Growth and flowering of flamingo flower *(Anthurium andraenum)* as influenced by fertilizer source and growing medium

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ABSTRACT

Flamingo flower (Anthurium andraenum) is an important ornamental plant grown for cut flower and potted flowering plant. In order to study effects of source of fertilizer and growing media on growth and flowering of pink and white specie of flamingo flower, pot experiment was conducted at the University of Agriculture Horticultural Nursery, Abeokuta, Ogun State, Nigeria in 2009 and 2010. Treatments consisted of two fertilizer sources (poultry manure and NPK) and three growing media (topsoil, sawdust and wood shavings) arranged in a completely randomized design, replicated four times. Data collected on plant height, number of leaves, leaf area, dry matter accumulation, days to flowering and flower size were subjected to analysis of variance. Application of poultry manure and NPK fertilizer affected dry matter and flower size of pink and white species differently. White specie that received poultry manure produced bigger (4.7 cm) flower than NPK fertilizer (3.7 cm). Both species planted in topsoil produced wider leaf area than either sawdust or wood shavings. Pink specie grown in sawdust produced significantly bigger (4.7 cm) flower than those in topsoil (3.5 cm). Interactive effects of source of fertilizer and growing media on growth parameters and flower size of flamingo flower was significant ($p< 0.05$). Addition of poultry manure to a sawdust or wood shavings is a good alternative for production of flamingo flower.

Keywords: poultry manure, NPK, flower size, cut flower, flowering indoor plant

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INTRODUCTION

Flamingo flower (*Anthurium andraenum*) is an herbaceous perennials plant belonging to the family Araceae. It is a native of tropical America, but now being widely cultivated in other areas of the world for their attractive flower colours, shapes and ornamental leaves. Flamingo flower is a flowering plant up to 30 cm tall with red, pink, white, orange or bicolour spathe and leaves are heart-shape and glossy dark green.

It is one of the most important ornamentals for cut flower trade globally which is one of the blooming floricultural industries. It is also widely accepted as potted flowering plant for indoor landscaping, floral arrangements for table and interior decorations, for making high quality bouquet and as gift to people on various occasions of birthday, housewarming, wedding, and yuletide.

Presently, production and marketing of Anthuriums is an international business that worth millions of dollars (USDA, 2010). Presence of varied agroclimatic zones, cheap labour, proximity to Europe and America make it a highly profitable proposition to grow Flamingo flower in Nigeria to better her economy.

The quality of growing medium and sources of fertilizer have been reported to significantly influence successful growth and flowering floricultural plants (Blackhard and Runkle, 2008). The need to improve growth and flowering of ornamental crops has been met by using inorganic fertilizer unscrupulously which has worsened the acidic problems of soil and its physical properties. The removal of subsidy on inorganic fertilizer (NPK) in Nigeria has further compounded the problems of availability and exorbitant cost. It is therefore reasonable to seek alternative source of maintaining growing medium nutrient fertility. Organic fertilizers, particularly, poultry manure is abundant in Nigeria, and therefore could serve as a reliable alternative to fertilize production of flamingo flower. Researchers have established that application poultry manure improves soil physical condition, nutrient status, pH, organic carbon, Ca, and Mg (Mullins *et al*., 2002; Ano and Agwu, 2005, Alabi, 2006; Busari *et al*., 2008), resulting in better crop performance.

Natural soil commonly used as substrate for ornamentals is not sustainable; therefore, there is the need to replace or at least reduce utilization of topsoil as a growing medium for ornamental plants. Continuous digging of agricultural soils meant for cropping could make the land susceptible to erosion and other forms of soil degradation (Baiyeri and Mbah, 2006).

The utilization of urban and agricultural waste products as growing medium for flamingo flower cultivation enhances easier transportation because of lighter weight and eliminates environmental degradation caused by unutilized urban and agricultural by-

products. It also prevents indiscriminate removal of topsoil.

