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Growth response of *Dracaena fragrans* and *Cordyline terminalis* to growing medium

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ABSTRACT: *Dracaena fragrans and Cordyline terminalis are important hardy foliage house plants. The quality of potting media plays a significant role in the performance of indoor plants. Therefore, a study to examine response of D. fragrans and C. terminalis to different growing media was conducted at the Federal University of Agriculture Horticultural Nursery, Abeokuta, Ogun State, Nigeria in 2009 and 2010. Treatments consisted of Dracaena varieties (D. fragrans and C. terminalis) and growing media (topsoil, rice husk, sawdust, topsoil + rice husk, topsoil + sawdust, rice husk + sawdust) and (topsoil, sawdust, wood shavings, topsoil + sawdust, topsoil + wood-shavings, sawdust + wood shavings) for first and repeat trials respectively. Treatments were arranged in a completely randomized design and replicated three times. Data collected on plant height, number of leaves, leaf area, chlorophyll content, number and length of roots were subjected to analysis of variance. C. terminalis was taller with more (34) leaves and longer (52 cm) roots but low chlorophyll content compared to D fragrans. Homogenous topsoil medium was generally poorer in most of the parameters measured. Interactive effects of varieties and growing medium was significant (p = 0.05). Growth responses of both varieties suggested that rice husk + topsoil and sawdust + topsoil composite media are the best for growing potted D. fragrans and C. terminalis.*

Key words: *foliage house plants, chlorophyll content, alternative growth medium, potted plants*

INTRODUCTION

It is widely recognized today that ornamental plants within towns, cities, residential areas and even office environments provide important practical and ecological benefits to the environment. Production of floricultural crops had significant impacts on economic growth and development of some countries (Society of American Florist 2006; Fakayode *et al*., 2008) and can contribute greatly to economic emancipation of Nigeria and sub sahara countries by creating jobs for youth and middle age men and women (Fakayode *et al*., 2008).

Indoor plants have also been known to have a marked impact on human health and provide psychological benefits. A well planned and planted interior landscape encourages productive and effective activities and reduces aggressive tendencies. Dracaenas such as *Dracaena fragrans* and *Cordyline terminalis* are recognized worldwide for their attractive foliage colour, shape and their ability to reduce component of indoor air pollution and remove carbon (iv) oxide CO_2 which is correlated with lower work performance from indoor areas (Terran *et al*., 2007). NASA Clean Air Study shown that *D. deremensis* helps in removing chemicals such as Xylene, Toluene and Formaldehyde from the atmosphere, reduce airborne microbes and increase humidity (Wolverton, 1996). Hence, the increased use of potted ornamental plants as decorations in many offices and residential areas. The rhizome of the mature plant is very sweet and used as food and medicine.

Dracaena fragrans and *Cordyline terminalis* belongs to the family Agavaceae and are important plants widely use for interior decoration across the globe. They have upright multiple unbranched stems with rosettes of arching broad evergreen leaves which forms a heavy but graceful tropical clump. *Dracaena fragrans*, also known as corn plant, Chinese money tree or cornstalk dracaena is native to West Africa, Tanzania and Zambia. Leaf colour ranges from green to grey green with various white striped patterns

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available. It has rosettes of glossy, green leaves, broadly striped and banded with light green and yellow down the centre. Cornstalk Dracaena has white flowers that are highly fragrant, hence the specific name 'fragans'. While Cordyline is believed to originate from East Asia and Polynesia and are popular worldwide for their intense leaf colours and shape producing interest and contrasts even in deep shade. They have large lanceolate leaves that may be edged, striped or blotched with shades or red, white and yellow. Dracaenas are recognized worldwide for their attractive foliage colour and shape.

Numerous factors affects the growth and productivity of plants, but importance of a good growth medium for production of potted ornamental plants for interior and exterior decorations cannot be overemphasised (Habibah *et al*., 2008). An effective growth media should provide anchorage to the plant; hold sufficient available nutrient; be porous and well drained; relatively low in soluble salts; standardized and uniform; free from harmful soil pests and pathogens; biologically and chemically stable. Field soils commonly used for growing ornamentals are generally unsatisfactory because soils do not provide the aeration, drainage and water holding capacity required in the containers.

