Int.J.Curr.Microbiol.App.Sci (2019) *8*(8): 1208-1215

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 08 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.808.142

Effect of Potting Media on Reproductive and Quality Parameters of *Nephrolepis undulate* J. Sm under Protected Condition

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Keywords

Nephrolepis fern, Sporangia, Spores, Cocopeat, Vermicompost and perlite

Article Info

Accepted:
10 July 2019
Available Online:
10 August 2019

A B S T R A C T

An experiment was conducted to study the effect of potting media on quality parameters of Nephrolepis undulate J. Sm under protected conditionin Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere (Under University of Agricultural and Horticultural Sciences, Shivamogga) during 2018-19. The suckers were collected around the region of Mudigere and are planted in 12" pot. 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 number of leaflets (135.00), number of sori per leaflet, number of sporangia per sori and number of spores per sporangia (63.00, 35.56 and 54.33 respectively) chlorophyll "a", chlorophyll "b" and total chlorophyll content (1.99, 0.97 and 2.96 mg/g of fresh weight respectively), visual plant grade (4.85), shelf life (8.00 days) and vase life (20.33 days) compared standard check.

Introduction

The cut-foliage occupies an important position in the local and international markets and constitutes 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 foliages and florist's 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). 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. They differ from mosses by being vascular i.e. having specialized tissues that conduct water and nutrients (Olsen, 2007). Ferns are extremely diverse in their habitat, form and reproductive methods. The foliage of ferns ranges from dark green to light yellow and others with surprising colors of grey, silver, red and blue-green which increase their utility in different types of floral arrangements. The genus *Nephrolepis* is commonly known as "sword fern" which are evergreen or semi-evergreen, either terrestrial or epiphytic species, distributed in tropical to subtropical regions around the world (Patil and Dongare, 2014). These are mainly grown in inside and outside showrooms, hotels, houses, institutional buildings, bungalows *etc*. (Muthukumar and Prabha, 2012).

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 from grand growth stage and were statistically analyzed.

Results and Discussion

The results of the present investigation revealed that plants which are grown in media containing recorded the soil + cocopeat + FYM + vermicompost in 2:1:1:1 maximum (135.00) number of leaflets which was on par with the treatment soil + perlite + coir pith + vermicompost (2:1:1:1) (130.20) while, the minimum number of leaflets per frond was observed in the treatment (65.78) soil + sand + FYM (2:1:1)(control) (Table 1). This may be due to FYM provides all the nutrients for growth, cocopeat affords higher total pore space (TPS) and water holding capacity (WHC) and vermicompost is richer in humic compounds which might have helped to increase the number of leaflets. This was in-line with conclusions of Kayalvizhi *et al.,* (2013) in asparagus and Swetha *et al.,* (2014) in aglaonema and Khayyat *et al.,* (2007) in pothos.

The number of spores is one of reproductive character of *Nephrolepis* fern which increases the multiplication of ferns. The number of sori per leaflet, number of sporangia per sori and number of sori per sporangia varied significantly among the treatments (Table 1). The maximum number of sori per leaflet, number of sporangia per sori and number of spores per sporangia (63.00, 35.56 and 54.33 respectively) was noted in the treatment havingsoil + cocopeat + FYM + vermicompost (2:1:1:1) which was on par with the treatment soil + perlite + coir pith +

vermicompost (2:1:1:1) (59.33, 34.89 and 50.00 respectively) whereas, the minimum number of sori per leaflet, number of sporangia per sori and number of sori per sporangia (27.67, 21.22 and 35.22 respectively) was recorded in treatment soil + sand + FYM (2:1:1)which is represented in Figure 1. The maximum number of sori per leaflet was due to maximum number of leaflets and frond length. 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. This was reported earlier by Nair *et al.,* (2015) in leather leaf fern and Sandeep *et al.,* (2018) in *Nephrolepis* fern.

The results of the present investigation revealed that plants were moderate yellowish green 138A was observed in soil + cocopeat + FYM + vermicompost in 2:1:1:1 and soil + coir pith + vermicompost (2:1:1) while that of moderate olive green 137B was observed incocopeat + vermicompost + FYM (2:1:1) and cocopeat + perlite + vermicompost (2:1:1:1).

