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Influence of photoselective shade nets on growth and yield of Asparagus

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Abstract

Study on "Influence of photoselective shade nets on growth and yield of Asparagus" was carried out at KRC college of Horticulture, Arabhavi, Gokak, Karnataka during 2018-19. The result revealed that, among photoselective shade nets, plant height, plant spread and internodal length were higher under red shade net. Plants grown under grey shade net recorded higher number of cut cladophylls per plant (54.89) and per square meter (406.73). Cladophylls harvested from grey shade net recorded maximum vase life (12 days) followed by red (10.28 days). Among different asparagus species, *A. densiflorus* 'Sprengeri' performed better with respect to vegetative growth and yield. Higher cumulative number of cut cladophylls per plant (61.07) and per square meter (452.50) was recorded in *A. densiflorus* 'Sprengeri' followed by *A. densiflorus* 'Myers'. *A. densiflorus* 'Myers' recorded maximum vase life (10.20 days) followed by *A. myriocladus* (10.10 days).

Keywords: Photoselective, cut foliage, cut greens, asparagus, cladophyll

Introduction

Cut greens also known as ornamental filler crops, occupy an important position in the local and international market and constitute an important section of floral industry as cut foliages. Cut foliage is used in large quantities for decoration either on its own or in association with flowers in bouquets. The cut foliages are exploited because of year around production, low investment and lesser market risk. The perishable decorative greens, which were used earlier at about five per cent as fillers in bouquet making have increased substantially to 20-25 per cent (Bhattacharjee, 2006) [3]. This trend is set to increase further because of the green, healthy image presented by such products and the predicted increase in consumption of floral products. Several asparagus species and cultivars viz., *A. densiflorus* Myers, *A. densiflorus* Sprengeri, *A. myriocladus*, *A. plumosus*, *A. virgatus* are becoming popular as specialty products for use in floral decorations (Stamps, 2009) [14]. Plants respond to quantity, quality and duration of light. Light quantity (light intensity) can be modified by use of shade nets of different shade factor ranging from 25 to 75 per cent. Photoselective shade netting is a new approach that can be used for modification of light quality. These photoselective nets are manufactured in blue, grey, pearl, red, white, green and yellow colours (Rajapakse and Shahak, 2007) [10] which can alter the light spectrum. The scientific knowledge regarding use of photoselective shade nets for cultivation of cut greens like asparagus is very limited which warrants urgent need for systematic study on use of photoselective shade nets in cultivation asparagus. Therefore, an attempt to study the performance of different species of asparagus under different photoselective shade nets can be of great help to farmers to take up the cultivation of Asparagus as an alternate crop to obtain high yield and realise more profit.

Material and Methods

The experiment was laid out at Department of Floriculture and Landscape Architecture, KRC College of Horticulture, Arabhavi (University of Horticultural Sciences, Bagalkot) during the year 2018-2020 in a factorial completely randomized block design (FCRD) with two factors viz., five different photoselective shade nets (Red, blue, grey, pearl and green) as factor I and three different species of Asparagus (*A. densiflorus* 'Myers', *A. densiflorus* 'Sprengeri' and *A. myriocladus*) as factor II with three replications.

Shade houses of 15 m X 10 m are constructed at 5 m apart to avoid overlapping of shade. Each structure was covered with five different photosensitive shade nets of 50 percent light factor. Raised beds of 0.90 m width, 45 cm height and 14 m length were prepared. Each bed was divided into plots of 1.8 m length and twelve plants were planted per plot with spacing of 45 cm between rows and 30 cm between each plant. Data on growth and yield parameters was recorded at 18 months after planting.

Results and Discussion

The observations on growth parameters *viz.*, plant height, plant spread, internodal length, cladophyll production interval, number of cladophylls and leaf area were recorded at 18 months after planting.

Among five different shade nets under study, plant height, plant spread and internodal length were higher under red shade net (49.86cm, 7950.11 cm² and 2.24 cm, respectively), whereas, lower under blue shade net (37.53 cm, 4610.33 cm² and 1.67 cm, respectively). Variation in plant height and plant spread may be attributed to variation in internodal length under different shade nets. Improved internodal length in red shade net may be attributed to the reduced ratio of R/FR light or the deficiency of blue light (Oren-Shamir *et al.*, 2001) [6]. Islam *et al.* (2014) [4] reported higher levels of endogenous gibberellic acid in poinsettia plants when exposed to far red light which resulted in elongation of internodes ultimately increasing the plant height. The lower internodal length in blue colour net could be attributed to the blue light phytochrome B-cryptochrome effect which could reduce the transport of auxin (Ballare *et al.*, 1995) [2]. Since the plants grown under blue colour shade net are likely to receive blue light from all directions, it is possible that the reduction in auxin transport minimizes the elongation of cells surrounding the stem just beneath the zone of cell division of the apical meristem thereby, leading to reduced elongation of stem just as in the case of chrysanthemum and Easter lilies (Rajapakse and Kelly, 1992; Oyaert *et al.*, 1999) [9, 7]. Among different species, *A. densiflorus* 'Sprengeri' recorded higher plant height and plant spread. Whereas, *A. densiflorus* 'Myers' recorded minimum plant height and spread. Further, internodal length of *A. myriocladus* was significantly higher and *A. densiflorus* 'Myers' recorded lower internodal length. Such a range of variability in plant height, plant spread and internodal length among the varieties is mainly due to genetic nature, growing environmental conditions and cultural practices. This was in accordance with the reports of Safeena *et al.* (2019) [12] in Asparagus species.

