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EFFECT OF DIFFERENT GROWING MEDIA AND SHADE LEVELS ON POT PLANT PRODUCTION OF *Aglaonema modestum*

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ABSTRACT

An investigation was carried out to study the relative performance of indoor pot plant *Aglaonema modestum* in various media composition and shade levels on pot plant production. The experiment was laid down under shade nets with different light intensity levels i.e. 50%, 75% and 90% in a Completely Randomised Design (CRD) of 13 treatment combinations with four levels of growing media i.e. Soil + Sand+ FYM (1:1:1 v/v), Soil+ Cocopeat + FYM (1:2:2 v/v), Soil+ Cocopeat + Vermicompost (1:2:1 v/v) and Forest Soil. Findings revealed that maximum plant height (34.02cm), number of leaves (25.40 cm), plant spread (29.50cm), leaf length (18.90cm),leaf width (8.42cm) leaf area (108.49 cm^2), chlorophyll (0.660), visual leaf colour grade (4.93) and plant growth index (63.52) was recorded in growing media Soil + Cocopeat + Vermicompost (1:2:1 v/v) with 90% of shade level. It can be concluded that growing media comprising of Soil + Cocopeat + Vermicompost (1:2:1v/v) with 90% of shade level was suitable for pot plant production of *Aglaonema modestum*.

Keywords: *Aglaonema modestum*, Cocopeat, Foliage plant, Shade level, Vermicompost

Foliage plants are the interesting group of ornamentals which are valued for their foliage and can be grown for longer periods in the indoors. Aglaonema (*Aglaonema modestum*) is an attractive indoor foliage plant commonly called Chinese Evergreen. The genus *Aglaonema* belongs to the family Araceae including 21 species. *Aglaonema* species and cultivars are valuable ornamental foliage plants and are tolerant to different environmental conditions of commercial and residential interior scapes. It is grown from substantial clumps of green stems with 10 to 14 inch long, shiny glossy dark green, leathery, waxy, 15-20 cm long, pendent and ovate acuminate leaves. Flowering time of *Aglaonema* is summer, late summer or early fall. *Aglaonema* needs shade to grow and can tolerate dark places in indoors. Warm room temperature is suitable for this plant. *Aglaonema modestum* needs a moderate temperature i.e. between 16 and 21˚C (60-70˚F) all year round and winter temperature should not drop below 13˚C (55˚F). Moderate watering is required during active growth period. Use of good growing media is important for quality pot production of *Aglaonema*. An ideal growing medium should be free of weeds and diseases. The media should be well drained and should retain enough water to reduce frequency of watering. So, use of good growing media is important for quality pot production of Aglaonema. The components selected to make growing substrate affect its physical and chemical properties. Different combinations consisting of peat moss, bark, wood chips, saw dust, vermicompost, FYM, cocopeat, soil are used to grow pot plants for indoors. Swetha *et al*. (2014) reported that *Aglaonema* cv. 'Ernesto's Favourite' grown in growing medium consisting of cocopeat + sand + vermicompost (2:1:1v/v) resulted in maximum plant height, number of leaves, leaf area, plant growth index, fresh weight of roots, dry weight of root, visual plant grade and visual colour grade. Light intensity, received by plant is important for proper plant growth of indoor plants. Quality of light and its wavelength is an important aspect for photosynthesis and growth. Light is absorbed by the plant and turned into energy through photosynthesis. Under natural conditions, *Aglaonema modestum* grows well in lower tier forest, where little light penetrates. It is tolerant to shade but cannot tolerate direct sunlight. And it requires 100-300 foot candles light intensity for its proper growth. Some studies revealed that shaded conditions increase plant height and number of leaves in Aglaonema when compared with full sun conditions. Shade is a very important factor in reducing leaf and air temperature as it absorbs most of the solar radiation entering the greenhouse during summer period (Al- Helal and Al- Musalam, 2003). Aasha and Nair (1992) reported the influence of different light intensities on growth parameters of some foliage plants and recommended that *Aglaonema costatum, Alocasia cuprea* and *Dracaena sanderiana* showed more number of leaves under shade as compared to full sunlight. Keeping in view the present demand and paucity of research work

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done on this crop on the above mentioned aspects, the present studies were carried out on the "Effect of different growing media and shade levels on pot plant production of *Aglaonema modestum*".

