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## Influence of growing media on the growth and morphology of Leatherleaf fern (*Rumohra adiantiformis* G. Forst.) under protected condition

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### Abstract

Floriculture industry is emerging and diversifying sector in the recent years, ornamental plants and cut greens plays a key role in it. Ferns are such excellent ornamentals with their unique leaf forms, whereas leatherleaf fern is one such ornamental cut foliage having magnificent and charming verdure. The present investigation was carried out in the college of Horticulture, Mudigere (under Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga), during 2020-21. The Completely Randomized Design (CRD) was employed with eleven treatments and three replications of each treatment, which consisted the combination of various substrates namely, soil, cocopeat, vermiculite, FYM, sphagnum moss, perlite and sand in different proportions. Results revealed that the treatment comprising of Soil+ Cocopeat + Vermiculite + FYM (1:1:1:1 v/v) shows the maximum plant height, plant spread, number of croziers, crozier length, number of fronds, frond length and width, number of leaflets, leaflet length and breadth compared to check treatment.

**Keywords:** Influence, Leatherleaf, Vermiculite, condition, *Rumohra adiantiformis*

### Introduction

Cut foliage are plant species having delightful herbage, finding its various uses in fresh and dried floral designs, floral ornaments such as bouquets, wreaths, corsages, boutonnières as well as in interior decorations. The importance of foliage compared to fresh cut flowers is very modest. Along with the flower crops, cut foliage production occupies an important position in the local and foreign markets and has a considerable share in the national income. Amongst various kinds of cut greens, ferns are extremely valued for the elegant symmetry of their fronds, form and freshness of leaves. The ferns, encompassing approximately 11,916 species (Ebihara and Nitta, 2019) <sup>[1]</sup>, represent only about 4 per cent of vascular plant diversity (Mehltreter, 2010) <sup>[6]</sup>. *Rumohra adiantiformis* G. Forst. is the leading tropical foliage species with long attractive fronds and widely used in floral arrangements along with annual flowers and grouping under clusters of palm or beneath overhead shade structures, atriums and in baskets.

### Material and Methods

The present investigation was carried out in college of Horticulture, Mudigere (under Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga) under protected condition, in the year 2020-2021. The experiment was laid out in Completely Randomized Design (CRD) which had eleven treatments with three replication each. Treatments of experiment are:

T<sub>1</sub> - Soil + Sand + FYM (2:1:1 v/v) – Check, T<sub>2</sub> – Soil + Sand + FYM + Sphagnum moss (1:1:1:1 v/v), T<sub>3</sub> - Soil + Vermiculite (2:1 v/v), T<sub>4</sub> - Soil+ Cocopeat (2:1 v/v), T<sub>5</sub> - Soil+ Perlite (2:1 v/v), T<sub>6</sub> - Soil+ Cocopeat + FYM (1:1:1 v/v), T<sub>7</sub> - Soil+ Cocopeat + Vermiculite (1:1:1 v/v), T<sub>8</sub> - Soil+ Perlite+ Vermiculite(1:1:1 v/v), T<sub>9</sub> – Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v), T<sub>10</sub> – Soil+ Cocopeat + Perlite + Vermiculite(1:1:1:1 v/v) and T<sub>11</sub> – Soil+ Cocopeat + Perlite + FYM (1:1:1:1 v/v). Pot culture method was followed with 12-inch pots. Various substrates were mixed according to the treatments at different proportions and filled in the pots. The cut rhizomes of leatherleaf fern were planted along with two leaves. Plants were watered daily and periodical hand weeding was done. Observations were recorded at 30 days interval till 180 days after planting.

## Results and Discussion

The experimental results revealed that the maximum plant height (40.14 cm) was recorded in the treatment containing Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v) which was on par with the media combination of Soil + Cocopeat + FYM (1:1:1 v/v) (37.21 cm) while, the minimum plant height (31.10 cm) was observed in the check treatment Soil + Sand + FYM (2:1:1 v/v) (Table 1). The differences may be due to the combination of cocopeat and FYM, having good physical properties, *i.e.*, aeration with good water holding capacity, highest total porosity and nutritional status, which might increase the plant height. These results are in conformity with the reports of Muraleedharan *et al.* (2020)<sup>[5]</sup> in Anthurium, Gaikwad *et al.* (2020)<sup>[3]</sup> in Tuberose, Kavana *et al.* (2019a)<sup>[4]</sup> in *Nephrolepis undulata*.

