Effects of container opacity and growing medium on growth and aesthetic quality of dumb cane (*Dieffenbachia amoena* Schott)

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Abstract

Dumb cane (Dieffenbachia amoena Schott) is a perennial tropical indoor plant commonly grown for interior decoration and air purification. Effects of nine container opacity and growing medium combined on growth and aesthetic appearance of dumb cane was assessed at the Horticulture Nursery, Federal University of Agriculture, Abeokuta, Nigeria in 2010 and 2011. Treatments were T1 - rice husk in opaque pot, T2 - rice husk in translucent pot, T3 - rice husk in transparent pot, T4 - sawdust in opaque pot, T5 - sawdust in translucent pot, T6 - sawdust in transparent pot, T7 - topsoil in opaque pot, T8 - topsoil in translucent pot, T9 - topsoil in transparent pot arranged in a Completely Randomized Design (CRD) with three replications. Data collected on number of leaves, plant height, stem girth, chlorophyll content, colour ranking of the leaves, number of roots/plant, length of the longest root/plant, shoot and root dry weight were subjected to analysis of variance and significant treatment means separated using Least Significant Difference at $p \leq 0.05$. Results of the experiment revealed that container opacity and growing medium significantly ($p \leq 0.05$) influenced growth parameters and appearance of dumb cane. However, plant height was at par across the treatments. Dumb cane grown on rice husk in a transparent pot performed best when compared with other treatments in terms of the growth and aesthetic indices assessed in this experiment. Thus use of rice husk medium in a transparent container enhanced growth and appearance of dumb cane.

Keywords: *Dieffenbachia amoena* ‘Dumb Cane’, Perennial house plant, Foliage indoor plants, Air purifier.

INTRODUCTION

'Tropic snow' (*Dieffenbachia amoena* Schott) is a large foliage plant widely grown for interior decoration. It is a perennial herbaceous tropical plant belonging to the Arum family (Araceae) along with other toxic aroids like Anthurium, Philodendrons, Caladiums (Justin, 2008). It has dark or deep green coloured leaves lined along the midrib by irregular bands of creamy-white patterns. It could grow as tall as 1.5 m with leaves over a 30 cm long. It requires good humidity and partial shade for optimum growth and beautiful appearance. Being a versatile plant, it can be grown best as a container plant, indoor potted plant.

In the commercial indoor plant production, a variety of growing media are used worldwide and are known to influence the value of potted ornamental plants (Vendrame *et al.,* 2005). In Nigeria, growers/florists know little about alternative potting media and therefore commonly use topsoil for growing potted plants. Though topsoil is the most readily available growing medium, it is heavier and being highly competed for in agriculture, building companies and road construction. It is thus imperative to source for alternatives such as sawdust, wood shavings, rice husk, maize cobs, and coconut husk that are available as agricultural and forest by-products. They have relevant and important properties such as good drainage, anchorage, good aeration and even added qualities like light weight and being free of disease organisms and weed seeds (Williams and Robert, 2006). Cabrera (2003) also stated that the most important physical properties of the growing media used in horticulture for stability are good aeration, drainage and optimum water retention capacity. Additionally, Sahin *et al* (2004) reported that the optimal conditions required for good plant growth are not less than 20% air content and 20-30 % available water (water retention) which can be met by these materials proposed as alternative growing media.

Containers for housing plant roots play important role in the drainage ability of the media in them as well as regulate the amount of air and light available to plant roots. Blanchard & Runkle (2008) reported a significant response of plant to container opacity and growing media components. Containers for ornamental plants may vary in terms of shapes, sizes, colors and textures. They could be made from a wide range of materials ranging from concrete, wood, ceramic, clay, cane baskets, plastic and fibre glass.

This study was designed to determine the effects of alternative homogeneous growing medium such as sawdust and rice husk and container opacity on growth and aesthetic characteristics of *Dieffenbachia amoena.*

MATERIALS AND METHODS

To study the effect of different growing media and container type on the rooting and growth of *Dieffenbachia amoena* 'Dumb cane' cuttings, a research was carried out at Ornamental Horticulture Nursery, Department of Horticulture, Federal University of Agriculture, Abeokuta in the years 2010 and 2011. Abeokuta is located on longitude 7º 15´ N,3º 25´ E and the prevailing climate is tropical humid with annual temperature of 34.7ºC and relative humidity of 82%.