MATERIALS AND METHODS

The experiment was conducted at the Experimental farm of Department of Floriculture and Landscape Architecture, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan(HP). The experimental area falls under mid hill zone of Himachal Pradesh with sub temperate climate characterized by mid summers and cool winters. Healthy disease free rooted cuttings (with 3-4 number of leaves) were planted in completely sterilized media consisting of Soil, FYM, Cocopeat, Vermicompost and Forest soil in different combinations. Source of Forest Soil is oak tree forest soil. Experiment was laid out under shade nets with 50%, 75% and 90% shade levels in Completely Randomised Design (CRD) with 3 replications. There were total of 13 treatments [T_1: Soil + Sand+ FYM (1:1:1 v/v) with 50% Shade,T_2: Soil + Sand + FYM (1:1:1 v/v) with 75% Shade, T_3: Soil + Sand + FYM (1:1:1 v/v) with 90% Shade, T_4: Soil+ Cocopeat + FYM (1:2:2 v/v) with 50% Shade, T_5: Soil+ Cocopeat + FYM (1:2:2 v/v) with 75% Shade, T_6: Soil+ Cocopeat + FYM (1:2:2 v/v) with 90% Shade, T_7: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 50% Shade, T_8: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 75% Shade, T_9: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 90% Shade, T_{10}: Forest Soil with 50% Shade, T_{11}: Forest Soil with 75% Shade, T_{12}: Forest Soil with 90% Shade and T_{13}: Soil + Sand+ FYM (1:1:1 v/v) with normal indoor conditions]. The observations were recorded on important growth parameters like Number of leaves, Plant spread(cm), Leaf length(cm), Leaf width (of fully expanded leaves was measured with meter scale),Leaf area (of fully expanded leaves was measured with leaf area meter), Chlorophyll content (estimated using DMSO method (Dimethyl sulphoxide) (Hiscoxand Israelstam, 1979)), Plant height (recorded from the base of the plant to the apical growing point of the tallest shoot of the plant),visual leaf colour grade (visual leaf grade was determined using the grade table using 1, 3 and 5 scale grade system, where 1= poor colour, 3= Good (light green)and 5= Excellent (dark green and shining) as given by Henny *et al.* (2008) and Plant Growth Index (Plant growth index was calculated by using the formula of net change in plant height plus net change in plant width). The standard cultural practices were followed throughout the growing season from planting till the day of termination of the trial (240 days). To raise healthy crop, intercultural operations i.e. transplanting, hoeing, weeding, etc. were carried out manually depending upon the requirement of the crop. The data recorded under field conditions was subjected to statistical analysis using MS- Excel and OPSTAT packages using Completely Randomized Design (CRD) described by (Gomez,1984).

RESULTS AND DISCUSSION

Number of leaves

The number of leaves (Table 1) was significantly higher in T_9 comprising of Soil+ Cocopeat + Vermicompost (1:2:1v/v) (25.40) with 90%. These results resemble to the findings of (Awang *et al.,* 2010), who noticed that when *Celosia cristata* was grown in medium consisting of cocopeat: kenaf core fibre, it resulted in high leaf development. These results might be because medium contains both cocopeat and a vermicompost characteristic where cocopeat composes of higher total pore space and vermicompost consists of high organic matter (Sahni *et al*., 2008). Bhatia *et al.*(2004) reported that FYM and cocopeat amended media improved several growth and floral parameters in *Dianthus caryophyllus*. Regarding light intensity (Sharma *et al.*,1992) noticed that decreased light intensity (2000-3000 Lux) resulted in increase in number of leaves of *Aglaonema costatum*.

Plant spread

It is evident from data presented in Table 1 that potting media and shade levels had significant impact on indoor foliage plant species with respect to plant spread. Maximum plant spread was recorded in T_9 consisting of Soil + Cocopeat + Vermicompost (1:2:1v/v) (29.50cm) with 90% shade. This may be due to versatile properties of cocopeat and vermicompost containing adequate quantities of N, P, K and several micronutrients essential for plant growth (Preethi *et al.*, 2018). Improvement in plant spread of potted Dieffenbachia in media comprising of coconut coir: FYM (1:1v/v) was also reported by Sarkar *et al*, 2016. Similar good foliage habits were observed by (Al-Menaie *et al.*, 2008) in *Gardenia jasminoides* grown in peat mixture. Further, *Aglaonema costatum* when grown under low light intensity resulted in good leaf parameters as studied by Sharma *et al*. (1992).