To improve this situation an alternative media sources for potted ornamental plants could alleviate the challenges associated with topsoil in terms of its heterogeneity in physical and chemical properties, environmental degradation and provide growers with additional options when selecting media. There is the need to source an alternative potting material if meaningful progress is to be made in pot plant production in Nigeria (Bayeri and Mbah, 2006; Ekwu and Mbah, 2001). The use of these readily available local materials and residues provides environmental benefits as ecosystem damage caused by soil or peat extraction is avoided and the impact of residue accumulation is minimized (Raviv *et al*., 1986). There are also economic benefits as the use of these residues means lower costs than conventional materials (Ingelmo *et al*., 1998).

Dracaena fragrans and *Cordyline terminalis* have become increasingly popular as interior and exterior ornamental plants because of their durability, versatility and retention of form and leaf colours. This study therefore investigated the effects of topsoil, wood shavings, sawdust and their mixtures on rooting characteristics and seedling growth of *Dracaena fragrans* and *Cordyline terminalis*.

MATERIALS AND METHODS

Experiment was conducted at the Horticultural Nursery of the University of Agriculture, Abeokuta, Ogun State, Nigeria situated in the rain forest-savanna transition zone (3°25'E and 7°25'N) between June, 2010 and February 2011. Treatments composed of two Dracaena varieties (*Dracaena fragrans* and *Cordyline terminalis)* and six growth media (topsoil, rice husk, sawdust, topsoil + rice husk, topsoil + sawdust, rice husk + sawdust) and (topsoil, sawdust, wood shavings, topsoil + sawdust, topsoil + wood-shavings, sawdust + wood shavings) for first and repeat trials respectively. The media components were mixed on equal volume (v/v) basis. Stem cuttings of *Dracaena fragrans* and *Cordyline terminalis* with lengths ranged from 15 cm – 20 cm were sourced from matured stock plants. The experiments were laid out in a Completely Randomized Design (CRD) with three (3) replicates. One cane cutting from each of the two dracaena varieties was grown in 7 litre plastic pots filled with growing media up to the 5 litre mark. Data were collected on number of roots per cutting, length of longest root, plant height, number of leaves, leaf area, and chlorophyll content (SPAG 502).

Leaf area: Non destructive sampling method was used for leaf area estimation. For each plant type, area of 100 leaves of varying sizes, from recently matured to fully matured leaves were determined by graph paper tracing method. The midrib length (X_1) and leaf breath (X_2) were measured and the product of length and breadth (X_3) for each leaf were determined. Leaf area as determined was regressed on each of these linear measurements, using two linear equations; $Y = a + bX$ and $Y = bX$ to describe the relationship between the leaf area and the linear measurements. The following equations were obtained;

Dracaena fragrans

Equation 1	Equation 2
$Y = -71.95 + 6.905X_1$ $r^2 = 0.96$	$Y = 5.302X_1$ $r^2 = 0.91$
$Y = -281.9 + 65.99X_2$ $r^2 = 0.81$	$Y = 29.06X_2$ $r^2 = 0.55$
$Y = 14.12 + 0.613X_3$ $r^2 = 0.97$	$Y = 0.649X_3$ $r^2 = 0.97$

Cordyline terminalis

Equation 1	Equation 2
$Y = -115.2 + 8.908X_1$ $r^2 = 0.96$	$Y = 5.038X_1$ $r^2 = 0.77$
$Y = -150.7 + 42.37X_2$ $r^2 = 0.94$	$Y = 21.03X_2$ $r^2 = 0.70$
$Y = 1.163 + 0.684X_3$ $r^2 = 0.99$	$Y = 0.689X_3$ $r^2 = 0.99$

Linear equations $Y = 0.649X$ ($r^2 = 0.97$) and $Y = 0.689X$ ($r^2 = 0.99$), where X = L x B with reasonable reliability and accuracy were used for the final leaf

area determination of *Dracaena fragrans* and *Cordyline terminalis,* respectively. Data on all the parameters measured were subjected to Analysis of Variance (ANOVA) and treatment means separated using Fisher's Least Significance Difference (LSD) test at 5% probability level.

RESULTS AND DISCUSSION

The results of chemical analysis of growing media show that N content of topsoil differed compared to sawdust, wood shavings or rice husk (Table 1). Topsoil had less quantities of both macro and micro nutrient elements but adequate for growth and maintenance of dracaenas.

