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Effect of potting media on growth parameters of *Nephrolepis undulate* J. Sm under protected condition

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Abstract
An experiment was conducted to study the effect of potting media on growth parameters of Nephrolepis undulate J. Sm under protected condition in Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere (Under University of Agricultural and Horticultural Sciences, Shivamogga) during 2018-19. The experiment was consisted with ten different treatments viz., T_1 - Soil + Sand + FYM (2:1:1) (Control), T_2 - Soil + Cocopeat + Vermicompost (2:1:1), T_3 - Soil + Coir pith + Vermicompost (2:1:1), T_4 - Soil + Cocopeat + FYM + Vermicompost (2:1:1:1), T_5 - Soil + Perlite + Coir pith + Vermicompost (2:1:1:1), T_6 - Cocopeat + Sand + FYM (2:1:1), T_7 - Cocopeat + Vermicompost + Coir pith (2:1:1), T_8 - Cocopeat + Vermicompost + FYM (2:1:1), T_9 - Cocopeat + Perlite + Sand + Vermicompost (2:1:1:1) and T_{10} - Cocopeat + Perlite + Coir pith + Vermicompost (2:1:1:1). Each treatment was replicated thrice in Completely Randomized Design (CRD). The results revealed that the plants which are grown in the media containing Soil + Cocopeat + FYM + Vermicompost (2:1:1:1) recorded the maximum plant height (95.30 cm), plant spread in both EW and NS direction (72.00 and 73.67 cm), number of shoots (6.17), croziers (3.10), fronds (12.00), crozier length (4.93 cm), frond length (87.00 cm) and width (15.67 cm), leaflet length (8.30 cm) and breadth (2.10 cm) and shoot diameter (0.95 mm) compared standard check.

Keywords: *Nephrolepis* fern, cocopeat, vermicompost, coir pith and perliten

Introduction
In India with changing life style and increased urban affluence, floriculture has assumed a commercial status in recent times, particularly during the past 2-3 decades. Availability of natural resources like diverse agro-climatic conditions permit production of a wide range of temperate and tropical flowers and cut greens, almost all through the year (Ladha and Gunjal, 2011) [8]. A cut foliage's occupy an important position in the local and international markets and constitute an important section of floral industry. It is either used alone in large quantities as a source of decoration or in association with flowers and other accessories for value addition. These attractive plant parts are known differently as cut greens, cut foliage's and florists greens. The commercial interest in one such foliage is fern, highly valued in the international florist greenery market because of their beautiful and varied foliage, long post-harvest life, low cost, low investment, year-round availability and versatile design qualities in form, texture and colour. Usually these cut foliage of ferns is harvested when the uppermost leaves are fully expanded to avoid postharvest wilting of the immature shoot tips (Safeena, 2013) [12]. A fern is a member of a group of vascular plants (plants with xylem and phloem) that reproduce *via* spores and have neither seeds nor flowers. The potting media play important role in the growth and development of foliage plants. The awareness of using these foliage plants is increasing day by day. These are mainly grown in inside and outside showrooms, hotels, houses, institutional buildings, bungalows *etc*. (Muthukumar and Prabha, 2012) [10]. There is a huge demand in the international market for foliage plants. Keeping the above points in view, the present study of *Nephrolepis undulate* J. Sm entitled standardization of potting media for *Nephrolepis undulate* J. Sm under protected condition.

Materials and Methods
The experiment was carried out at the Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere (Under University of Agricultural and Horticultural

Sciences, Shivamogga) during 2018-19. The experiment was laid out in Completely Randomized Design with 10 treatments and 3 replications [T_1 - Soil + Sand + FYM (2:1:1) (Control), T_2 - Soil + Cocopeat + Vermicompost (2:1:1), T_3 - Soil + Coir pith + Vermicompost (2:1:1), T_4 - Soil + Cocopeat + FYM + Vermicompost (2:1:1:1), T_5 - Soil + Perlite + Coir pith + Vermicompost (2:1:1:1), T_6 - Cocopeat + Sand + FYM (2:1:1), T_7 - Cocopeat + Vermicompost + Coir pith (2:1:1), T_8 - Cocopeat + Vermicompost + FYM (2:1:1), T_9 - Cocopeat + Perlite + Sand + Vermicompost (2:1:1:1) and T_{10} - Cocopeat + Perlite + Coir pith + Vermicompost (2:1:1:1)]. Each component of the mixture was added on the basis of volume while preparing the potting mixture which was added to earthen pots of 12" and the suckers were planted which are collected in the Mudigere region. The intercultural operations like weeding and irrigation were done as and when necessary. The observations were recorded at different intervals and were statistically analyzed.

