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PERFORMANCE OF DIFFERENT GROWING CONDITIONS AND LENGTH OF CUTTINGS ON BIOCHEMICAL PARAMETERS OF DRAGON FRUIT (*HYLOCEREUS UNDATUS*) SAPLINGS

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Abstract–Dragon fruit is getting wider popularity among the farmers and researchers as well. Due to high value benefits many farmers are cultivating this crop. This increasing demand of these fruit necessitates more advanced research on its better establishment. By keeping this in consideration, an investigation was taken to evaluate planted saplings under abiotic stresses for success and standardizing the growing conditions and length of cuttings. The results indicated that, the data on biochemical parameters at 50 days after first shoot initiation, the maximum shoot moisture content (79.33%) and total chlorophyll content (6.90 mg g^{-1}) was recorded in shade net condition, whereas highest protein content (0.25 mg g^{-1}), phenol content (44.47 mg g^{-1}), proline content (49.92 µ g^{-1}) and total sugars (5.86%) were recorded in the open field condition. However, the 35 cm length of cuttings exhibited highest total chlorophyll content (6.13 mg g^{-1}) and total sugar content (5.88%), whereas maximum protein content (0.25 mg g^{-1}), total phenol content (39.70 mg g^{-1}) and proline content (46.51µ g^{-1}) was recorded in 45 cm length of cuttings. Therefore, treatment combination shade net condition with 35cm length of cuttings has reduced the abiotic stress as compared to other treatments at 50 days intervals after first shoot initiation so, shade net condition with 35 cm length of cuttings performed better under abiotic stresses.

INTRODUCTION

Dragon fruit (*Hylocereus undatus*) commonly called as Pitaya belongs to the family Cactaceae (Morton, 1987). It is also called as "Noble Woman" or "Queen of the Night" (Jadhav *et al.*, 2021; Perween *et al.*, 2018). Dragon fruit is originated from North, Central and South America (Luders and McMahon, 2006). The chromosome number of *Hylocereus undatus* is 2n = 22 and *Selenicerus megalanthus* is 2n = 44 (Lichtenzveig, *et al.*, 2000). Dragon fruit is mainly cultivated in countries like Vietnam, Taiwan, Sri Lanka, Thailand, Malaysia, Philippines, China, Australia and India (Babar *et al.*, 2021). The total area under cultivation of dragon fruit in India during 2019-2020 is about 3084.6 ha and production is 12113.4 MT and also great potential for exporting to countries of USA and Europe (Waghmare, *et al.*, 2021). It can be grown in wide range of soil types (Karunakaran *et al.*, 2019). Dragon fruit plants prefer high organic matter, moderately acidic sandy loam soil and grow well in soil having good drainage. Soil pH ranging from 5.5 to 7.0 is suitable for the propagation and planting (Mahorkar and Bahiram, 2019). Dragon fruit can be propagated by seed and sapling, but sapling propagation is the most common and simplest practice for which the entire section of saplings ranges in length from 10 to 60 cm (Zee *et al.*, 2004). In rooting, sapling length plays an important role and it is the main element deciding the success of rooting (Leakey, 2004). In India, having less cultivation and production of dragon fruit due to lack of research on adoptability of plant species under biotic and abiotic stresses. Therefore, with respect to this fruit, farmers have to face many difficulties. Considering the above fact, to conduct an experiment on performance of different growing conditions and length of cuttings on biochemical parameters of dragon fruit (*Hylocereus undatus*) saplings to evaluate the biochemical changes in plants to tolerate the abiotic stresses.

MATERIALS AND METHODS

An experiment on dragon fruit (*Hylocereus undatus*) was conducted at ICAR-National Institute of Abiotic Stress Management, Malegaon (Baramati) Pune, India during 2019-2020. The experiment was laid out in a Factorial Complete Randomized Design with two factors *viz*. growing conditions (open field and shade net) and length of saplings (15 cm, 25 cm, 35 cm and 45 cm) and 08 treatment combinations with three replicates. The observations were recorded as per standard procedures. The statistical analysis of the data in respect of success rate of saplings was done according to the standard procedure given by Panse and Sukhatme (1996). The treatments means were separated by least significant differences (LSD) at 5% probability using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Performance of different growing conditions and length of cuttings on biochemical parameters of dragon fruit saplings: Growing conditions exhibited a significant effect on all biochemical parameters of dragon fruit saplings at 50 days intervals days after first shoot initiation (Table 1). Particularly, maximum moisture content (79.33%) and total chlorophyll content (6.90 mg g^{-1}) were recorded under shade net growing condition, however maximum protein (0.25 mg g^{-1}), total phenol (44.47 mg g^{-1}), proline (49.92ì g^{-1}) and total sugar (5.86%) were recorded in open field growing condition. The length of cuttings also had marked significant influence on all the biochemical parameters except the moisture content at 50 days after first shoot initiation. The 35cm length of cuttings exhibited highest total chlorophyll content (6.13 mg g^{-1}) and total sugar (5.88%), however maximum protein (0.25 mg g^{-1}), total phenol (39.70 mg g^{-1}) and proline (46.51ì g^{-1}) was recorded in 45cm length of cuttings. Interactive effect of different growing conditions and length of cuttings on all the biochemical parameters at 50 days after first shoot initiation found to be non-significant.