For the treatmentsoil + cocopeat + vermicompost (2:1:1) and soil + perlite + coir pith + vermicompost (2:1:1:1) the colour grade was moderate yellow green 139C while, that of greyish olive green NN137A was observed in soil + sand + FYM (2:1:1) (control) and moderate yellowish green N138B was observed incocopeat + sand + FYM (2:1:1). The moderate yellow green 138B was noted in cocopeat + vermicompost + coir pith (2:1:1) while that of brilliant yellow green 149B was observed in cocopeat + perlite + coir pith + vermicompost (2:1:1:1) (Table 2).

The amount of chlorophyll decides the quality and colour of foliage. Significantly maximum chlorophyll “a”, chlorophyll “b” and total chlorophyll content (1.99, 0.97 and 2.96 mg/g of fresh weight) was noted in treatment having soil + cocopeat + FYM + vermicompost (2:1:1:1)and the whereas, the minimum chlorophyll “a”, chlorophyll “b” and total chlorophyll content (0.98, 0.33 and 1.35 mg/g of fresh weight) was recorded in soil + sand + FYM (2:1:1) (Table 2). This may be due to the superiority of vermicompost and FYM, which having ability to supply nutrients like N, P, K, Ca and Mg in available form. As N and Mg are the important constituents of chlorophyll, higher availability and uptake of these nutrients resulted in higher chlorophyll synthesis in turn leading to higher photosynthesis and growth. These results are in conformity with Scagel (2003) in rhododendron, Naggar and Nasharty (2009) in amaryllis and Olosunde *et al.,* (2014) in dracaena and cordyline.

The potting media treatments varied significantly(Table 2) on visual plant grade of *Nephrolepis* fern significantly maximum visual plant grade (4.85) was recorded in the media containing soil + cocopeat + FYM + vermicompost (2:1:1:1) which was followed by soil + perlite + coir pith + vermicompost (2:1:1:1) (4.54) whereas, the minimum visual plant grade (3.08) was recorded in soil + sand + FYM (2:1:1).

Higher production or accumulation of total protein and amino acids in their fronds than plants grown in other medium and that protein and amino acid composition of different plant parts has been related to energy storage for future growth which might be the reason for maximum visual plant grade. These results are found earlier by Swetha *et al.,* (2014) in aglaonema and Nazari *et al.,* (2011) in hyacinth.

The shelf life decides the ability of the plant. Shelf life of *Nephrolepis* fern varied significantly among the treatments.

Table.1 Effect of potting media on number of leaflets and reproductive parameters of *Nephrolepis undulate* J. Sm under protected condition

Treatment details	Number of leaflets per frond	Number of sori per leaflet	Number of sporangia per sori	Number of spores per sporangia
T_1 - Soil + Sand + FYM (2:1:1) (control)	65.78	27.67	21.22	35.22
T_2 - Soil + Cocopeat + Vermicompost (2:1:1)	73.97	49.22	24.00	42.22
T_3 - Soil + Coir pith + Vermicompost (2:1:1)	91.97	47.22	28.78	43.22
T_4 - Soil + Cocopeat + FYM + Vermicompost (2:1:1:1)	135.00	63.00	35.56	54.33
T_5 - Soil + Perlite + Coir pith + Vermicompost (2:1:1:1)	130.20	59.33	34.89	50.00
T_6 - Cocopeat + Sand + FYM (2:1:1)	113.73	42.33	25.22	37.78
T_7 - Cocopeat + Vermicompost + Coir pith (2:1:1)	93.70	43.00	25.86	37.89
T_8 - Cocopeat + Vermicompost + FYM (2:1:1)	77.20	45.67	24.63	38.00
T_9 - Cocopeat + Perlite + Sand + Vermicompost (2:1:1:1)	82.40	41.11	26.89	37.67
T_{10} - Cocopeat + Perlite + Coir pith + Vermicompost (2:1:1:1)	82.33	51.89	23.33	37.67
S. Em ±	**1.42**	**1.16**	**0.74**	**1.14**
CD @ 1%	**5.72**	**4.67**	**2.99**	**4.57**