Results and Discussion

The results of the present investigation revealed that plants which are grown in media containing soil + cocopeat + FYM + vermicompost in 2:1:1:1 recorded maximum plant height (95.30 cm) and plant spread in both EW and NS direction (72.00 and 73.67 cm) which was statistically on par with soil + perlite + coir pith + vermicompost (2:1:1:1) (93.97, 70.00 and 71.33 cm respectively) while, the minimum plant height (55.63, 56.67 and 57.33 cm respectively) was noted in the treatment soil + sand + FYM (2:1:1) (control) (Table 1). This may be due to the vermicompost, which is rich in humus and contains valuable vitamins, enzymes and hormones like auxins, gibberellins, *etc*. helpful for better growth and development and high nitrogen content available to plants which are grown in cocopeat. These results are in conformity with the reports of Sandeep *et al*. (2018) [13] in *Nephrolepis* fern, Swetha *et al*. (2014) [15] in aglaonema, Abid *et al*. (2017) [1] in dracaena, Dabral *et al*. (2019) [3] in calla lily, Chauhan *et al*. (2014) [2] in gerbera and Muraleedharan and Karuppaiah (2015) [9] in anthurium.

The maximum number of shoots (6.17), croziers (3.10) and crozier length (4.93 cm) was recorded in the plants which are raised in the media containing soil + cocopeat + FYM + vermicompost in 2:1:1:1 which was statistically on par with soil + perlite + coir pith + vermicompost (2:1:1:1) (6.07, 2.48 and 4.88 cm respectively) while, the minimum (3.53, 1.60 and 2.43 cm respectively) in media soil + sand + FYM (2:1:1) (control) (Table 1). This is due to improve in the physical properties of substrate, such as bulk density, container capacity, electrical conductivity, microbial activity and nitrate concentrations which are helpful for increasing the number of croziers. Similar results are obtained earlier by Nair *et al*. (2015) [11] in leather leaf fern and Singh and Nair (2003) [14] in dieffenbachia, Jawaharlal *et al*. (2001) [5] in anthurium and Dhananjaya and Sulladmath (2003) [4] in anthurium.

The number of fronds per plant is one of the important character in *Nephrolepis* fern, as they play a key role in deciding the ultimate yield of cut foliages. The number of fronds (Table 1) varied significantly the maximum number of fronds (12.00) was noted in media soil + cocopeat + FYM + vermicompost (2:1:1:1) which was statistically on par with soil + perlite + coir pith + vermicompost (2:1:1:1) (11.33) while, the minimum number of fronds (8.63) was noticed in soil + sand + FYM (2:1:1) (control). This may be due to the vermicompost, in appropriate quantities to potting media has synergistic effects and cocopeat was found to improve the physical properties of the substrate, decrease compaction and enable better growth and production which was beneficial for increasing the number of fronds. These results are in conformity with earlier by Nair *et al*. (2015) [11] in leather leaf fern and Sandeep *et al*. (2018) [13] in *Nephrolepis* fern.

The frond length and width varied significantly among the treatments (Fig. 1). The maximum frond length (87.00 cm) and width (15.67 cm) was recorded in was noted in media soil + cocopeat + FYM + vermicompost (2:1:1:1) which was statistically on par with soil + perlite + coir pith + vermicompost (2:1:1:1) (85.59 and 14.87 cm) while, the minimum frond length and width (54.38 and 12.00 cm) was noticed in soil + sand + FYM (2:1:1) (control). This is because of that vermicompost contains microorganisms which can form synergistic relationships in plant rhizospheres, thereby increasing the capacity of plants to utilize soil moisture and nutrients. Similarly, variation in the frond length was also reported earlier by Nair *et al*. (2015) [11] in leather leaf fern and Sandeep *et al*. (2018) [13] in *Nephrolepis* fern.