Treatments were T1 - rice husk in opaque pot, T2 - rice husk in translucent pot, T3 - rice husk in transparent pot, T4 - sawdust in opaque pot, T5 - sawdust in translucent pot, T6 - sawdust in transparent pot, T7 - topsoil in opaque pot, T8 - topsoil in translucent pot, T9 - topsoil in transparent pot arranged in a Completely Randomized Design (CRD) with three replications. Topsoil was collected with a shovel to a depth of 10 cm from the surface under the forest area (rainforest transition ecology of south west Nigeria) of the Federal University of Agriculture, Abeokuta. Rice husk and sawdust were collected from rice and saw mills respectively, in Abeokuta City. Topsoil was sieved using 2 mm sieve while rice husk and sawdust were used as collected from the sources. Amprobe light meter (LM-120) was used to ascertain that varying quantum of light was passing through clay pot (opaque), red plastic pot (translucent) and colourless plastic pot (transparent) under full shine condition.

Twenty four cane cuttings per treatment were inserted into opaque (clay pot), translucent (red plastic pot) and transparent (colourless plastic pot) filled with ten litres of each of topsoil, sawdust and rice husk. These were kept in the traditional nursery with oil palm frond shed to minimize water loss due to transpiration and reduce heat stress. Watering was repeated frequently throughout the duration of the experiment. Data were collected on number of leaves per plant, plant height per plant, stem girth, chlorophyll content of the leaves, color ranking of the leaves, number of roots per plant, and length of the longest root (per plant). For root measurements, the rooted cuttings were removed from their host media, their roots washed under running tap and roots counted. The longest root was also measured. A non destructive method was used for leaf area estimation. This was determined by measuring length, breadth and product of length and breadth of 100 randomly selected leaves. The measurements were regressed against the true leaf area which was determined graphically. The evolved regression equation was used in the final leaf area determination. The regression equations are as follows:

Length (L)	$Y=24.03x - 402.4$	$R^2= 0.97$
	$Y=12.99x$	$R^2=0.75$
Breadth (B)	$Y=46.98x - 335.8$	$R^2=0.95$
	$Y=27.59x$	$R^2=0.78$
L x B	$Y=0.705x + 1.402$	$R^2=0.99$
	$Y=0.707x$	$R^2=0.99$

Where: x= mean of the leaf R^2= Regression Coefficient.

Y= total leaf area

The regression equation used for leaf area determination of this experiment was $Y = 0.707x$ ($R^2 = 0.99$)

Data collected were subjected to analysis of variance (ANOVA) and least significant difference (LSD) test at $p \leq 0.05$ was used to separate the treatment means.

RESULTS

Results chemical analysis of the growing media as presented in Table 1 shows that topsoil was sandy loam in texture with pH - 7.1, N - 0.11%, P - 47.47 mg/kg, K - 0.65 c mol g kg^{-1}, Mg - 1.93 c mol g kg^{-1}, Fe - 16.43 mg.kg and Zn - 7.35 mg/kg. Sawdust had pH - 5.0, N - 0.29%, P - 47.47 mg/kg, K - 994 .04%, Mg - 2214%, Fe - 2038 mg.kg and Zn - 80 mg/kg. Elemental nutrient composition of rice husk was pH - 5.5, N - 0.22%, P - 47.47 mg/kg, K - 551.65%, Mg - 2458%, Fe - 1947 mg.kg and Zn - 65 mg/kg.

Container opacity and growing medium significantly ($p \leq 0.05$) affected height and number of leaves of *Dieffenbachia amoena* across sampling period (Table 2). Plants grown on rice husk in transparent pot were the tallest (11, 11.9 and 13.1 cm) at 12, 14 and 16 weeks after planting (WAP), respectively. Cuttings grown on rice husk in translucent pots had 4.6, 7.3 and 8.2 cm and those on sawdust in transparent pots had 5.4, 7.4, 8 cm. Similarly, *Dieffenbachia amoena* planted on rice husk in transparent pots (1, 2, 3, and 4) and on topsoil in opaque pot (1, 2, 3, and 4) produced highest number of leaves per cutting at 10, 12, 14 and 16 WAP, respectively. However, plants grown on rice husk in translucent pots produced fewer leaves per plant (1 leaf/plant).