The results revealed that variation among the growing media significantly influenced growth and appearance of *Dracaena fragrans* and *Cordyline terminalis*. The tallest height was observed in *C. terminalis* planted in topsoil than those in sawdust and *D. Fragrans* in sawdust, rice husk + sawdust and rice husk only were the shortest (Table 2). The differences in height of *C. terminalis* planted in topsoil, topsoil +rice husk, topsoil + sawdust, rice husk + sawdust and rice husk and *D. fragrans* in topsoil, topsoil + rice husk, topsoil + sawdust, and rice husk + sawdust was insignificant (p=0.05). Significant effect of growing media on height was very pronounced at 16 WAP. However, *C. terminalis* was consistently taller than *D. fragrans* at 4, 8 and 12, except at 16 WAP, indicating that the former had early growth and probably establishment than the later which catches up with the former as the experiment progressed.

In the first trial, there were no differences in the number of leaves per plant among the treatments. However, *C. terminalis* planted in topsoil + sawdust medium produced highest number of leaves, followed by those in either topsoil only or topsoil + wood shavings while *D. fragrans* in sawdust, wood shavings,

Table 1
Chemical properties of the growing media

Growing media	*N (%)*	*P (%)*	*K (%)*	*Mg mg/kg*	*Ca mg/kg*	*C (%)*	*Cu mg/kg*	*Mn mg/kg*	*Zn mg/kg*	*Fe mg/kg*
Topsoil	0.15	0.16	0.16	890	382	0.32	0.22	14.19	1.44	18.38
Sawdust	1.06	0.75	0.07	1260	6050	33.01	0.04	26.0	12.6	1239
Wood shavings	1.07	0.46	0.06	930	3825	21.12	0.05	36.3	42.00	4009
Rice husk	1.02	0.36	0.20	1295.0	333.0	0.14	38.0	62.9	346	1078

Table 2
Height (cm) of *Dracaena fragrans* and *Cordyline terminalis* as influenced by growing medium

Treatments		*Weeks after planting*							
		First trial				*Second trial*			
		4	*8*	*12*	*16*	*4*	*8*	*12*	*16*
D. fragrans	Topsoil	0.00	10.93	22.17	30.27	0.00	3.10	6.10	7.33
	Rice husk	0.00	8.17	15.77	24.07				
	Sawdust	0.00	4.33	10.70	17.80	0.00	3.60	9.33	11.00
	Wood shavings					0.00	4.37	10.00	11.67
	Topsoil+Rice husk	0.00	6.16	15.97	30.87				
	Topsoil+Sawdust	0.00	7.87	17.33	31.40	0.00	3.33	10.67	12.33
	Topsoil+Wood shavings					0.00	4.00	10.00	10.67
	Rice husk+Sawdust	0.00	7.33	14.40	17.27				
	Sawdust+Wood shavings					0.00	4.00	9.67	12.00
C. terminalis	Topsoil	1.13	25.47	36.83	50.80	4.67	8.50	13.67	18.67
	Rice husk	2.33	15.77	22.57	29.57				
	Sawdust	0.00	20.30	23.57	26.13	3.87	7.67	13.33	16.00
	Wood shavings					3.83	6.63	11.33	13.67
	Topsoil+Rice husk	1.70	17.77	25.23	34.30				
	Topsoil+Sawdust	2.63	16.83	23.40	29.43	3.83	8.33	12.67	15.33
	Topsoil+Wood shavings					4.33	9.90	14.00	14.33
	Rice husk+Sawdust	0.00	19.67	6.33	34.17				
	Sawdust+Wood shavings					5.00	10.43	14.67	16.00
	LSD(Plant type X growing media)	ns	12.99	18.93	21.95	1.23	2.57	3.71	3.93
	LSD (Plant type)	1.25	5.31	7.73	ns	0.50	1.05	1.52	1.61
	LSD (growing media)	Ns	ns	ns	15.52	Ns	ns	ns	ns

LSD = Least Significant Difference at 5% probability level, ns = not significant

topsoil + sawdust topsoil + wood shavings had the least number of leaves (Table 3). Generally, *C. terminalis* produced more leaves than *D. fragrans* at 4 and 16 WAP. Plants in topsoil + sawdust or wood shavings produced the highest and least number of leaves, respectively.

The differences in the leaf area of *C. terminalis* and *D. fragrans* in all the growing media was insignificant ($p<0.05$) in both trials, except at 12 WAP in the second trial where *D. fragrans* planted in topsoil, sawdust or wood shavings had the least leaf area values (Table 4). Mean effect of growing media on leaf area was significant only at 8WAP in the second trial, plants in topsoil +wood shavings, topsoil + sawdust, wood shavings + sawdust and sawdust had broader leaves than other treatments. Similarly *C. terminalis* produced wider total leaf area than *D. fragrans* at 8 and 4, 8 and 12 WAP in the first and second trials, respectively. The findings from this study agrees with earlier studies by Bugbee, (2002) and Chen *et al*., (2002) that base materials for potting media influenced growth of ornamental foliage plants probably due to variations in their physcio-chemical properties. Similar observation was made by Bayeri and Mbah, (2006) that plants could respond differently to variation in physio-chemical properties of base materials used for composting growing media.