The leaflet length and breadth significantly varied among the treatments (Table 2). The maximum leaflet length (8.30 cm) and breadth (2.10 cm) was noted in media soil + cocopeat + FYM + vermicompost (2:1:1:1) which was statistically on par with soil + perlite + coir pith + vermicompost (2:1:1:1) (8.20 and 1.94 cm) while, the minimum leaflet length (5.60 cm) and breadth (1.37 cm) was noticed in soil + sand + FYM (2:1:1) (control). This variation due to effects of cocopeat has the ability to store and release nutrients to plants for an extended period of time, vermicompost has considerable amounts of humic substances and improves plant nutrition and that FYM provide the nutrients for the growth of the plant. Similarly, variation in leaflet breadth was also noticed earlier by Kayalvizhi *et al*. (2013) [6] in asparagus and Swetha *et al*. (2014) [15] in aglaonema.

The treatment having media soil + cocopeat + FYM + vermicompost (2:1:1:1) significantly recorded the maximum diameter of the shoot (0.95 mm) which was followed by soil + perlite + coir pith + vermicompost (2:1:1:1) (0.86 mm) while, minimum shoot diameter (0.62 mm) was noted in soil + sand + FYM (2:1:1) (Table 2). This is because media contains minerals and nutrients that are required for the efficient growth of the plant and that increases the size (diameter) of the plant. These results are in conformity with Khayyat *et al.* (2007) [7] in pothos.

In conclusion, the plants which are grown in the media containing soil + cocopeat + FYM + vermicompost (2:1:1:1) recorded best results with respect to growth parameters like plant height, plant spread, number of shoots, croziers and fronds, frond length and width, leaflet length and breadth and shoot diameter.

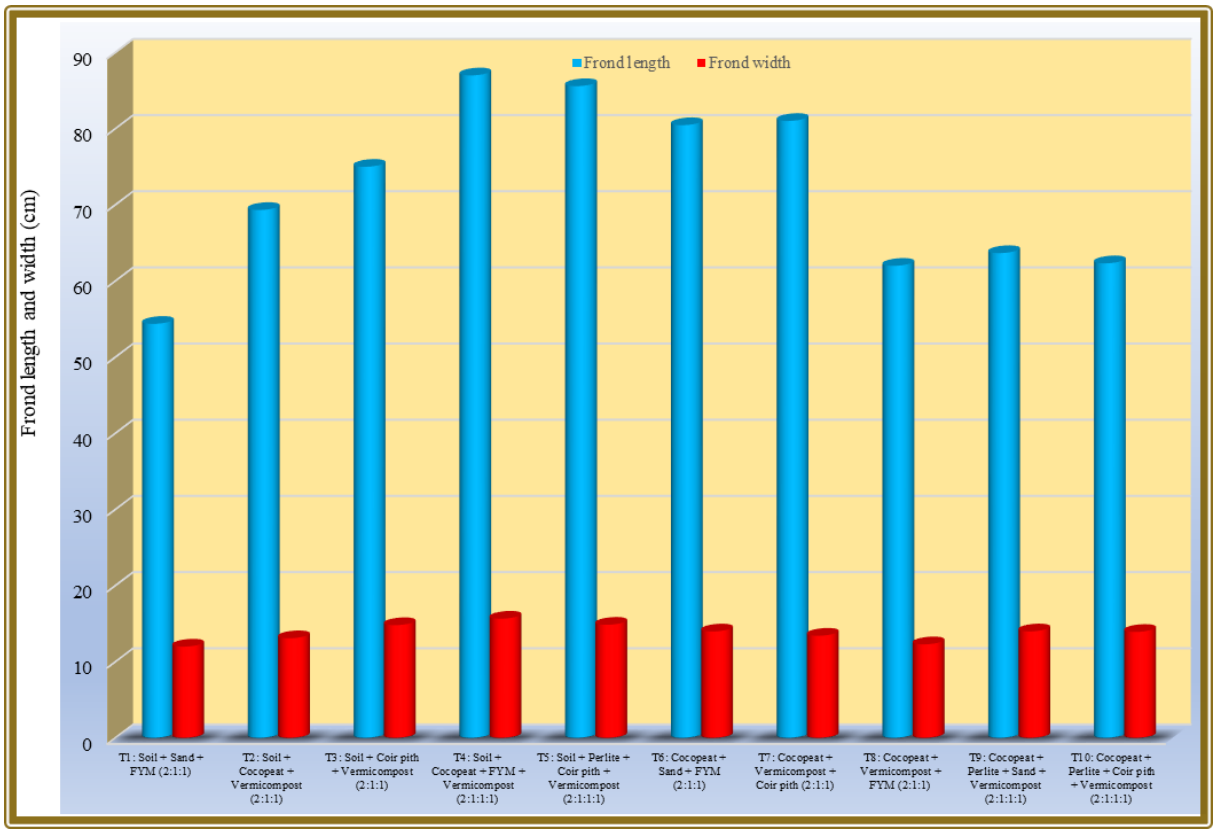

Fig 1: Effect of potting media on frond length and width of *Nephrolepis undulate* J. Sm under protected condition