Maximum number of cladophylls and leaf area per plant (Table 1) was recorded in grey shade net (53.33 and 17365.21 cm², respectively) while, minimum was recorded in blue shade net (38.06 and 7978.55 cm², respectively). Variations in number of cladophylls per plant may be attributed to varying cladophyll production interval under different photosensitive nets. Plants grown under grey shade net produced newer cladophylls at higher frequency. Further, Variations in leaf area may be attributed to variation in light intensities under different coloured shade nets. Decreased light intensity in grey shade net increased leaf production and leaf area. Similar

observations were also made by Aasha (1986) [1] in different indoor plants. Among the different species maximum number of cladophylls per plant was observed in *A. densiflorus* 'Sprengeri' (50.11), whereas, minimum was recorded in *A. myriocladus* (34.88). Similar differences with respect to cladophyll production was reported by Safeena (2013) [11]. Among the species, maximum leaf area was found in *A. myriocladus* while, minimum was found in *A. densiflorus* 'Myers' during all stages of growth.

In the present investigation, early harvesting was seen in *A. densiflorus* 'Sprengeri' while *A. myriocladus* took maximum days to first harvest (Table 2). Harvesting of cladophylls was carried out after six months of planting and cumulative yield per plant and per square meter was recorded. With respect to photosensitive shade nets, maximum cumulative number of cut cladophylls per plant and per square meter was recorded in grey shade net (54.89 and 406.73, respectively) followed by red shade net (48.59 and 360.04, respectively) while, minimum was recorded in green shade net (27.44 and 203.36 respectively). These variations may be attributed to production of a greater number of cladophylls per plant due to more frequent production of cladophyll (lower cladophyll production interval) under grey shade net. Stamps and Chandler (2008) [13] reported similar variations in yield parameters due to different photosensitive shade nets in *Aspidistra elatior*. Among the species, maximum cumulative number of cut cladophylls per plant and per square meter was found in *A. densiflorus* 'Sprengeri' (61.07 and 452.50, respectively) while, minimum was found in *A. myriocladus* (25.37 and 188.02, respectively). The cladophyll production interval was less in *A. densiflorus* 'Sprengeri' which resulted in higher yield. Similar results were obtained by Pratheeksha (2019) [8] in asparagus.

Among photosensitive shade nets higher cumulative weight of cut cladophylls per plant and per square meter (Table 2) was recorded in grey shade net (542.15 g and 4017.36 g respectively) while, minimum was recorded in green shade net (217.14 g and 1609.02 g respectively). Among different species under study, higher cumulative weight of cut cladophylls per plant and per square meter was recorded in *A. densiflorus* 'Sprengeri' (529.71 g and 3925.12 g respectively) and lower in *A. densiflorus* 'Myers' (246.59 and 1827.26 respectively). Variations with respect to fresh weight of cut cladophylls may be attributed to genetic makeup of a plant. Similar variations due to species / varieties in asparagus were also reported by Pratheeksha (2019) [8] and Safeena *et al.* (2019) [12].

Vase life of cut cladophylls was maximum (12 days) in grey shade net followed by red shade net (10.28), while minimum (8.11 days) was found in green shade net (Table 2). Similar variations in vase life due to different photosensitive shade nets in *A. densiflorus* was also reported by Myrthong (2016) [5]. With respect to species, maximum vase life was found in *A. densiflorus* 'Myers' (10.20 days) which was on par with *A. myriocladus* (10.10 days) and minimum was observed in *A. densiflorus* 'Sprengeri' (8.39 days). Similar variations in vase life due to different species of asparagus was also reported by Safeena *et al.* (2019) [12].

