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Influence of Various Potting Media on Growth and Nutrient Uptake Efficiency of *Scindapsus aureus*

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ABSTRACT

The effects of various potting media were studied with a view to determine growth response and nutrient uptake efficiency of *Scindapsus aureus.* Soil amendments were made by using F.Y.M., leaf mould and poultry manure as main source by making different combinations with sand, silt and sawdust. Potting media in different combinations were better than sole factor of soil itself as different combinations of potting media presented more growth and vigour of the plants alongwith improving total available N and P. Moreover, correlation coefficients indicated positive relationship among various growth responses and soil and plant NPK contents except leaf P which exhibited negative relationship.

Key Words: Potting media; Nutrient uptake Efficiency; *Scindapsus aureus*

INTRODUCTION

Scindapsus aureus occupy a dominant place among foliage plants due to its attractive colour of foliage and permanent nature. Scindapsus belongs to order Arales and family Araceae, having 123 genera and more than 2400 species. It is a tropical climber from Malaysian monsoon area and commonly known as pothos or money plant. There are many varieties of Scindapsus mostly a mixture of yellow, green and white shades. It is used for the preparation of totem and helps to soften the effect of architectural features. Due to its pendulous habit it is also suitable for hanging baskets.

Plant vigour, more number of shoots and leaves are important features for quality production of foliage plants. The physical and chemical properties of soil, structure, texture, density, pH, organic matter as well as nitrogen, phosphorus and potassium concentration of soil are dominant factors for the growth and development of the plant. Therefore it is important to ameliorate the composition and nutrition of soil to produce quality indoor plants.

It has been reported that high nitrogen rates (320-400 ppm) have adverse effects on plant growth in many cases but in some they promoted growth, depending on nitrogen form, soil pH and species tested (Miva & Ozaki, 1976). While Smith (1978) attributed that nitrogen significantly increased leaf number and length of *Zamia integrifolia* but potassium had no effect.

Use of organic manures has always been advocated for better plant growth. These not only increase nitrifying activities of microorganisms but also decrease N losses by increasing cation exchange capacity (CEC) of soil (Simpson, 1983). Whereas, Cumming (1964) recommended poultry manure, sheep and horse manure in addition to soil for potting. Moreover, Robinson and Lamb (1975) recommended peat as an amendment for the potting media in addition to soil because it forms the major bulk component in any substrate and account for 50-100% of the bulk volume.

Plants grown in the bark or peat medium produced more leaves and have heavier fresh weights and larger total leaf areas than those in 100% bark (Wang & Konow, 1999). Whereas, according to Hidalgo and Harkess (1999), total bract area and growth index of poinsettia were greatest in those treatments consisting of 3: 1 and 1: 1 (castings: peat) from sheep and cow manures, and 1: 0 (castings: peat) from horse manure. For these two characteristics, 100% sheep manure castings and 100% peat moss had the lowest values.

Composted sawdust amended with nitrogen and other fertilizers was suitable as the main component of potting mixes for containers one liter or more in size, but for smaller containers or seedlings about 25% peat should be added (Worrall, 1978). It was observed that plant fresh weight was greatest on a substrate containing peat moss and vermiculite (1:1) (Agut, 1984). Whereas, Paul and Lee (1976) observed improved aeration in poorly aerated aggregated loam and sand in addition to organic amendments and further reported that peat plus vermiculite had the best aeration of all the media.

The main objective of this study was to explore the relationship of different potting media with various plant growth and nutrient uptake responses and to explore possibilities of using waste materials for increasing horticultural production.

MATERIALS AND METHODS

The study was carried out in Institute of Horticultural Sciences, University of Agriculture, Faisalabad. Data were recorded on various growth indices as well as soil and leaf analyses were also carried out for determination of NPK.

