Effects of Different Pot Mixtures on spathiphyllum (*Spathiphyllum wallisii* Regel) Growth and Development

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Abstract

The growth of *Spathiphyllum wallisii* Regel plants was evaluated using different pot mixtures (v:v). Plant growth was measured by 11 parameters: leaf area, leaf number, mean shoot length, shoot fresh and dry weight, mean root length, root number, root fresh and dry weight, root volume and number of suckers. Parameters such as leaf area, leaf number, shoot fresh and dry weight, root fresh and dry weight and root length were higher in the media containing only perlite. Mean shoot length was higher in the medium containing 3:1 perlite: sand mixture, 1:3 perlite: sand mixture and only perlite; and root number was higher in the medium containing 3:1 perlite: sand mixture and only perlite. Furthermore, root volume was higher in the medium containing equal perlite: sand mixture and only perlite. The highest number of suckers was obtained in equal leaf-mold: sand mixture. It is concluded that these differences represent a direct effect on the rooting process and that substrate characteristics are of the utmost importance for the quality of rooted plants.

Keywords: *Spathiphyllum wallisii* Regel, leaf-mold, perlite, quartz-sand

Introduction

Spathiphyllum is a genus of about 40 species of monocotyledonous flowering plants in the family Araceae, native to tropical regions of the Americas and southeastern Asia. Certain species of *Spathiphyllum* are commonly known as Spath or Peace Lilies. Several species are popular indoor houseplants. *Spathiphyllum* cleans indoor air of many environmental contaminants, including benzene, formaldehyde, and other pollutants. It cleans best at one plant per 10 m^3. It lives best in shade and needs little sunlight to thrive. It is watered approximately once a week. The soil is best left moist but only needs watering if the soil is dry. Apart from the function of endogenous physiological and morphological factors which affect root formation in cuttings (Hartman et al., 2002), environmental or exogenous conditions during rooting may play a critical role in the quality of the cutting. One of the most important influential exogenous factors is the physical condition at the basal portion of the cutting, e.g., use of various rooting media (Altman, Freudenberg, 1983). It is generally known that most perennial ornamental plants are propagated by vegetative means using cuttings, layering, grafting, budding, etc. The rate of success in harvesting rooted cuttings depends on physiological age, time of rooting, environmental conditions, i.e., light, temperature and humidity and making use of plant growth regulators (Mamba, Wahome, 2010). Combinations of various media have become especially popular in cutting production of ornamentals (Altman, Freudenberg, 1983). However, considerable differences between the qualities of cuttings grown on various media combinations are evident, depending on the plant species and on the specific environmental conditions of the nursery. Although, effects of different pot mixtures on plant growth and development have been previously investigated (Douglas et al., 2000; Nowak, Strojny, 2003; Samartzidis et al., 2005). Potting media as well as nutritional requirements are the most important factors affecting growth of ornamental plants (El-Naggar, El-Nasharty, 2009). The type of rooting media and their characteristics are of utmost importance for the quality of rooted cuttings (Khayyat et al., 2007). commonly used media for encouraging rooting in cuttings include peat moss, coir, rockwool, vermiculite, perlite, sand, shredded bark, garden soil, leaf-mold, compost, etc. Choice of the used medium components depends on availability of materials, size and type of container, method of watering etc. However, the medium should be free of infectious pathogens, weeds, pests, nematodes, have good water holding capacity and good drainage. Soil-less media have become very popular among propagators because of their consistency, excellent aeration, reproducibility and low bulk density, which reduce shipping and handling costs of the medium itself and of the produced plants (Mamba, Wahome, 2010). In the present investigation, the effects of different pot mixtures on rooting characteristics of *Spathiphyllum wallisii* plants are studied in greenhouse condition.