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

Treatment details	Colour code (as per RHS chart)	Colour	Chlorophyll content (mg / g fresh weight)			Visual plant grade *	Shelf life (days)	Vase life (days)
			Chlorophyll "a"	Chlorophyll "b"	Total Chlorophyll			
T_1 - Soil + Sand + FYM (2:1:1) (control)	NN137A, Fan3	Greyish olive green	0.98	0.33	1.35	3.08	6.00	15.00
T_2 - Soil + Cocopeat + Vermicompost (2:1:1)	139C, Fan 3	Moderate yellow green	1.64	0.75	2.39	3.23	6.87	17.67
T_3 - Soil + Coir pith + Vermicompost (2:1:1)	138A, Fan 3	Moderate yellowish green	1.70	0.51	2.21	3.73	6.03	20.00
T_4 - Soil + Cocopeat + FYM + Vermicompost (2:1:1:1)	138A, Fan 3	Moderate yellowish green	1.99	0.97	2.96	4.85	8.00	20.33
T_5 - Soil + Perlite + Coir pith + Vermicompost (2:1:1:1)	139C, Fan 3	Moderate yellow green	1.97	0.88	2.84	4.54	7.00	18.33
T_6 - Cocopeat + Sand + FYM (2:1:1)	N138B, Fan 3	Moderate yellowish green	1.87	0.87	2.75	4.34	6.00	16.33
T_7 - Cocopeat + Vermicompost + Coir pith (2:1:1)	138B, Fan 3	Moderate yellow green	1.39	0.64	2.02	3.94	6.67	16.67
T_8 - Cocopeat + Vermicompost + FYM (2:1:1)	137B, Fan 3	Moderate olive green	1.05	0.37	1.51	3.51	7.00	15.67
T_9 - Cocopeat + Perlite + Sand + Vermicompost (2:1:1:1)	137B, Fan 3	Moderate olive green	1.09	0.46	1.42	3.94	6.33	15.33
T_{10} - Cocopeat + Perlite + Coir pith + Vermicompost (2:1:1:1)	149B, Fan 3	Brilliant yellow green	1.74	0.54	2.28	3.33	6.17	16.33
S. Em ±	-	-	**0.04**	**0.02**	**0.05**	**0.02**	**0.16**	**0.43**
CD @ 1%	-	-	**0.16**	**0.07**	**0.19**	**0.09**	**0.66**	**1.75**

* (Swetha *et al.*, 2014)