Soil amendments were made by using F.Y.M., poultry manure and leaf mould as main source in different combinations with sand, silt and sawdust in order to find out the best combination and to determine the fertilizer needs of pothos. These combinations were T_o= Normal soil (control), T_1= F.Y.M. + soil + sand + silt (2:2:1:1), T_2= F.Y.M. + soil + sand + sawdust (2:2:1:1), T_3= F.Y.M. + sand + silt + sawdust (2:1:1:1), T_4= F.Y.M. + soil + sand + silt + sawdust (2:2:1:1:1), T_5= Leaf mould + soil + sand + silt (2:2:1:1), T_6= Leaf mould + soil + sand + sawdust (2:2:1:1), T_7= Leaf mould + sand + silt + sawdust (2:1:1:1), T_8= Leaf mould + soil + sand + silt + sawdust (2:2:1:1:1), T_9= Poultry manure + soil + sand + silt (2:2:1:1), T_{10}= Poultry manure + soil + sand + sawdust (2:2:1:1), T_{11} = Poultry manure + sand + silt + sawdust (2:1:1:1), T_{12} = Poultry manure + soil + sand + silt + sawdust (2:2:1:1:1).

The media were mixed thoroughly by parts in different combinations. These were then filled in 10 inches clay pots. Young rooted plants of Scindapsus were planted in the pots. Canal water was used for irrigation. Experiment was laid out in completely randomized design having three replications with two experimental units in each treatment. Single plant was planted in each pot. Data were recorded fortnightly on mortality rate, number of buds sprouted per plant, stem length, number of shoots, increase in number of leaves per plant and leaf area and subjected to statistical analysis. Increase in number of leaves per plant was calculated by taking difference between initial and final number of leaves at regular interval of 14 days. Whereas leaf area of matured leaves was measured by the formula 0.634 x length x breadth = cm^2 (Suggs *et al*., 1960).

Medium pH of media was measured by using ion analyzer (pH meter). Soil saturation percentage was calculated by the formula:

$$\frac{\text{Loss in weight of soil}}{\text{Oven dry weight of soil}} \times 100$$

Analyses of media were made following standard procedures to determine the available NPK in different compositions of the media. Moreover, leaf analysis was carried out by wet digestion to determine NPK contents. Total nitrogen was determined by Chapman and Parker method (1961), whereas, phosphorus was determined by Vanadomolybdo-phosphoric acid colour method, described by Jackson (1958). Leaf potassium was estimated by emission method.

RESULTS AND DISCUSSION

Influence of potting media on growth. Results obtained on mortality rate depicted that trend towards mortality is not dependent on treatments. It is therefore concluded that this may be due to mishandling of plants while planting or due to any other reason.

Table I. Influence of different potting media on growth of *Scindapsis aureus*

Treatments	Number of sprouted buds	Stem length (cm)	Number of leaves	Leaf area (cm^2)
T_0	5.83 h	69.17 h	6.33 c	77.03 f
T_1	8.67 efg	79.67 g	5.50 c	82.87 e
T_2	8.50 fgh	83.93 fg	6.30 c	81.07 ef
T_3	10.17 defg	88.07def	6.67 bc	85.07 e
T_4	7.50 gh	86.63 efg	8.17 bc	91.37 d
T_5	10.17 defg	92.40 de	9.50 bc	92.70 d
T_6	10.50 cdef	94.53 cde	7.33 bc	94.93 d
T_7	9.83 defg	96.13 bcd	7.83 bc	96.53 cd
T_8	11.83 bcde	101.27 abc	7.50 bc	101.07 bc
T_9	13.67 ab	101.97 abc	8.83 bc	103.73 ab
T_{10}	12.50 abcd	103.70 abc	14.17 a	104.97 ab
T_{11}	13.17 abc	104.17 ab	11.50 ab	107.07 a
T_{12}	14.83 a	105.37 a	9.00 bc	107.60 a

Means with same letters are statistically non-significant at P< 0.05.

Table II. Influence of different potting media on pH and saturation %age of media

Treatments	pH of media	Soil saturation %age
T_0	8.39 bc	54.18 efg
T_1	7.92 f	52.63 g
T_2	8.11 e	55.75 de
T_3	8.16 e	58.80 c
T_4	8.29 b	57.52 cd
T_5	8.34 cd	49.88 h
T_6	8.40 b	49.33 h
T_7	8.56 a	71.66 a
T_8	8.56 a	44.37 i
T_9	7.33 j	55.28 ef
T_{10}	7.40 i	55.23 fg
T_{11}	7.46 h	62.27 b
T_{12}	7.55 g	46.24 i

Means with same letters are statistically non-significant at P< 0.05

Results on number of buds sprouted per plant showed that Poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) excelled rest of the treatments while control was observed at the bottom. Present data focused the better results of the treatments in different combinations than the sole factor of soil itself. It was observed that when poultry manure was used as main source for amendment to normal soil while incorporating sand, silt and sawdust (2:2:1:1:1) has presented maximum number of sprouted buds per plant (Table I). It may further be added that poultry manure has given higher concentration of nutrients to the soil which shows high N percentage, high phosphorus concentration and relatively low potassium percentage. Based on these results it can be noted that more number of sprouted buds per plant was observed in treatments having more quantities of nitrogen and phosphorus.

