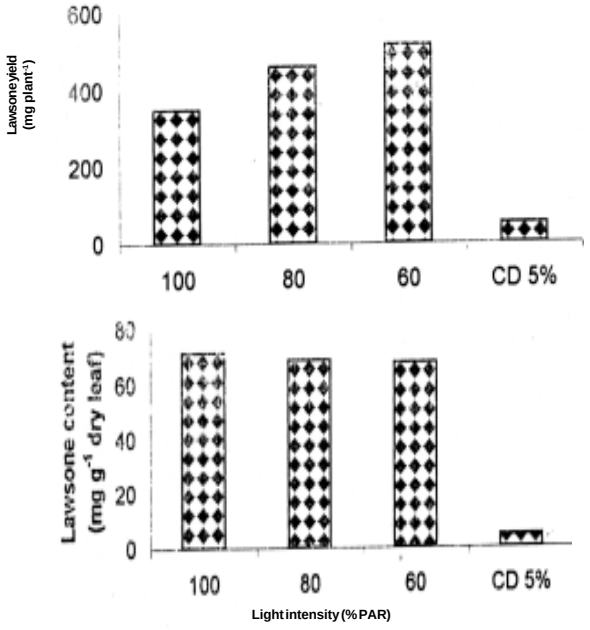

Fig. 1. Influence of varying light intensities on lawsone content and yield

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