Results from Table 5 show that growing media significantly ($p< 0.05$) affected rooting characteristics, *C. terminalis* raised in topsoil + sawdust had more roots , followed by those in topsoil, rice husk, sawdust and *D. fragrans* in rice husk but fewer roots observed in sawdust medium. However in the second trial, *C terminalis* had similar number of roots across the growing media but statistically higher than roots produced by *D. fragrans*. Generally *C. terminalis* produced more roots than *D. fragrans* with highest number of roots recorded in plants grown in rice husk medium, particularly the first trial. *C. terminalis* that grew in topsoil, rice husk, sawdust, topsoil + sawdust, rice husk+ sawdust and *D. fragrans* rice husk, topsoil, topsoil + sawdust and rice husk+ sawdust treatments had longer roots. However in the second trial, longer roots was observed in *C. terminalis* planted in wood shavings, sawdust + wood shavings, topsoil + wood shavings and sawdust media than other treatments. *D. fragrans* planted in topsoil medium had the shortest roots. Growing media significantly affected root growth and elongation, longest roots recorded in plants raised in wood shavings, sawdust + wood shavings, followed by sawdust only, then topsoil + wood shavings and then topsoil medium. Also, roots produced by *C. terminalis* were longer than those by *D. fragrans*.

Table 3
Number of leaves of *Dracaena fragrans* and *Cordyline terminalis* as influenced by growing medium

Treatments		*Weeks after planting*							
		First trial				*Second trial*			
		4	*8*	*12*	*16*	*4*	*8*	*12*	*16*
D. fragrans	Topsoil	0.33	3.67	7.33	11.00	0.00	1.67	7.67	14.00
	Rice husk	0.00	4.33	7.00	9.67				
	Sawdust	0.33	1.33	3.67	6.00	0.00	2.67	12.67	17.00
	Wood shavings					0.00	3.00	11.67	13.67
	Topsoil+Rice husk	0.00	2.67	7.33	11.00				
	Topsoil+Sawdust	0.00	3.33	6.67	11.67	0.00	2.00	11.33	13.33
	Topsoil+Wood shavings					0.00	2.33	7.67	9.33
	Rice husk+Sawdust	0.00	3.00	5.00	6.00				
	Sawdust+Wood shavings					0.00	2.67	12.67	13.67
C. terminalis	Topsoil	0.00	5.00	9.33	13.67	4.67	9.67	15.67	23.00
	Rice husk	0.33	4.00	5.33	7.67				
	Sawdust	0.00	4.67	6.33	8.00	5.67	11.33	16.00	17.67
	Wood shavings					5.00	9.67	13.67	14.33
	Topsoil+Rice husk	0.67	4.00	6.33	7.67				
	Topsoil+Sawdust	0.33	4.67	7.67	10.33	9.00	14.67	20.33	29.67
	Topsoil+Wood shavings					7.33	12.33	18.00	23.00
	Rice husk+Sawdust	0.00	4.33	7.00	10.00				
	Sawdust+Wood shavings					4.33	9.00	14.00	18.33
	LSD(Plant type X growing media)	Ns	ns	Ns	ns	3.20	4.03	6.31	9.28
	LSD (Plant type)	Ns	ns	Ns	ns	2.26	ns	ns	6.56
	LSD (growing media)	Ns	ns	Ns	ns	1.31	1.65	2.58	3.79

LSD = Least Significant Difference at 5% probability level, ns = not significant

Table 4
Leaf area (cm²) of *Dracaena fragrans* and *Cordyline terminalis* as influenced by growing medium