Stem length was observed maximum in poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) whereas minimum stem length was obtained in normal soil as shown in Table I. The media which contained poultry manure as main source in various combinations has given favourable support to the plants. Treatments with leaf mould and

Table III. Nitrogen %age, available phosphorus (ppm) and available potassium (%) in Scindapsus leaves at both initial and final stages in different potting media

Treatments	Nitrogen %age		Available Phosphorus (ppm)		Available Potassium (%)	
	Initial	Final	Initial	Final	Initial	Final
T_0	1.78	1.75	1500	1600	2.50	2.40
T_1	2.06	2.02	3850	3750	2.80	2.96
T_2	2.98	2.88	2250	2300	4.92	5.20
T_3	3.40	3.26	3200	2850	4.38	4.85
T_4	3.44	3.28	2850	2400	2.30	2.48
T_5	3.80	3.42	3100	2350	3.86	3.95
T_6	4.24	4.05	1650	1400	2.93	3.11
T_7	4.81	4.55	2700	2450	3.87	4.23
T_8	5.10	4.96	3750	2350	3.71	3.84
T_9	4.21	4.15	2900	2300	4.19	4.37
T_{10}	4.35	4.02	2800	2100	2.84	2.96
T_{11}	5.06	4.94	1750	1350	1.68	1.75
T_{12}	5.58	5.40	2800	2050	3.33	3.52

Table IV. Correlation coefficients among various growth responses and soil and plant NPK contents

Variables	No. of buds	Stem length	Soil			Leaf		
			N	P	K	N	P	K
Soil N	0.926	0.934	-	-	-	0.016	-0.300	0.465
Soil P	0.800	0.877	-	-	-	-	-	-
Soil K	0.355	0.283	-	-	-	-	-	-
Leaf N	0.838	0.957	0.016	-	-	-	-	-
Leaf P	-0.022	-0.065	-	-0.300	-	-	-	-
Leaf K	0.172	0.118	-	-	0.465	-	-	-
No. of buds	-	-	0.926	0.800	0.355	0.838	-0.022	0.172
Stem length	-	-	0.934	0.877	0.283	0.957	-0.065	0.118

F.Y.M. as main source have attained second and third position respectively for this factor of growth.

Data collected on number of shoots could not be subjected to statistical analysis because almost all the treatments presented one shoot per plant. All the treatments behaved in a statistically identical fashion. No additional shoots were developed during the period of study. More time may be required for the development of secondary shoots.

Scindapsus plants produced more number of leaves in poultry manure + soil + sand + sawdust (2:2:1:1) whereas F.Y.M. + Soil + sand + silt (2:2:1:1) had minimum increase regarding number of leaves. It was noted that poultry manure + soil + sand+ silt + sawdust (2:2:1:1:1) which occupied first position for bud sprouting came down to fourth position, however, soil amendment with poultry manure was found to produce best results as presented in Table I. It was observed that fertility status of media had significant influence on number of leaves per plant.

Poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) and poultry manure + sand + silt + sawdust (2:1:1:1) with poultry manure as main source exhibited more leaf area as compared to rest of the treatments. Control has attained lowest position for this indice of study. Treatments with leaf mould as main source have attained second position regarding leaf area. Whereas, treatments with F.Y.M. as main source are in comparatively low position for this parameter (Table I). It was observed that media having high fertility status produced more leaf area.

Data regarding pH of the media elucidated that treatments with leaf mould as main source presenting pH 8.56 were non-significant with each other but excelled all other treatments. All the treatments with poultry manure as main source presented low figures of pH as compared to treatments having F.Y.M. and leaf mould as main source (Table II). But the treatments with poultry manure as main source represented significant difference with each other. While overall response of Scindapsus based on different parameters varied with the pH of the media.