Materials and Methods

Media

Thirteen pot mixtures were used for this experiment. The compositions of these media, expressed in volume ratios, were as follows:

L100: Only leaf-mold
S100: Only quartz-sand
P100: Only perlite
L50S50: leaf-mold/quartz-sand (1:1)
L25S75: leaf-mold/quartz-sand (1:3)
L75S25: leaf-mold/quartz-sand (3:1)
P50S50: perlite/quartz-sand (1:1)
P25 S75: perlite/quartz-sand (3:1)
L25P75: leaf-mold/peat moss (1:3)
L50P50: leaf-mold/perlite (1:1)
L75P25: leaf-mold/perlite (3:1)
S25P75: quartz-sand/perlite (1:3)
P33S33L33: perlite/quartz-sand/ leaf-mold (1:1:1)

Rooting condition

Sub-terminal stem cuttings of *Spathiphyllum wallisii* were prepared in mid-October 2010. The stem cuttings were equal in length and each had 4 leaves. After planting, all the cuttings were placed in a greenhouse controlled environment with 16°C night temperature. During autumn, light intensity was reduced to 25 to 30 klx by shading the roof. Plants were "hand watered" during the experiment.

Data recording and analysis

The water-holding capacity and the air space of the substrates were calculated by the method of Verdonck and Gabriels (1992) (Table 1). Root and shoot fresh and dry weights and leaf area were measured using an Analytical single-pan balance and a leaf area meter (Delta-T Devices Ltd., Burwell, Cambridge, England), respectively. In addition, root and shoot lengths and also root and leaf number were measured at the end of experiment (end of June 2010). Experiments were conducted in a Completely Randomized Design (CRD) with 13 treatments, 4 replications .Analysis of data was carried out using SAS software and Means were compared using LSD at the 5% level.

Table 1. The water-holding capacity and the porosity of the substrates used.

Medium	Total porosity (%)	Water holding capacity (%)
Quartz-sand	96	36
Perlite	76.7	59-68.9
Leaf-mold	91	68

Results

There were significant differences between substrates with regard to the quality of produced roots and developed shoots. Greater leaf area, leaf number, shoot fresh and dry weight; root fresh and dry weights and root length were observed in the media containing only perlite and significant differences were observed between this medium and the other pot mixtures (Figures 1 and 2, Tables 2 and 3).Mean shoot length was higher in each separate media containing P75S25 mixture, P25S75 mixture and P100. Root number was higher in the medium containing P75S25 mixture and P100 (Tables 2 and 3). The media containing only perlite yielded the best results with regard to parameters such as leaf area, leaf number, shoot fresh and dry weight; root fresh and dry weights and root length and root volume (Tables 2 and 3). Greater leaf area was observed in P100and was significantly more than the other media (Table 2). The highest leaf number was observed in P100 mixture. However, no significant differences were observed between P75S25 and P25S75 mixtures (Table 2). Root volume was higher in separate media containing P50S50 mixture and P100 (Table 3). The highest number of suckers was obtained in L50S50 mixture. The P50S50 mixture yielded almost the same number of suckers as the L50S50 mixture (Table 3).

Figure 1. Long shoots produced on the *Spathiphyllum* cuttings cultured in P100 medium.

Figure 2. Root production on one *Spathiphyllum* cutting cultured in P100 medium.

Table 2. Effects of growing medium components on leaf area, leaf number, mean shoot length, and shoot fresh and dry weight of *Spathiphyllum*.

Treatment	Leaf area (cm^2)	Number of leaves/plant	Shoot length (cm)	Fresh weight of shoots (g/plant)	Dry weight of shoots (g/plant)
L100	19.90f*	2.50f	5.50cd	0.70f	0.05d
S100	173.11cd	10.50bc	11.00b	5.73de	0.66cd
P100	478.88a	14.75a	19.25a	17.35a	2.43a
L50S50	124.76def	7.25def	7.75bcd	6.11cd	0.84c
L25S75	88.43def	7.00def	8.00bcd	3.08def	0.33cd
L75S25	29.98f	3.00f	4.00d	1.10ef	0.12d
P50S50	144.46def	8.25bcd	10.00bc	6.10cde	0.73cd
P25S75	291.98b	11.50ab	16.75a	13.40ab	1.83ab
P75S25	250.85bc	11.50ab	17.00a	11.07bc	1.62b
P50L50	42.78ef	4.00ef	8.00bcd	2.05def	0.22cd
P25L75	104.21def	5.750def	10.00bc	4.64def	0.42cd
P75L25	102.11def	5.00def	7.50bcd	3.62def	0.38cd
P33S33L33	94.55def	5.00def	6.50bcd	3.62def	0.36cd

*In each column, means followed by same letter(s) are not significantly different using LSD test at 5% level.