Dumb cane grown on rice husk in transparent pots had broadest leaf area (135, 241, 294, and 312 cm^2/ plant) and thickest stem girth (8.7, 15.8, 19.2 and 21.9 mm) at 10, 12, 14 and 16 WAP (Table 3). Plants on rice husk in translucent pots had the least leaf area (52 and 73 cm^2/plant) and stem girth (9.2 and 13.1 mm) values at 14 and 16 WAP, respectively. However, plants grown on either rice husk, sawdust or topsoil in opaque pots and topsoil in transparent pots had similar leaf sizes and stem girth.

Effects of container opacity and growing medium on chlorophyll content, colour ranking of the leaves, number and length of longest root/plant, shoot and root dry of *Dieffenbachia amoena* was significant at $p \leq 0.05$ (Tables 4). Leaf chlorophyll content was in order of rice husk in transparent pot > sawdust in opaque pot > topsoil opaque pot > topsoil in translucent pot > rice husk in opaque pot > sawdust in transparent pot > rice husk in translucent pot > sawdust in translucent pot. *Dieffenbachia amoena* planted on rice husk in transparent pot (2.67) ranked superior while those on topsoil, sawdust or rice husk in translucent pots were least in the aesthetic quality ranking index (1). Plants grown on rice husk in transparent pot produced longer (39 cm) root, highest root density (16 roots/plant), leaf (4 g), stem (7.2 g) and root (2.38 g) dry weights values per plants (Table 4)

Table 1. Chemical properties of topsoil, sawdust and rice husk media

	Topsoil	Sawdust	Rice husk
Ph	7.1	5.0	5.5
N (%)	0.11	0.29	0.22
Org. C (%)	0.94	5.38	3.08
Av.P (mg/kg)	47.47	477.65	477.65
Cu (mg/kg)	1.08	9.0	8.0
Mn (mg/kg)	47.92	255.0	222.0
Fe (mg/kg)	16.43	2038	19470
Zn (mg/kg)	7.35	80.0	65.0
K (%)	-	994.04	551.68
Na (%)	-	1438.1	885.0
Mg (%)	-	2214.0	2458.0
Ca (%)	-	5326.0	5011.0
K (cmol)	0.65	-	-
Na (cmol)	0.3	-	-
Mg (cmol)	1.93	-	-
Ca (cmol)	8.58	-	-
ECEC (cmol)	11.51	-	-
Sand (%)	90.6	-	-
Silt (%)	4.8	-	-
Clay (%)	4.6	-	-

Table 2: Effects of container opacity and growing medium on height and number of leaves of *Dieffenbachia amoena* (mean of two trials)

Treatments	Height (cm)				Number of leaves/plant			
	10*	12*	14*	16*	10*	12*	14*	16*
Rice husk in opaque pot	4.5	9.3	9.6	10.1	0.67	1.33	2.33	2.67
Rice husk in translucent pot	0.0	4.6	7.3	8.2	0.0	0.0	1.0	1.33
Rice husk in transparent pot	6.7	11.0	11.9	13.1	1.0	2.33	2.67	3.67
Topsoil in opaque pot	7.4	8.4	8.8	10.5	1.3	2.0	3.0	3.67
Topsoil in translucent pot	5.7	8.6	9.1	9.7	0.67	1.33	1.67	2.0
Topsoil in transparent pot	3.7	8.2	9.0	10.2	0.3	1.67	2.0	2.33
Sawdust in opaque pot	5.4	8.4	9.4	10.8	0.67	2.0	2.33	3.0
Sawdust in translucent pot	5.7	8.9	9.5	10.0	1.0	1.67	2.0	2.67
Sawdust in transparent pot	1.7	5.4	7.4	8.0	0.3	1.0	1.67	2.33
LSD ($P \leq 0.05$)	**Ns**	**4.0**	**3.5**	**4.6**	**0.99**	**1.24**	**1.1**	**0.87**

***= weeks after planting**

Table 3: Effects of container opacity and growing medium on leaf area and stem girth of *Dieffenbachia amoena* (mean of two trials)