Higher cost and non-availability of inorganic fertilizer in Nigeria and most Sub-Saharan African countries coupled with the environmental pollution associated with indiscriminate use of inorganic fertilizers necessitate the need to seek an alternative source of fertilizing ornamental plants. Thus, this study examined the growth and flowering of white and pink species *Anthurium andraenum* as influenced by source of fertilizers and growing medium.

MATERIALS AND METHODS

The experiments were conducted at the Horticultural Nursery, University of Agriculture, Abeokuta, Ogun State, Nigeria between 2009 and 2010. There were two fertilizer sources (poultry manure and NPK 20: 10: 10) and three growing media (Sawdust, topsoil and wood shavings) in factorial combinations. The treatments were laid out in a Completely Randomed Design (CRD) with four replications. The sawdust and wood shavings were decomposed for 30 days before used. Laboratory analysis of growing media and poultry manure samples was carried out prior to transplanting of seedlings. Seedlings of white and pink *Anthurium adraenum* were trimmed to two leaves per plant before transplanting into a 7 litres plastic pots filled with different media to 5 liters mark. Poultry manure (5.28 tons/ha) and NPK (624 kg/ha) fertilizers were applied at the rate of 165 and 19.5 g per plant at 32000 potted plants population per hectare, respectively. Each fertilizer type was applied in three split equal doses at 2, 10 and 18 weeks after transplanting.

Representative plants from pots were labeled and the observation made on plant height, number of leaves and leaf area were recorded periodically. Information on dry weight of flamingo flower's shoot and root, days to flowering and flower size were also recorded.

Non-destructive method was used for leaf area estimation by measuring length, breadth and product of length and breadth of 100 randomly selected leaves. The measurements were regressed against the leaf area determined by graphical method to evolve regression equation used in the final leaf area determination. The regression equations obtained are as follow:

Length	Y = 11.04X (r^2 = 0.651) Y = 21.91 X -159 (r^2 = 0.84)
L x B	Y = 0.86 X (r^2= 0.985) Y = 0.92 X -14.53 (r^2= 0.999)
Breadth	Y = 1377X (r^2 = 0.774) Y = 23.32 X – 117.3 (r^2 = 0.959)

Where

L	=	Length
B	=	Breadth
X	=	Mean of leaf length, breadth or L X B
Y	=	Total leaf area
r^2	=	Regression Co-efficient

The regression equation Y = 0.92X -1453 (r^2 =0.999) where X = L x B with the reliability of getting 99% accuracy was adopted. The data on all the parameters measured were subjected to Analysis of Variance (ANOVA) and treatment means separated using 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 or wood shavings (Table 1) Nutrient contents of the poultry manure used for the study was adequate , except total nitrogen which was low (Hsieh and Hsieh,1990).

Effects of source of fertilizer and growing medium on height of pink and white species of flamingo flower was insignificant ($p<0.05$) across sampling period (Table 2). However, source of fertilizer and growing medium interactions significantly influenced plant height at 12, 16 and 12 weeks after planting (WAP) and throughout sampling period in white specie. Height of white specie was in order of topsoil + poultry manure > wood shavings + NPK > topsoil + NPK > sawdust + poultry manure > wood shavings + poultry manure > sawdust + NPK. While in pink specie the order of height was sawdust + NPK > topsoil + poultry manure > wood shavings + poultry manure > sawdust + poultry manure > topsoil + NPK > wood shavings + NPK. Height of white specie planted in topsoil + poultry manure did not significantly differed compared to other treatment combinations, except those in sawdust + NPK which had short plants. The plant height superiority under different treatment combinations was probably due to synergy between the factors, and differences existing between pink and white species, fertilizer sources and variations in physical and chemical properties of the media.