Table 3. Effects of growing medium components on root length, root number, root fresh and dry weight, root volume and number of suckers of *Spathiphyllum.*

Treatment	Number of roots/plant	Root length (cm)	Fresh weight of roots (g/plant)	Dry weight of roots (g/plant)	Root volume (cm^3)	Number of suckers/plant
L100	8.50de*	7.37d-g	6.07d	0.78c	15.50bc	1.00c
S100	17.25cde	10.50de	13.18bcd	2.32bc	22.50ab	2.25bc
P100	45.00a	25.00a	28.17a	5.35a	35.25a	1.75c
L50S50	27.00bc	12.75c	23.35abc	4.13ab	21.25ab	5.50a
L25S75	6.75e	4.87g	4.44d	0.94c	6.25c	1.00c
L75S25	5.75e	5.25fg	2.12d	0.29c	5.50c	0.75c
P50S50	36.50ab	13.75c	13.21bcd	2.79abc	21.75a	4.25ab
P25S75	33.00ab	19.75b	24.55ab	4.37ab	22.50ab	3.25abc
P75S25	44.00a	19.62b	21.64abc	4.34ab	21.75ab	1.50c
P50L50	7.00de	6.37efg	3.49d	0.77c	4.25c	2.50bc
P25L75	27.00bc	10.75cd	14.44bcd	2.07bc	11.00bc	3.00abc
P75L25	19.50cd	12.00cd	10.65cd	1.86bc	9.25bc	1.50c
P33S33L33	16.00cde	10.25c-f	10.70cd	1.99bc	6.25c	2.25bc

*In each column, means followed by the same letter(s) are not significantly different using LSD test at 5% level.

Discussion

It is confirmed that different media have their own efficiencies. Differences in plant's performance on numerous rooting media can be attributed to a direct effect of the substrate on the basal portion of the cutting. The large differences in the quality of the produced root system and shoot characteristics do indeed indicate the importance of direct effects of the media.

Improved root formation and growth on P100 and P75S25 mixtures might be due to the better aeration and drainage condition and water maintenance capabilities of these substrates compared to other media (Eleni et al., 2001; Mamba, Wahome, 2010; Noguera et al., 2000) which are considered as critical for the first phase of the root initiation. The presence of the leaves on the cuttings may cause earlier growth of the root system, but other environmental factors can also be involved. Thus, while new leaf development on P100 mixture is largely concurrent with the superior root development on these media, L100 has less deleterious effects on leaf growth.

On the other hand, sand mixtures allowed moderate leaf development, although root growth was not noticeable. In the media containing leaf-mold, low leaf development occurred; also, root growth was low. Since these phenomena cannot be explained solely by differences in the water/air relationship of the various rooting media, other factors are probably involved. Mechanical impedance and reduced porosity are such factors which may restrict root formation (Khayyat et al., 2007).

The number of leaves produced per cutting is determined by the type of cutting used, utilized plant growth regulators, temperature, and dry matter content of the cuttings before planting in the medium and the health status of the plant. Since all cuttings used in this investigation were uniform, the highest number of leaves per cutting observed in *Spathiphyllum wallisii* plants rooted in the mixture of perlite and sand could be attributed to other medium characteristics like porosity and water holding capacity. In conclusion, perlite was found to be superior in the propagation of *Spathiphyllum wallisii* plants as compared to the other medium components when most of the root and shoots parameters were evaluated. Only perlite and the mixture of perlite and sand, are therefore recommended for use in commercial propagation of *Spathiphyllum wallisii* plants under suitable environmental conditions.

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