Treatments		*Weeks after planting*							
		First trial				*Second trial*			
		4	*8*	*12*	*16*	*4*	*8*	*12*	*16*
D. fragrans	Topsoil	0.00	10.44	26.86	57.96	0.00	5.22	30.49	49.42
	Rice husk	0.00	5.23	18.00	52.89				
	Sawdust	0.00	4.02	12.49	25.79	0.00	10.06	35.88	50.92
	Wood shavings					0.00	7.82	34.20	61.81
	Topsoil+Rice husk	0.00	3.35	14.01	55.47				
	Topsoil+Sawdust	0.00	4.28	20.40	51.61	0.00	8.57	50.17	76.75
	Topsoil+Wood shavings					0.00	6.97	47.62	67.33
	Rice husk+Sawdust	0.00	7.47	24.54	34.34				
	Sawdust+Wood shavings					0.00	11.17	54.91	73.26
C. terminalis	Topsoil	0.29	15.20	27.41	40.43	1.84	18.92	55.43	72.77
	Rice husk	0.39	16.50	27.78	43.34				
	Sawdust	0.00	12.18	19.83	25.24	4.89	18.83	56.10	74.07
	Wood shavings					3.86	17.98	49.30	67.23
	Topsoil+Rice husk	14.83	10.50	21.92	36.25				
	Topsoil+Sawdust	0.00	9.91	17.19	26.83	3.67	18.90	54.40	74.37
	Topsoil+Wood shavings					5.02	21.62	56.63	75.43
	Rice husk+Sawdust	0.00	11.67	22.20	31.40				
	Sawdust+Wood shavings					4.77	24.09	57.30	72.83
	LSD(Plant type X growing media)	Ns	ns	Ns	ns	2.89	6.33	21.39	28.74
	LSD (Plant type)	Ns	5.67	Ns	ns	1.18	2.58	8.7	ns
	LSD (growing media)	Ns	ns	Ns	ns	ns	4.48	Ns	ns

LSD = Least Significant Difference at 5% probability level, ns = not significant

Table 5
Chlorophyll content and rooting characteristics of *Dracaena fragrans* and *Cordyline terminalis* as influenced by source of fertilizer and growing medium

		First trial			*Second trial*		
Treatments		*Chlorophyll content*	*Number of roots*	*Root length (cm)*	*Chlorophyll content*	*Number of roots*	*Root length (cm)*
Plant type	Growing media						
D. fragrans	Topsoil	48.63	14.00	19.27	21.40	4.00	12.17
	Rice husk	43.47	24.33	27.40			
	Sawdust	36.43	0.67	2.90	20.23	9.00	31.80
	Wood shavings				29.13	10.00	37.80
	Topsoil+Rice husk	50.37	8.67	11.53			
	Topsoil+Sawdust	53.20	12.33	24.30	33.60	6.33	23.07
	Topsoil+Wood shavings				27.13	5.00	16.73
	Rice husk+Sawdust	33.20	8.33	17.83			
	Sawdust+Wood shavings				19.17	8.33	30.20
C. terminalis	Topsoil	54.67	30.00	41.47	36.53	36.33	50.00
	Rice husk	27.13	30.00	19.13			
	Sawdust	23.73	28.67	38.17	32.90	37.33	52.00
	Wood shavings				33.27	32.00	64.33
	Topsoil+Rice husk	39.30	9.67	12.20			
	Topsoil+Sawdust	36.03	37.67	36.67	35.43	36.67	41.00
	Topsoil+Wood shavings				31.93	39.00	50.73
	Rice husk+Sawdust	30.07	12.33	21.20			
	Sawdust+Wood shavings				27.90	39.67	57.73
	LSD(Plant type X growing media)	21.10	24.31	27.28	13.17	10.02	13.97
	LSD (Plant type)	8.61	9.33	Ns	5.38	4.09	5.70
	LSD (growing media)	14.92	17.19	Ns	9.31	Ns	9.88

LSD = Least Significant Difference at 5% probability level, ns = not significant

Results on the chlorophyll content among the treatments presented in Table 5 showed a least value for the chlorophyll content when *C. terminalis* and *D. fragrans* were planted in rice husk + sawdust and sawdust + wood shavings and sawdust only in the first and second trials, respectively. Effect of growing media on the chlorophyll content indicated a higher value in topsoil +sawdust medium and least in wood shavings + sawdust. This suggests that chlorophyll synthesis by both varieties is dependent on some specific attributes of base materials used for formulating potting media in this study which could have significant effects on the plants growth and appearance.

CONCLUSION

The results from this study showed that there was marked difference in the establishment and growth of *C. terminalis* and *D. fragrans*. Mixing rice husk or sawdust with topsoil was the best alternative to homogenous topsoil only for sustainable production of potted *C. terminalis* and *D. fragrans*. The use of rice husk + topsoil or sawdust + topsoil composite medium could mitigate environmental concerns associated with removal of topsoil and disposal of rice husk and sawdust. Therefore, it is recommended for optimum growth of potted *C. terminalis* and *D. fragrans*

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