Table 1: Growth parameters in *Asparagus* species as influenced by photoselective shade nets

| Treatment s | Plant height (cm) | Plant spread (cm ²) | Internodal length (cm) | Number of cladophylls per plant | Cladophyll production interval (days) | Leaf area per plant (cm ²) |
|--|-------------------|---------------------------------|------------------------|---------------------------------|---------------------------------------|--|
| Factor A (S- Photoselective shade nets) | | | | | | |
| S ₁ | 49.86 | 7950.11 | 2.24 | 45.67 | 6.18 | 10740.53 |
| S ₂ | 37.53 | 4610.33 | 1.67 | 38.06 | 7.93 | 7978.55 |
| S ₃ | 48.21 | 6461.56 | 1.71 | 53.33 | 5.97 | 17365.21 |
| S ₄ | 43.69 | 6499.56 | 1.95 | 45.95 | 6.41 | 9840.00 |
| S ₅ | 44.83 | 4623.39 | 2.08 | 39.25 | 10.87 | 8581.86 |
| S.Em± | 0.30 | 2.27 | 0.03 | 0.28 | 0.11 | 100.27 |
| CD @ 1% | 1.15 | 8.83 | 0.12 | 1.10 | 0.42 | 389.94 |
| Factor B (T- <i>Asparagus</i> species) | | | | | | |
| T ₁ | 34.65 | 1770.07 | 0.69 | 48.36 | 6.89 | 4048.29 |
| T ₂ | 52.73 | 13452.47 | 2.40 | 50.11 | 4.86 | 10573.37 |
| T ₃ | 47.09 | 2864.43 | 2.71 | 34.88 | 10.66 | 18082.03 |
| S.Em± | 0.23 | 1.76 | 0.02 | 0.22 | 0.08 | 77.67 |
| CD @ 1% | 0.89 | 6.84 | 0.09 | 0.86 | 0.32 | 302.05 |
| Factor A X B (S X T) | | | | | | |
| S ₁ T ₁ | 37.94 | 3221.00 | 0.64 | 56.00 | 5.14 | 5043.74 |
| S ₁ T ₂ | 64.62 | 16415.67 | 2.81 | 53.35 | 3.92 | 10907.47 |
| S ₁ T ₃ | 47.01 | 4213.67 | 3.27 | 27.67 | 9.48 | 16270.39 |
| S ₂ T ₁ | 28.45 | 1297.33 | 0.67 | 42.63 | 7.19 | 3870.75 |
| S ₂ T ₂ | 40.38 | 10212.67 | 1.73 | 39.19 | 5.84 | 7590.78 |
| S ₂ T ₃ | 43.75 | 2321.00 | 2.61 | 32.35 | 10.76 | 12474.10 |
| S ₃ T ₁ | 40.14 | 1606.33 | 0.58 | 49.28 | 5.07 | 4777.81 |
| S ₃ T ₂ | 48.41 | 15127.67 | 2.19 | 68.34 | 3.90 | 16653.97 |
| S ₃ T ₃ | 56.09 | 2650.67 | 2.37 | 42.39 | 8.94 | 30663.83 |
| S ₄ T ₁ | 34.32 | 1530.33 | 0.63 | 47.29 | 5.77 | 2855.21 |
| S ₄ T ₂ | 54.47 | 15050.33 | 2.58 | 49.06 | 3.90 | 9047.14 |
| S ₄ T ₃ | 42.27 | 2918.00 | 2.65 | 41.49 | 9.55 | 17617.64 |
| S ₅ T ₁ | 32.39 | 1195.33 | 0.92 | 46.62 | 11.30 | 3693.92 |
| S ₅ T ₂ | 55.78 | 10456.00 | 2.70 | 40.62 | 6.74 | 8667.49 |
| S ₅ T ₃ | 46.34 | 2218.83 | 2.63 | 30.51 | 14.56 | 13384.18 |
| S.Em± | 0.51 | 3.93 | 0.05 | 0.49 | 0.18 | 173.67 |
| CD @ 1% | 1.99 | 15.29 | 0.20 | 1.91 | 0.72 | 675.40 |

S₁ - Red Shade netS₂ - Blue Shade netS₃ - Grey Shade netS₄ - Pearl Shade netS₅ - Green Shade netT₁ - *Asparagus densiflorus* 'Myers'T₂ - *Asparagus densiflorus* 'Sprengeri'T₃ - *Asparagus myriocladus*

NS - Non-significant

Table 2: Days to first harvest and number of cut cladophylls per plant of *Asparagus* species as influenced by photoselective shade nets