The maximum plant spread in North-South & East-West (34.50 and 36.47 cm, respectively) direction was found in the media composition of Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v) (Table 1) whereas, the minimum plant spread in N-S & E-W (25.38 and 26.40 cm, respectively) was noticed in the check treatment comprising of Soil + Sand + FYM (2:1:1 v/v). These variations might be due to the ideal physico-chemical properties of cocopeat and vermiculite, which attracts and holds positively charged ions like potassium, magnesium, calcium and ammonium, it releases these vital elements to the plant roots, thereby it improves the nutrient availability and results in increased growth as well as plant spread. These results are in accordance with the reports of Thakur and Grewal (2019)<sup>[9]</sup> in Chrysanthemum, Kavana *et al.* (2019a)<sup>[4]</sup> in *Nephrolepis undulata*.

**Table 1:** Effect of different growing media on plant height, plant spread, number of croziers and crozier length of Rumohra adiantiformis G. Forst. Under protected condition

Tr. No.	Treatments	Plant height (cm)	Plant spread (cm)		Number of croziers	Crozier Length (cm)
			N-S	E-W		
T <sub>1</sub>	Soil + Sand + FYM (2:1:1 v/v)- Check	31.10	25.38	26.40	4.86	2.87
T <sub>2</sub>	Soil + Sand + FYM + Sphagnum moss (1:1:1:1v/v)	33.06	26.95	27.84	5.26	3.29
T <sub>3</sub>	Soil + Vermiculite (2:1v/v)	32.79	27.41	29.34	5.46	3.08
T <sub>4</sub>	Soil + Cocopeat (2:1 v/v)	35.16	28.54	30.84	5.73	3.94
T <sub>5</sub>	Soil + Perlite (2:1 v/v)	33.14	28.24	30.07	5.33	3.48
T <sub>6</sub>	Soil + Cocopeat + FYM (1:1:1 v/v)	37.21	31.28	34.04	6.53	4.48
T <sub>7</sub>	Soil + Cocopeat + Vermiculite (1:1:1 v/v)	33.78	28.19	31.59	6.93	3.20
T <sub>8</sub>	Soil + Perlite + Vermiculite (1:1:1 v/v)	34.71	27.00	31.04	5.46	3.28
T <sub>9</sub>	Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v)	40.14	34.50	36.47	7.93	4.73
T <sub>10</sub>	Soil + Cocopeat + Perlite + Vermiculite (1:1:1:1 v/v)	35.37	30.26	32.22	5.86	3.14
T <sub>11</sub>	Soil + Cocopeat + Perlite + FYM (1:1:1:1 v/v)	35.78	29.26	31.86	6.06	3.71
	S.Em ±	0.71	0.31	0.24	0.18	0.14
	CD @ 1%	2.94	1.26	0.97	0.74	0.57

The number of croziers is the vital factor, which is directly proportional to the number of fronds *i.e.*, yield of the fern. Significantly superior number of croziers (7.93) and maximum crozier length (4.73 cm) was observed in the media combination of Soil+ Cocopeat + Vermiculite + FYM (1:1:1:1 v/v) whereas, the minimum number of croziers (4.86) and crozier length (2.87 cm) was recorded in Soil + Sand + FYM (2:1:1 v/v) (Table 1). These differences might be due to the presence of cocopeat, which helps to maintain the appropriate texture of the growing media, prevents compaction and has ideal EC, thereby enhances the croziers emergence and growth. These results are confirmed by Nair *et al.* (2020)<sup>[7]</sup> in Leatherleaf fern and Kavana *et al.* (2019a)<sup>[4]</sup> in *Nephrolepis undulata*.

Fronds are the economic part of the cut foliage plant, which is much important parameter from the practical point of view. The maximum number of fronds (19.83) were observed in the media consisting Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v) whereas, the minimum fronds (11.20) were noticed in Soil + Sand + FYM (2:1:1 v/v) (Table 2). These variations might be due to the nutrients effective physico-chemical properties of the cocopeat, vermiculite and FYM, which increases the water retention capacity of soil with less compaction and the combination of these substrates have high nitrogen, phosphorous and potassium content, which promote the yield of the foliage. Similar results were observed by Thakur and Grewal (2019)<sup>[9]</sup> in Chrysanthemum and Kavana

*et al.* (2019)<sup>[4]</sup> in *Nephrolepis undulata*, Nair *et al.* (2020)<sup>[7]</sup> in Leatherleaf fern.