Leaf length

It is evident from Table 1 that maximum leaf length was recorded in T_9 (18.90cm) containing Soil + Cocopeat + Vermicompost (1:2:1v/v) with shade level of 90%. Addition of cocopeat in media increases the aeration and water holding capacity of the mix; it makes the media resistant to various fungal and bacterial growth which has high oxygen properties and helps in root development (Gohil *et al.*, 2018). Anjana *et al*. (2017) also studied the properties of cocopeat due to its porosity and high nutritive value and reported that

cocopeat improves the porosity, wettability, CEC and water holding capacity of the media. Hatem *et al*. (2007) also revealed increased plant growth when *Aglaonema crispum* was grown under shaded net house as compared to un-shaded. Similar results were reported by Aasha *et al*. (1992), who observed that low light intensity resulted in more leaf length in *Aglaonema*.

Leaf width

Growing media and shade level tend to influence the leaf width in *Aglaonema* plants as presented in Table 1. Maximum leaf width was recorded in T_9 (8.42cm) consisting of Soil + Cocopeat + Vermicompost (1:2:1v/v) with shade level of 90%. Similar results on leaf width were obtained by Swetha *et al.* (2014) in *Aglaonema* cv. 'Ernesto's favourite', when cocopeat was used as a constituent of growing media.This result corresponds to better physiological, chemical properties of cocopeat and FYM. Cocopeat allows maximum air and nutrients to reach to the root system which have been one of the reasons for better and vigorous growth.

Leaf area

Effect of growing media and shade levels are presented in Table 1. Maximum leaf area was recorded in T_9 with 90% shade.

The significant increase in leaf area may due to good aeration and better nutrient status of the growing substrate and higher water holding capacity of cocopeat and high nutrient content of FYM. Leaf area is a crucial growth index determining the capacity of plant to trap solar energy for photosynthesis and has a marked effect on growth of the plant. Higher water holding capacity of cocopeat and high nutrient content of FYM may have been responsible for better leaf area. Cocopeat has the ability to store and release the plant nutrients on time for long period of time (Sahni *et al.*, 2008). FYM contains all the macro and micro nutrients required for plant growth (Heck, 1931).

Chlorophyll content

Growing media and shade levels significantly influenced the chlorophyll content in indoor pot plant *Aglaonema modestum* as presented in Table 2. Maximum chlorophyll content of leaves was recorded in T_9 (0.660µmol m^{-2}) containing Soil + Cocopeat + Vermicompost (1:2:1v/v) with 90% of shade level.

As cocopeat amended medium helps in higher production of proteins and higher nitrogen availability to the plants, which may lead to higher colour intensity in leaves (Scagel, 2003). Further, nutrition from vermicompost changes the biochemical properties of plants like chlorophyll, protein and enzyme synthesis.

Table 1. Effect of different growing media and shade levels on number of leaves, plant spread, leaf length, leaf width, leaf area and chlorophyll content of *Aglaonema modestum*

Treatment	No. of leaves	Plant Spread (cm)	Leaf Length (cm)	Leaf Width (cm)	Leaf Area (cm^2)
T_1	14.13	22.92	16.94	6.57	90.10
T_2	14.73	24.32	17.57	7.37	94.88
T_3	15.06	26.06	18.24	8.12	98.87
T_4	15.73	23.72	17.33	7.28	103.89
T_5	18.60	24.86	17.72	7.91	105.84
T_6	21.53	27.46	18.68	8.32	106.70
T_7	17.86	24.63	17.32	7.57	105.17
T_8	20.26	25.08	17.93	7.95	105.76
T_9	25.40	29.50	18.90	8.42	108.49
T_{10}	12.60	24.37	15.68	6.88	84.9
T_{11}	13.73	24.77	16.10	7.29	94.01
T_{12}	14.13	24.79	18.14	7.60	106.08
T_{13}	19.60	25.59	17.19	7.23	100.39
$CD_{0.05}$	1.15	0.82	0.45	0.379	1.84