Treatments	Leaf area (cm^2)				Stem girth (mm)			
	10*	12*	14*	16*	10*	12*	14*	16*
Rice husk in opaque pot	38	117	167	198	9.4	10.9	13.6	17.1
Rice husk in translucent pot	0.0	0.0	52	73	0.0	5.4	9.2	13.1
Rice husk in transparent pot	135.0	241	294	312	8.7	15.8	19.2	21.9
Topsoil in opaque pot	62.0	126	181	225	9.2	12.4	16.5	19.6
Topsoil in translucent pot	19.0	108	114	123	8.2	10.8	14.8	16.1
Topsoil in transparent pot	20.0	96	132	201	3.7	9.4	13.9	17.7
Sawdust in opaque pot	53	117	175	237	6.9	11.7	13.8	19.3
Sawdust in translucent pot	28	100	156	162	8.0	10.8	12.7	15.0
Sawdust in transparent pot	24	23	50	116	5.8	8.1	10.8	15.3
LSD ($P \leq 0.05$)	**116.6**	**128.1**	**112.3**	**122.1**	**7.2**	**4.7**	**5.6**	**5.8**

***= weeks after planting**

Table 4: Influence of container opacity and growing medium on chlorophyll content, colour ranking and dry matter of *Dieffenbachia amoena* (mean of two trials)

Treatments	Chlorophyll Content	Colour ranking	Dry leaf weight (g)	Dry stem weight (g)	Number of roots/plant	Length of Longest root (cm)	Dry root weight (g)
Rice husk in opaque pot	33.7	2.0	2.22	3.6	14.0	30.1	0.86
Rice husk in translucent pot	25.3	1.0	0.55	1.13	5.0	26.0	0.25
Rice husk in transparent pot	40.3	2.67	4.08	7.21	16.33	39.0	2.38
Topsoil in opaque pot	37.3	1.67	2.46	3.96	11.0	28.1	1.09
Topsoil in translucent pot	23.3	1.0	0.70	1.42	6.67	37.2	0.71
Topsoil in transparent pot	34.3	2.0	1.97	3.15	12.0	27.3	1.14
Sawdust in opaque pot	39.0	1.67	2.53	3.99	10.33	42.4	1.30
Sawdust in translucent pot	20.0	1.0	1.17	2.02	6.0	35.5	0.35
Sawdust in transparent pot	26.0	2.0	0.76	1.51	5.33	5.5	0.09
LSD ($P \leq 0.05$)	**10.64**	**0.57**	**1.78**	**3.08**	**15.2**	**16.55**	**1.27**

DISCUSSION

The significant differences noted in the growth and aesthetic characteristics of *D. amoena* grown on topsoil, sawdust and rice husk media was probably due to their varying nutrient composition. Topsoil had pH that was near neutrality while sawdust and rice husk were slightly acidic. Similarly, elemental composition was relatively different among the three media used in this study. Topsoil had the least while sawdust and rice husk media had relatively higher values for all nutrient elements. Enhanced growth and better aesthetic appearance of *D. amoena* grown on rice husk medium could be attributed to the availability of higher nutrient elements in organic media than topsoil. Variation in the growth response of *D. amoena* across the growing media suggests differences in their carrying capacity and ability. Earlier studies have shown that growing media could have a marked effect on growth of potted plants and that such effects vary greatly among plants. For example, growth and aesthetic features of *Dracaena fragrans* and *Cordyline terminalis* varied when grown on different growing media (Olosunde *et al*., 2015). Akintoye *et al*. (2012), reported that growing media components influenced establishment and growth of *Chrysanthemum morifolii*

Better growth performance and aesthetic appearance observed in *Dieffenbachia amoena* planted on different homogeneous growing medium in transparent pot could result from variation in the light penetration. It was observed in this study that variation in container opacity and media components significantly ($p \leq 0.05$) influenced chlorophyll content, colour ranking, dry matter accumulation, number and length of root of *Dieffenbachia amoena.* These results disagrees with Blanchard and Runkle (2008) who reported a better growth in *Phalaenopsis* and *Doritaenopsis* orchids grown on chunky peat medium in a translucent pot. Thus, it is likely that the plant root benefits from such light penetration directly or indirectly. This result suggests that container opacity and growing medium could have specific and selective effects on the growth and beauty of *Dieffenbachia amoena*. This implies that growers should consider pot opacity and kinds of media for optimum growth and best aesthetic quality of potted *Dieffenbachia amoena.*

In conclusion, rice husk medium in transparent pot enhanced optimum growth and aesthetic quality of *Dieffenbachia amoena*. Thus, rice husk medium could be used as the best alternative to topsoil for commercial production of potted *Dieffenbachia amoena* for house beautification.

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