Table 1: Chemical properties of the growing media and poultry manure

	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	
Poultry manure	2.14	4.0	0.12	260	2720	26.4	0.37	2610	2060	60.0	

Table 2: Effects of source of fertilizer and growing medium on height (cm) of Flamingo flower (mean value of two trials)

		Weeks after planting									
		Pink					White				
Treatments		4	8	12	16	20	4	8	12	16	20
NPK	Topsoil	10.60	11.05	11.55	11.95	12.05	13.53	13.70	14.60	14.98	15.28
	Sawdust	11.78	12.23	15.98	16.80	17.08	10.50	11.05	12.28	12.90	13.13
	Wood shavings	8.58	9.05	9.88	10.25	10.53	16.28	16.80	17.73	18.15	18.45
Poultry		13.03	13.65	14.55	14.90	15.15	16.53	17.05	18.70	19.33	19.80
manure	Topsoil										
	Sawdust	10.50	10.80	11.45	11.83	12.08	12.13	12.73	13.55	14.30	14.45
	Wood shavings	10.85	11.30	12.50	13.08	13.13	13.08	13.50	13.90	14.25	14.43
LSD(Fertilizer source X growing medium		ns	Ns	5.03	5.08	5.04	5.59	5.70	6.03	5.77	5.78
LSD (Fertilizer source)		ns	ns	Ns	ns	ns	ns	ns	ns	ns	ns
LSD (growing medium)		ns	ns	Ns	ns	ns	ns	ns	ns	ns	ns

LSD- Least Significant Difference, ns- not significant

Table 3: Number of leaves of Flamingo flower as influenced by source of fertilizer and growing medium (mean value of two trials)

		Weeks after planting									
		Pink					White				
Treatments		4	8	12	16	20	4	8	12	16	20
NPK	Topsoil	1.50	2.50	3.25	4.50	5.50	2.25	3.00	3.50	4.25	5.00
	Sawdust	1.00	2.00	2.00	3.00	4.00	2.00	2.50	3.75	5.25	6.50
	Wood shavings	2.00	2.50	3.75	5.00	5.50	2.25	2.75	3.25	4.75	5.50
Poultry		2.00	2.00	2.50	3.50	4.00	2.25	3.00	3.50	4.00	5.25
manure	Topsoil										
	Sawdust	1.75	1.75	1.75	2.50	3.50	2.25	2.75	3.25	4.50	5.25
	Wood shavings	1.50	1.50	2.00	2.25	2.50	2.00	2.25	2.25	3.25	3.25
LSD(Fertilizer source X growing medium		0.84	0.89	1.20	1.74	2.30	ns	0.69	1.11	1.47	2.09
LSD (Fertilizer source)		Ns	0.51	0.69	1.00	1.33	ns	Ns	ns	ns	ns
LSD (growing medium)		Ns	ns	0.85	1.23	ns	ns	0.69	ns	ns	1.48

LSD- Least Significant Difference, ns- not significant

Table 4: Leaf area (cm^2) of Flamingo flower as influenced by source of fertilizer and growing medium (mean value of two trials)

	Weeks after planting									
	Pink					White				
Treatments	4	8	12	16	20	4	8	12	16	20
NPK Topsoil	95.3	175.4	224.0	308.6	378.7	153.4	215.1	269.8	378.0	433.3
Sawdust	38.3	133.5	183.2	333.8	467.4	71.6	91.4	195.9	301.2	390.8
Wood shavings	64.9	89.5	146.2	220.1	228.8	64.5	114.4	99.1	362.1	361.4
Poultry	161.8	186.4	226.4	319.6	379.1	194.7	242.1	446.7	564.4	753.1
manure Topsoil										
Sawdust	80.6	94.1	115.1	175.9	179.9	105.1	132.1	137.8	199.4	231.1
Wood shavings	60.1	54.8	65.5	115.1	123.8	99.0	95.8	117.5	174.5	164.3
LSD(Fertilizer source X growing medium	90.2	102.7	132.7	185.0	172.4	ns	Ns	159.2	232.2	300.6
LSD (Fertilizer source)	ns	ns	Ns	ns	99.54	ns	Ns	ns	ns	ns
LSD (growing medium)	63.8	72.6	93.9	130.8	121.9	112.5	121.3	112.5	164.2	212.6