Table 1: Effect of potting media on growth parameters of *Nephrolepis undulate* J. Sm under protected condition

Treatment details	Plant height (cm)	Plant spread (cm)		Number of shoots	Number of croziers	Number of fronds
		EW	NS			
T_1 - Soil + Sand + FYM (2:1:1) (control)	55.63	56.67	57.33	3.53	1.60	8.63
T_2 - Soil + Cocopeat + Vermicompost (2:1:1)	73.38	68.67	68.67	3.77	2.10	9.47
T_3 - Soil + Coir pith + Vermicompost (2:1:1)	74.12	67.33	68.33	3.60	2.30	9.03
T_4 - Soil + Cocopeat + FYM + Vermicompost (2:1:1:1)	95.30	72.00	73.67	6.17	3.10	12.00
T_5 - Soil + Perlite + Coir pith + Vermicompost (2:1:1:1)	93.97	70.00	71.33	6.07	2.48	11.33
T_6 - Cocopeat + Sand + FYM (2:1:1)	81.13	58.00	60.33	3.97	2.10	10.50
T_7 - Cocopeat + Vermicompost + Coir pith (2:1:1)	86.46	60.33	60.67	3.10	2.03	10.97
T_8 - Cocopeat + Vermicompost + FYM (2:1:1)	68.48	60.00	61.00	4.37	1.70	10.67
T_9 - Cocopeat + Perlite + Sand + Vermicompost (2:1:1:1)	64.79	57.67	58.33	4.30	2.20	9.17
T_{10} - Cocopeat + Perlite + Coir pith + Vermicompost (2:1:1:1)	69.94	68.00	69.00	3.83	1.97	10.17
S. Em ±	1.15	0.79	1.16	0.10	0.06	0.25
CD @ 1%	4.65	3.17	4.68	0.40	0.24	0.99

Table 2: Effect of potting media on growth parameters of *Nephrolepis undulate* J. Sm under protected condition

Treatment details	Crozier length (cm)	Frond length (cm)	Frond width (cm)	Leaflet length (cm)	Leaflet breadth (cm)	Shoot diameter (mm)
T_1 - Soil + Sand + FYM (2:1:1) (control)	2.43	54.38	12.00	5.60	1.37	0.62
T_2 - Soil + Cocopeat + Vermicompost (2:1:1)	4.60	69.33	13.10	7.50	1.71	0.84
T_3 - Soil + Coir pith + Vermicompost (2:1:1)	2.53	75.00	14.82	7.83	1.66	0.81
T_4 - Soil + Cocopeat + FYM + Vermicompost (2:1:1:1)	4.93	87.00	15.67	8.30	2.10	0.95
T_5 - Soil + Perlite + Coir pith + Vermicompost (2:1:1:1)	4.88	85.59	14.87	8.20	1.94	0.86
T_6 - Cocopeat + Sand + FYM (2:1:1)	2.43	80.47	13.99	8.17	1.84	0.78
T_7 - Cocopeat + Vermicompost + Coir pith (2:1:1)	3.03	81.02	13.43	7.47	1.48	0.77
T_8 - Cocopeat + Vermicompost + FYM (2:1:1)	2.80	62.00	12.30	7.11	1.64	0.81
T_9 - Cocopeat + Perlite + Sand + Vermicompost (2:1:1:1)	3.53	63.67	14.00	5.90	1.74	0.71
T_{10} - Cocopeat + Perlite + Coir pith + Vermicompost (2:1:1:1)	4.20	62.33	13.93	7.40	1.66	0.82
S. Em ±	0.08	1.25	0.26	0.12	0.04	0.01
CD @ 1%	0.32	5.03	1.03	0.48	0.17	0.05

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