| Treatments | Days to first Harvest | Number of cut cladophylls | | Fresh weight of cut cladophyll (g) | | Vase life (days) |
|--|-----------------------|---------------------------|-----------|------------------------------------|-----------|------------------|
| | | Per plant | Per sq.m. | Per plant | Per sq.m. | |
| Factor A (S- Photoselective shade nets) | | | | | | |
| S ₁ | 168.13 | 48.59 | 360.04 | 413.05 | 3060.69 | 10.28 |
| S ₂ | 170.54 | 35.88 | 265.85 | 296.60 | 2197.83 | 8.39 |
| S ₃ | 170.34 | 54.89 | 406.73 | 542.15 | 4017.36 | 12.00 |
| S ₄ | 169.29 | 43.89 | 325.22 | 367.39 | 2722.37 | 9.94 |
| S ₅ | 171.99 | 27.44 | 203.36 | 217.14 | 1609.02 | 8.11 |
| S.Em± | 1.35 | 0.54 | 4.03 | 5.23 | 38.79 | 0.32 |
| CD @ 1% | NS | 2.12 | 15.68 | 20.36 | 150.85 | 1.24 |
| Factor B (T- <i>Asparagus</i> species) | | | | | | |
| T ₁ | 172.86 | 39.97 | 296.20 | 246.59 | 1827.26 | 10.20 |
| T ₂ | 165.59 | 61.07 | 452.50 | 529.71 | 3925.12 | 8.93 |
| T ₃ | 171.72 | 25.37 | 188.02 | 325.50 | 2411.99 | 10.10 |
| S.Em± | 1.04 | 0.42 | 3.12 | 4.05 | 30.05 | 0.25 |
| CD @ 1% | 4.06 | 1.64 | 12.14 | 15.77 | 116.85 | 0.96 |
| Factor A X B (S X T) | | | | | | |
| S ₁ T ₁ | 170.17 | 46.80 | 346.79 | 279.11 | 2068.23 | 10.67 |
| S ₁ T ₂ | 164.70 | 70.07 | 519.19 | 596.04 | 4416.66 | 9.00 |
| S ₁ T ₃ | 169.53 | 28.90 | 214.15 | 363.99 | 2697.19 | 11.17 |
| S ₂ T ₁ | 172.79 | 33.67 | 249.47 | 177.25 | 1313.40 | 8.67 |
| S ₂ T ₂ | 167.83 | 49.00 | 363.09 | 418.60 | 3101.83 | 7.50 |
| S ₂ T ₃ | 171.00 | 24.97 | 185.00 | 293.96 | 2178.27 | 9.00 |
| S ₃ T ₁ | 172.31 | 53.27 | 394.71 | 409.40 | 3033.65 | 13.17 |
| S ₃ T ₂ | 167.03 | 80.07 | 593.29 | 746.59 | 5532.26 | 10.67 |
| S ₃ T ₃ | 171.67 | 31.33 | 232.18 | 470.47 | 3486.16 | 12.17 |

| | | | | | | |
|-------------------------------|--------|-------|--------|--------|---------|-------|
| S ₄ T ₁ | 172.60 | 40.47 | 299.86 | 236.37 | 1751.53 | 9.83 |
| S ₄ T ₂ | 166.00 | 65.53 | 485.60 | 554.23 | 4106.82 | 9.50 |
| S ₄ T ₃ | 169.27 | 25.67 | 190.19 | 311.57 | 2308.76 | 10.50 |
| S ₅ T ₁ | 176.43 | 25.67 | 190.19 | 130.83 | 969.48 | 8.67 |
| S ₅ T ₂ | 162.40 | 40.67 | 301.34 | 333.07 | 2468.02 | 8.00 |
| S ₅ T ₃ | 177.13 | 16.00 | 118.56 | 187.53 | 1389.57 | 7.67 |
| S.Em± | 2.34 | 0.94 | 6.98 | 9.07 | 67.18 | 0.55 |
| CD @ 1% | NS | 3.66 | 27.16 | 35.26 | 261.28 | 2.15 |

S₁ - Red Shade netS₂ - Blue Shade netS₃ - Grey Shade netS₄ - Pearl Shade netS₅ - Green Shade netT₁ - Asparagus densiflorus 'Myers'T₂ - Asparagus densiflorus 'Sprengeri'T₃ - Asparagus myriocladus

NS - Non-significant

Conclusion

Among different shade nets used, plants grown under red shade net performed better with respect to vegetative parameters (plant height, plant spread and internodal length). Whereas, plants grown under grey shade net performed better with respect to number of cladophylls per plant, cladophyll production interval and leaf area. Higher cumulative number of cut cladophylls per plant (54.89) and per m² (406.73) was recorded in grey shade net followed by red shade net. Cladophylls harvested from plants grown under grey shade net recorded maximum vase life (12 days) followed by red (10.28 days) and pearl shade net (9.94 days). Among different species, *A. densiflorus* 'Sprengeri' performed better with respect to vegetative growth and yield. Higher cumulative number of cut cladophylls per plant (61.07) and per m² (452.50) was recorded in *A. densiflorus* 'Sprengeri' followed by *A. densiflorus* 'Myers'. *A. densiflorus* 'Myers' recorded maximum vase life (10.20 days) followed by *A. myriocladus* (10.10 days) and *A. densiflorus* 'Sprengeri' (8.93).

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