Fronde length and width are the factors that decides the visual quality and purpose of usage of the fronds. Significantly superior frond length (40.95 cm) and frond width (19.66 cm) was found in the media comprising Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v). The minimum frond length (33.28 cm) and width (13.02 cm) were noticed in Soil + Sand + FYM (2:1:1 v/v) (Table 2). This might be due to the vermiculite, which provides good water holding capacity with better porosity and cocopeat which gives the best aeration, rich in macronutrients like nitrogen, potassium, which promotes the frond length and width. Conclusions of Nair *et al.* (2020)<sup>[7]</sup> in Leatherleaf fern, Kavana *et al.* (2019)<sup>[4]</sup> in *Nephrolepis undulata* and Chaudhary *et al.* (2018)<sup>[2]</sup> in Liliium are in line with the outcome of the present results.

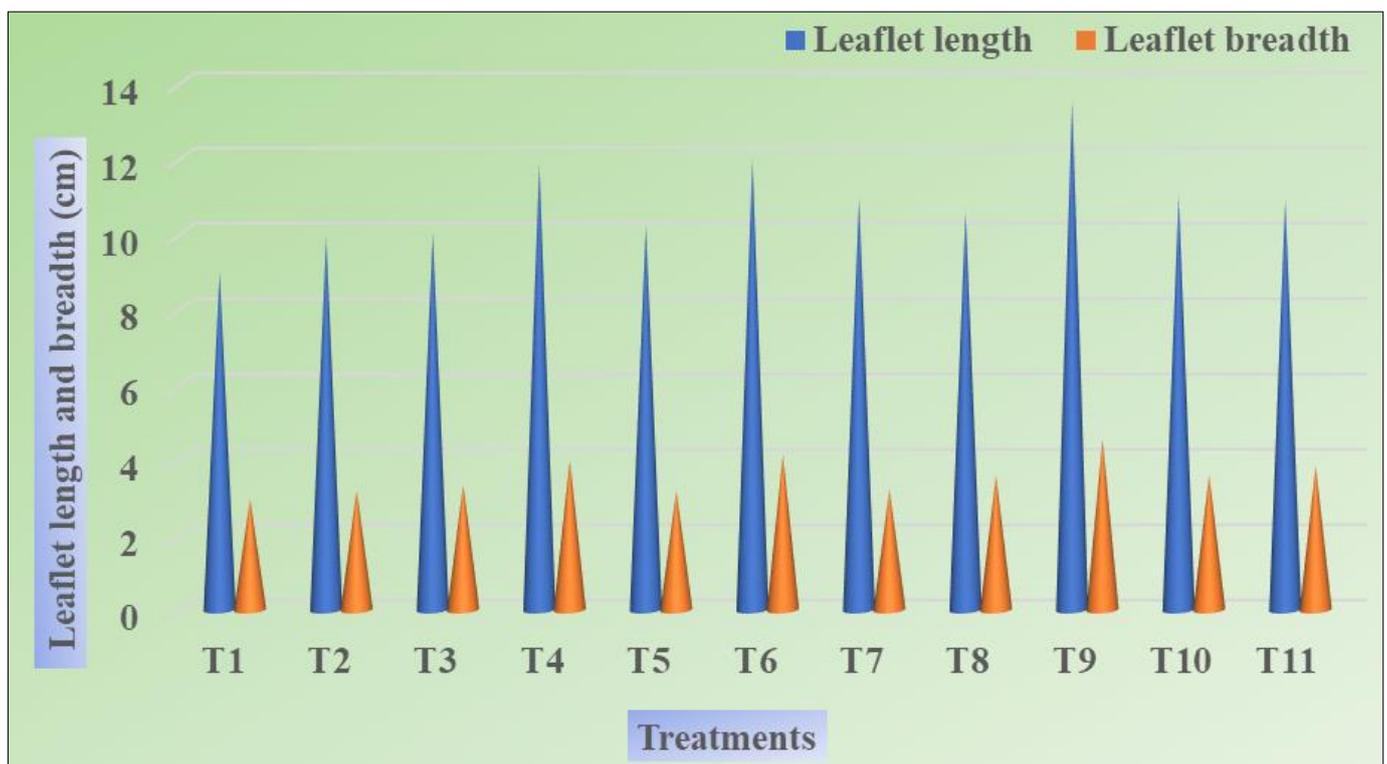
The number of leaflets that contributes to the length of the frond and its quality varied significantly among different treatments. The maximum number of leaflets (17.41) were found in the Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v) while, the minimum number of leaflets (12.00) were found in Soil + Sand + FYM (2:1:1 v/v) (Table 2). It might be due to the cocopeat, which improves the water holding capacity, texture of the media and increases the availability of the macro and micro nutrients to the plants results in the increased number of leaflets. These results are in line with the reports of Nair *et al.* (2020)<sup>[7]</sup> in Leatherleaf fern.