T_1: Soil + Sand+ FYM (1:1:1 v/v) with 50% Shade,T_2: Soil + Sand + FYM (1:1:1 v/v) with 75% Shade, T_3: Soil + Sand + FYM (1:1:1 v/v) with 90% Shade, T_4: Soil+ Cocopeat + FYM (1:2:2 v/v) with 50% Shade, T_5: Soil+ Cocopeat + FYM (1:2:2 v/v) with 75% Shade, T_6: Soil+ Cocopeat + FYM (1:2:2 v/v) with 90% Shade, T_7: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 50% Shade, T_8: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 75% Shade, T_9: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 90% Shade, T_{10}: Forest Soil with 50% Shade, T_{11}: Forest Soil with 75% Shade, T_{12}: Forest Soil with 90% Shade and T_{13}: Soil + Sand+ FYM (1:1:1 v/v) with normal indoor conditions

Table 2. Effect of different growing media and shade level on plant height, visual leaf colour grade and plant growth index of *Aglaonema modestum*.

Treatment	Plant Height (cm)	Visual leaf colour grade	Plant growth index	Chlorophyll Content (µmol m^{-2})
T_1	29.45	3.80	53.22	0.629
T_2	31.58	4.33	55.46	0.631
T_3	33.52	4.73	57.98	0.634
T_4	31.74	4.20	55.90	0.633
T_5	33.12	4.46	59.58	0.645
T_6	33.66	4.86	61.12	0.659
T_7	31.90	4.06	58.13	0.636
T_8	33.36	4.46	58.44	0.657
T_9	34.02	4.93	63.52	0.660
T_{10}	28.82	3.93	53.19	0.622
T_{11}	32.10	4.60	56.87	0.642
T_{12}	33.34	4.73	56.53	0.655
T_{13}	31.06	4.60	56.65	0.639
$CD_{0.05}$	0.59	0.004	2.42	0.004

T_1: Soil + Sand+ FYM (1:1:1 v/v) with 50% Shade,T_2: Soil + Sand + FYM (1:1:1 v/v) with 75% Shade, T_3: Soil + Sand + FYM (1:1:1 v/v) with 90% Shade, T_4: Soil+ Cocopeat + FYM (1:2:2 v/v) with 50% Shade, T_5: Soil+ Cocopeat + FYM (1:2:2 v/v) with 75% Shade, T_6: Soil+ Cocopeat + FYM (1:2:2 v/v) with 90% Shade, T_7: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 50% Shade, T_8: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 75% Shade, T_9: Soil+ Cocopeat + Vermicompost (1:2:1 v/v) with 90% Shade, T_{10}: Forest Soil with 50% Shade, T_{11}: Forest Soil with 75% Shade, T_{12}: Forest Soil with 90% Shade and T_{13}: Soil + Sand+ FYM (1:1:1 v/v) with normal indoor conditions

Plant height

The perusal of data reveals that growing substrates as well as shade levels exhibit significant effects on plant height (Table 2). Maximum plant height was recorded in T_9 comprising of Soil+ Cocopeat + Vermicompost (1:2:1v/v) (34.02cm) with 90% shade, followed by T_6 which consists of Soil + Cocopeat + FYM (1:2:2v/v) (33.66cm) with 90% Shade. This could be ascribed to some growing media properties like better water holding capacity, aeration, low bulk density, optimum pH, EC and high nutrient content of this media as compared to other media. Further, different physiological and chemical properties of growing media and shade level greatly influenced the growth and development of this plant. Singh *et al*. (2000), who observed similar results in *Aglaonema* reported that cocopeat alone resulted in tallest plants followed by Cocopeat + Leaf mould. In another study, Aasha (1986) revealed that low light intensity in foliage plant *Aglaonema* resulted in increased plant height.

Visual leaf colour grade

Visual leaf colour grade referred to overall look and presentability of *Aglaonema* plant. Maximum visual leaf colour grade (Table 2) was recorded in T_9 (4.93) consisting of Soil + Cocopeat + Vermicompost (1:2:1v/v) with 90% shade level). Availability of higher nitrogen may be responsible for higher colour intensity. Swetha *et al* (2014) also concluded that higher visual leaf colour grade of *Aglaonema* cv. 'Ernesto's Favourite' resulted in media consisting of cocopeat and vermicompost.