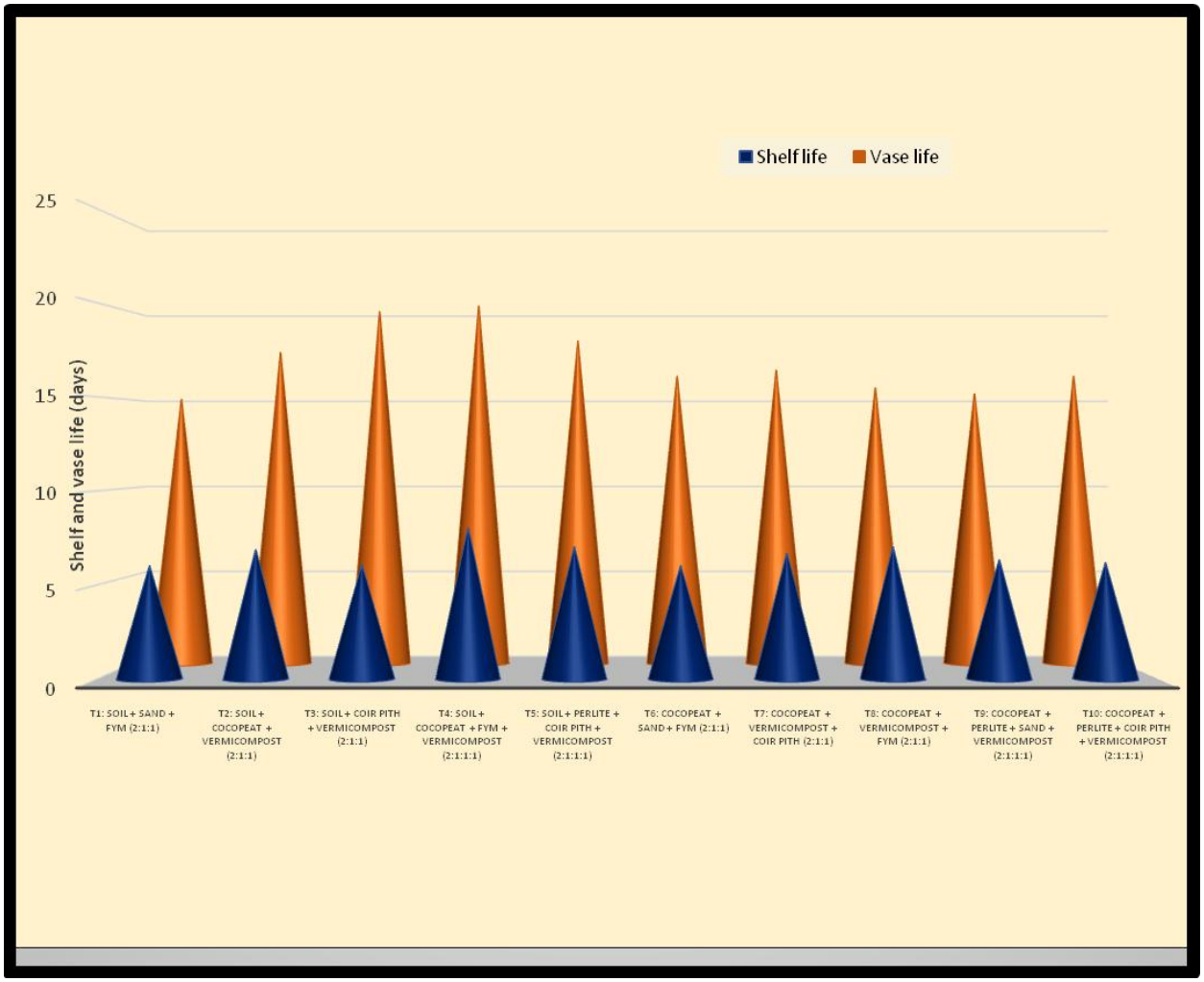

Fig.1 Effect of potting media on shelf and vase life of *Nephrolepis undulate* J. Sm atunder protected condition

The maximum shelf life (8.00 days) was recorded in the treatment having soil + cocopeat + FYM + vermicompost (2:1:1:1) which was followed by soil + perlite + coir pith + vermicompost (2:1:1:1) (7.00 days) whereas, the minimum shelf life (6.00 days) was recorded in soil + sand + FYM (2:1:1) which is represented in Figure 1. This is because of substrate having better physical properties, which influence the absorption of nutrients by the plants which ultimately produce long frond which increases the ability of the plant. These results are in accordance with Chavada *et al.*, (2017) in rose and Ikram *et al.*, (2012) in tuberose.

The vase life of fronds significantly differed among different treatments. The maximum vase life (20.33 days) was recorded in soil + cocopeat + FYM + vermicompost (2:1:1:1) which was followed by soil + perlite + coir pith + vermicompost (2:1:1:1) (18.33 days) whereas, the minimum vase life (15.00 days) was recorded in the treatment soil + sand + FYM (2:1:1) which is represented in Figure 1. The variation in vase life was due to the vermicompost, which is rich in humus and contains valuable vitamins, enzymes and hormones like auxins, gibberellins *etc.* which helps to reserve and also increases synthesis of carbohydrates which helps to extending the

keeping quality of fronds, and also due to trigger in the metabolic activity due to narrowing C: N ratio by significant accumulation of carbohydrates. Similar results were observed in Kayalvizhi *et al.*, (2013) in asparagus, Rajera *et al.,* (2017) in lily and Ikram *et al.,* (2012) in tuberose.

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 reproductive and quality parameters like number of leaflets, number of sori per leaflet, number of sporangia per sori, number of spores per sporangia, colour grade, chlorophyll content, visual plant grade, shelf and vase life.

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How to cite this article:

Kavana, G.B., S.Y. Chandrashekar, L. Hanumantharaya, Sarvajna B. Salimath and Hemanth Kumar, P. 2019. Effect of Potting Media on Reproductive and Quality Parameters of *Nephrolepis undulate* J. Sm under Protected Condition.
Int.J.Curr.Microbiol.App.Sci. 8(08): 1208-1215. doi: https://doi.org/10.20546/ijcmas.2019.808.142