In the growing conditions, shade net condition recorded maximum moisture and total chlorophyll

Table 1. Performance of different growing conditions and length of cuttings on biochemical parameters of dragon fruit saplings.

Treatments	Moisture (%) 50 DAFSI	Total chlorophyll (mg g^{-1}) tissue 50 DAFSI	Protein content (mg g^{-1}) 50 DAFSI	Phenol content (mg g^{-1} GAE) 50 DAFSI	Proline content (μ g^{-1}) 50 DAFSI	Total sugars (%) 50 DAFSI
Growing Conditions (G)						
Open field	71.72^{b}	5.12^{b}	0.25^{a}	44.47^{a}	49.92^{a}	5.86^{a}
Shade net	79.33^{a}	6.90^{a}	0.20^{b}	29.07^{b}	31.34^{b}	5.36^{b}
S.E (m)±	0.26	0.03	0.03	0.54	0.61	0.07
C.D @ 5%	0.79	0.10	0.09	1.62	1.83	0.21
Length of Cuttings (L)						
15 cm	75.30^{a}	5.98^{b}	0.20^{d}	33.87^{c}	34.83^{d}	5.29^{c}
25 cm	75.57^{a}	6.02^{ab}	0.21^{c}	35.98^{bc}	39.12^{c}	5.51^{bc}
35 cm	76.10^{a}	6.13^{a}	0.23^{b}	37.54^{ab}	42.06^{b}	5.88^{a}
45 cm	75.12^{a}	5.92^{b}	0.25^{a}	39.70^{a}	46.51^{a}	5.74^{ab}
S.E (m)±	0.37	0.05	0.04	0.76	0.87	0.10
C.D @ 5%	NS	0.14	0.12	2.28	2.59	0.30
Interactions (G × L)						
Open field+15 cm	71.40^{a}	5.09^{a}	0.22^{a}	41.65^{a}	43.59^{a}	5.56^{a}
Open field+25 cm	71.81^{a}	5.13^{a}	0.24^{a}	43.21^{a}	48.87^{a}	5.81^{a}
Open field+35 cm	72.42^{a}	5.21^{a}	0.25^{a}	45.07^{a}	51.13^{a}	6.07^{a}
Open field+45 cm	71.25^{a}	5.05^{a}	0.27^{a}	47.96^{a}	56.10^{a}	6.00^{a}
Shade net+15 cm	79.20^{a}	6.86^{a}	0.18^{a}	26.10^{a}	26.07^{a}	5.03^{a}
Shade net+25 cm	79.33^{a}	6.91^{a}	0.19^{a}	28.75^{a}	29.36^{a}	5.22^{a}
Shade net+35 cm	79.79^{a}	7.04^{a}	0.21^{a}	30.00^{a}	33.00^{a}	5.70^{a}
Shade net+45 cm	78.99^{a}	6.79^{a}	0.22^{a}	31.43^{a}	36.93^{a}	5.48^{a}
S.E (m)±	0.53	0.07	0.05	1.08	1.22	0.14
C.D @ 5%	NS	NS	NS	NS	NS	NS

DAFSI: Days after first shoot initiation.

content compared to the open field condition. This might be due to availability of relative humidity in shade net condition which helps to increase moisture level of shoots as a water form. The shade net condition reduces air temperature with optimum humidity and helps to increase moisture content in shoots, while high temperature causes loss of cell water (Rodriguez *et al.,* 2005) in open field condition resulting in loss of shoot moisture. The increase in chlorophyll content in shade due to efforts of plant adjusts in optimum light intensity. Plants under diffused light had greatest chlorophyll content than plants grown under direct sunlight this result correlates with finding of Bista *et al.,* (2020). The 35 cm long saplings have shown the maximum moisture content and total chlorophyll, which may be due to maximum growth of saplings. The maximum protein, phenol, proline and sugar content of the shoot observed under the open field condition indicates higher temperature, radiation and moisture stress in open field as compared to shade net as effect stunted plant growth in open field. The Heat Shock Protein increases when plant experiences high temperature (Firmansyah and Argosubekti, 2020). Temperature stress induces the accumulation of plant phenolics by activating their biosynthesis as well as inhibiting their oxidation (Rosa *et al.,* 2001). Solar radiation increases heat under open field condition causing increased proline content and it protects plants by stabilizing the proteins in plants (Paleg *et al.*, 1984; and Hare *et al.,* 1998). Heat stress increases the carbohydrates in plants (Liu and Huang, 2000). Saplings with a longest length of cuttings resulted in lower shoot length and thereof increase the abiotic stress due to low moisture content in shoots as effect increase protein, phenol and proline content with longest saplings length.

CONCLUSION

The critical evaluation of results of the present study indicated that, considering the overall performance of growing conditions and length of cuttings studied, shade net condition with 35 cm length of cuttings treatment have performed better for most of the traits under study. The shade net conditions with 35 cm length of cuttings provide optimum or stress free conditions to dragon fruit (*Hylocereus undatus*) saplings.

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