Observations pertaining to saturation percentage of media indicated that leaf mould + sand + silt + sawdust (2:1:1:1) has maximum saturation percentage which is significantly higher from all other treatments. Poultry manure + sand + silt + sawdust (2:1:1:1) attained second position while leaf mould + soil + sand + silt + saw dust (2:2:1:1:1) has occupied lowest position as presented in Table II. Poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) has attained relatively lower position than the other treatments regarding this indice of study.

Influence of potting media on nutrient uptake efficiency. As far as total nitrogen in different media was concerned, poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) established top position whereas normal soil occupied the bottom. Treatments amended with poultry manure as main source revealed non-significant results with each other. Number of buds sprouted and stem length presented

positive correlation with soil N contents (Table IV). A most probable explanation could be that better plant growth in media amended with poultry manure as main source may be due to high nitrogen percentage.

The results concerning available phosphorus depicted that poultry manure + sand + silt + sawdust (2:1:1:1) obtained first position for available phosphorus but it was non-significant with leaf mould + soil + sand + silt + sawdust (2:2:1:1:1) and leaf mould + sand + silt + sawdust (2:1:1:1) where leaf mould was used as main source and the other treatments with poultry manure as main source. The lowest available phosphorus concentration was observed in normal soil which indicated non-significant difference with F.Y.M. + soil + sand + silt (2:2:1:1). Difference in media nutrient analysis among amendments (F.Y.M., poultry manure, leaf mould) did appear to have an effect on various growth responses. Number of buds sprouted and stem length were positively correlated with soil phosphorus contents as shown in Table IV.

Data collected on available potassium exhibited that all treatments have non-significant difference. 35.5% and 28.3% correlation was found between soil potassium contents and number of buds sprouted and stem length of Scindapsus plants respectively (Table IV).

Results regarding leaf nitrogen contents revealed that poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) proved significantly better in terms of leaf nitrogen contents than rest of the treatments which followed the sequence of treatments with leaf mould and F.Y.M. as main source. Control attained bottom position for leaf nitrogen contents. Observations indicated that poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) has non-significant difference with leaf mould + soil + sand + silt + sawdust (2:2:1:1:1) having leaf mould as main source and poultry manure + sand + silt + sawdust (2:1:1:1) with poultry manure as main source at both stages. Nitrogen levels generally dropped down when second leaf analysis was carried out. This showed a fluctuating trend in leaf nitrogen contents at two intervals as presented in Table III. Varying amendments carrying nitrogen have been found to affect plant growth responses. Moreover, positive correlation was observed between leaf nitrogen contents and growth responses as shown in Table IV.

Data regarding the effect of different soil amendments on leaf phosphorus concentration demonstrated significant superiority of F.Y.M. + soil + sand + silt (2:2:1:1) over the other treatments. Control occupied lowest position whereas poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) attained relatively low position at both stages, but presented high leaf nitrogen contents as shown in Table III. These up and down changes in leaf phosphorus contents may be due to different soil amendments and sample date. It is evident that some of the growth responses like stem length and number of sprouted buds were not affected by leaf phosphorus contents by showing -0.065 and -0.022% negative correlations, respectively (Table IV). This indicated that leaf phosphorus contents did not affect growth indices.

Results pertaining to leaf potassium contents revealed that F.Y. M. + soil + sand + sawdust (2:2:1:1) attained top position while poultry manure + sand + silt + sawdust (2:1:1:1) was observed at the bottom at both stages. Observations indicated a fluctuating trend in leaf potassium contents at initial and final stage as presented in Table III. Results exhibited that number of buds sprouted and stem length in poultry manure + soil + sand + silt + sawdust (2:2:1:1:1) were positively correlated with leaf potassium contents, however, this did not show pronounced effect since it represented 17.2 and 11.8% correlation, respectively, as shown in Table IV.

CONCLUSION

Different combinations of potting media having F.Y.M., leaf mould or poultry manure as main source influence the nutrient uptake efficiency of Scindapsus plants. Moreover, potting media with poultry manure as a main source exhibited more pronounced effects on various growth responses as compared to rest of the combinations. There is a tremendous potential of using waste materials efficiently for increasing horticultural production.

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