Plant growth index

Maximum plant growth index (Table 2) was recorded in T_9 (63.52) containing Soil + Cocopeat + Vermicompost (1:2:1v/v) with 90% shade. WhereasT_{10} comprising of Forest Soil with 50% shade resulted in minimum plant growth index (53.19). These results are in confirmation with Preeti *et al.* (2018) who reported the versatile properties of cocopeat and adequate quantities of N, P, K and several micronutrients in vermicompost which are beneficial for plant growth.

It is concluded that Soil+ Cocopeat+ Vermicompost (1:2:1v/v) was a suitable growing media for quality pot plant production of *Aglaonema modestum* when kept under 90% shade level.

Authors' contribution

Conceptualization and designing of the research work (SB); Execution of field/lab experiments and data collection (MS); Analysis of data and interpretation (MS); Preparation of manuscript (MS).

LITERATURE CITED

Aasha 1986. *Effect of varying light intensities on the growth and development of indoor foliage and flowering plants*. M.Sc (Hort.) Thesis, Kerala Agricultural University, Trivandrum.

Aasha K and Nair S R 1992. Effect of varying light intensities on growth and development of indoor foliage plants. *South Indian Hortic* **40:** 64-66.

Al- Helal and Al- Musalam 2003. Influence of shading on the performance of a greenhouse evaporative cooling system. *Arab Gulf J Sci Res* **21:** 71-78.

Al- Menaie H S, Al- Shatti A A and Suresh N 2008. Effect of growing media on the growth and flowering patterns of *Gardenia jasminoides* under arid conditions. *Eur J Sci Res* **24:** 69-73.

Anjana , Fatmi U and Singh D 2017. Effect of different potting media in different potted croton varieties under shade net condition in Allahabad. *Int J Curr Microbiol Appl Sci* **6**: 3760-64

Awang S, Shaharom S S, Mohamad R B and Sclamat A 2010. Growth dynamics of *Celosia cristata*grown in cocopeat, burnt rice hull and kenaf core fibre mixtures. *Am J Agric Biol Sci* **5:** 70-76.

Bhatia S, Gupta Y C and Dhiman S R 2004. Effect of growing media and fertilizers on growth and flowering of carnation under protected cultivation. *J Ornam Hortic*. **7**:174-78.

Gohil P, Gohil M , Rajatiya J , Helepotara F, Solanki M, Malam V R and Barad R 2018. Role of growing media for ornamental pot plants. *Int J Pure App Biosc*. **6**:1219-24.

Hatem, Fathi G, El- Ebaby, El- Saady M, Badawy, Reda H, Emam 2017. Effect of external shading for greenhouse on growth and quality of some ornamental plants. *J Agric Eng* **24:** 630-47.

Heck 1931. Conservation and availability of the nitrogen in farm yard manure. *J Soil Sci* **31**: 335–63.

Henny R J, Chen J and Mellich T A 2008. Foliage plant cultivar: *Aglaonema* 'Stripes'. University of Florida, IFAS Extension, USA.

Hiscox J D and Israelstam G F 1979. A method for the extraction of chlorophyll from leaf tissue without maceration. *Can J Bot* **57:** 1332-34.

Preeti G, Gohil M, Rajatiya J, Halepotara F, Solanki M and Malam V R 2018. Role of growing media for ornamental pot plants. *Int J Pure App Biosci* **6:** 1219-24.

Sarkar N, Jana D, Nellipalli V K and Mandal T 2016. Efficacy of different media compositions on *Dieffenbachia* in pots. *Int J Life Sci Res* **11**:2457-61.

Sahni S, Sarma B K, Singh D P and Singh H P 2008. Vermicompost enhances the plant growth in promoting rhizobacteria in *Ciceraeritemum. J Crop Prot* **27:** 369-76.

Scagel F 2003. Growth and nutrient use of ericaceous plants grown in media amended with sphagnum moss peat or coir dust. *J Hortic Sci* **38:** 46-54.

Sharma S P, Jana B K and Bose T K 1992. Investigation on growth and development of house plants. In *National Seminar on Commercial Floriculture*, pp.16-17.

Singh D, Adhikari D and Barik S 2002. Effect of different growing substrates on Aglaonema. *J Bot Res Inst Tex* **12:** 241-22.

Swetha S, Padmalatha T, Dhanumjaya Rao and Siva Shankar 2014. Effect of potting media on growth and quality in *Aglaonema*. *J Hortic Sci* **9:** 90-93.