**Table 2:** Effect of different growing media on number of fronds, frond length, frond width and number of leaflets of *Rumohra adiantiformis* G. Forst. Under protected condition

Tr. No.	Treatments	No. of fronds	frond length (cm)	frond width (cm)	No. of leaflets
T <sub>1</sub>	Soil + Sand + FYM (2:1:1 v/v)- Check	11.20	33.28	13.02	12.00
T <sub>2</sub>	Soil + Sand + FYM + Sphagnum moss (1:1:1:1v/v)	13.80	34.16	15.41	13.06
T <sub>3</sub>	Soil + Vermiculite (2:1v/v)	13.93	35.59	15.97	13.66
T <sub>4</sub>	Soil + Cocopeat (2:1 v/v)	13.33	36.02	16.84	14.20
T <sub>5</sub>	Soil + Perlite (2:1 v/v)	13.06	35.42	14.85	13.20
T <sub>6</sub>	Soil + Cocopeat + FYM (1:1:1 v/v)	15.20	38.71	18.32	16.06
T <sub>7</sub>	Soil + Cocopeat + Vermiculite (1:1:1 v/v)	16.20	37.10	17.19	14.06
T <sub>8</sub>	Soil + Perlite + Vermiculite (1:1:1 v/v)	14.73	35.98	17.06	13.86
T <sub>9</sub>	Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v)	19.83	40.95	19.66	17.41
T <sub>10</sub>	Soil + Cocopeat + Perlite + Vermiculite (1:1:1:1 v/v)	15.86	36.20	17.23	15.20
T <sub>11</sub>	Soil + Cocopeat + Perlite + FYM (1:1:1:1 v/v)	16.00	36.59	17.15	14.13
	S.Em ±	0.40	0.29	0.33	0.18
	CD @ 1%	1.59	1.17	1.35	0.73

The leaflet length and leaflet breadth are directly proportional to the frond length and frond width, respectively. Significantly superior leaflet length (13.51 cm) and leaflet breadth (4.53 cm) was recorded in the media Soil + Cocopeat + Vermiculite + FYM (1:1:1:1 v/v) whereas, the minimum leaflet length (8.98 cm) and leaflet breadth (2.94 cm) was noticed in Soil + Sand + FYM (2:1:1 v/v)(Fig. 1). This might be due to the cocopeat has a high-water retention capacity,

which improves the texture of the media. High cation exchange capacity, low electrical conductivity and acceptable pH of cocopeat allow enough nutrient uptake for plant growth. These results were in similarity with the conclusions of Nair *et al.* (2020)<sup>[7]</sup> in Leatherleaf fern, Kavana *et al.* (2019)<sup>[4]</sup> in *Nephrolepis undulata* and Swetha *et al.* (2014)<sup>[8]</sup> in *Aglaonema*.

**Fig 1:** Effect of growing media on leaflet length and breadth (cm) of *Rumohra adiantiformis* G. Forst. at grand growth stage.



**Plate 1:** Leatherleaf fern of the best treatment and the check treatment

From the experiment, it can be concluded that the superior vegetative growth was noticed in the media consisting of Soil+ Cocopeat + Vermiculite + FYM (1:1:1:1 v/v). It might be due to the ideal physico-chemical properties of cocopeat and vermiculite, *i.e.*, good moisture retention capacity, arability, high CEC and possess the high NPK content, which results in increased plant height and spread, number of croziers, crozier length, number of fronds, frond length and width, number of leaflets, leaflet length and breadth. These findings are similar with the reports of Nair *et al.* (2020)<sup>[7]</sup> in Leatherleaf fern and Chaudhary *et al.* (2018)<sup>[2]</sup> in Lilium.

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