LSD- Least Significant Difference, ns- not significant

Table 5: Dry matter accumulation and flowering characteristics of Flamingo flower as influenced by source of fertilizer and growing medium (mean value of two trials)

		Pink				White			
		dry weight (g)		days to	flower	dry weight (g)		days to	flower
Treatments		root	shoot	flowering	size (cm)	root	shoot	flowering	size(cm)
NPK	Topsoil	1.23	6.36	192.5	3.75	6.48	14.13	183.8	2.90
	Sawdust	1.49	6.65	187.3	4.93	6.31	13.61	194.3	5.25
	Wood shavings	1.27	6.63	190.3	4.75	6.60	13.48	190.8	2.98
Poultry		3.25	10.10	185.5	3.18	2.29	7.70	189.0	4.80
manure	Topsoil								
	Sawdust	3.18	10.50	194.3	4.45	2.33	5.99	190.7	4.03
	Wood shavings	3.30	9.88	190.8	3.70	2.28	7.33	189.0	5.20
LSD(Fertilizer source X growing medium		0.74	0.88	3.9	1.39	0.43	2.60	5.4	1.26
LSD (Fertilizer source)		0.43	0.51	Ns	ns	0.25	1.50	Ns	0.73
LSD (growing medium)		ns	ns	Ns	0.98	ns	ns	Ns	ns

LSD- Least Significant Difference, ns- not significant

Results from Table 3 show that growth media significantly ($p< 0.05$) affected leaf production in both pink and white species. Plants in topsoil or wood shavings produced more leaves per plant than sawdust medium, though the differences between wood shavings and sawdust was insignificant ($P < 0.05$). Effect of source of fertilizer on leaf production was insignificant in white specie, but significantly affected pink specie as plants that received NPK fertilizer produced more leaves than when poultry manure was applied. Interactive effect of source of fertilizer and growing medium was significant in both species. Pink specie produced greater number of leaves when planted in topsoil + NPK or wood shaving + NPK than other treatments. Plants grown in wood shavings + poultry manure had the least number of leaves per plant. For white specie, higher number of leaves per plant was recorded in wood shavings + NPK, topsoil + NPK, topsoil + poultry manure, sawdust + NPK or, sawdust + poultry manure treatments while plant in wood shavings + poultry- manure produced the least.

Growing medium and fertilizer source significantly affected leaf area of both pink and white species of flamingo flower at 20 and 12, 15 and 20 WAP, respectively (Table 4). Pink specie grown in sawdust + NPK had broader leaf area but was statistically similar to those in topsoil + NPK and topsoil + poultry manure and significantly superior to other treatments. However, white specie planted in topsoil + poultry manure had wider leaf area compared to plants raised in other treatments.

Wider leaf area was recorded in topsoil than either sawdust or wood shavings for both species. However, effect of fertilizer sources on leaf area was insignificant except at 20 WAP for Pink specie where application of NPK fertilizer resulted in production of wider leaf area compared to poultry manure. Dry shoot and root weights, days to flowering and flower size of pink and white species of flamingo flower were significantly affected by growing medium and fertilizer source interactions (Table 5). For pink specie, dry matter accumulation was in the order of plants in topsoil + poultry manure > sawdust + poultry manure > wood shavings + poultry manure. However, white species planted in topsoil + NPK, sawdust + NPK and wood shavings + NPK treatments had significantly ($P < 0.05$) greater dry shoot and root weights values compared to other treatments. Higher shoot and root dry weights were observed in pink specie that received poultry manure than when NPK fertilizer was applied may be due to its N content (Olowoake and Adeoye, 2010). However, for white specie, application of NPK fertilizer resulted in a significantly greater shoot and root dry weights compared to poultry manure. This can be attributed to varietal differences which could play important role in increasing growth and yield of crops.

In pink specie, bigger flower size occurred in sawdust + NPK, followed by wood shavings + NPK while topsoil + poultry manure treatments produced smaller flowers. Though white specie of flamingo flower was bigger in sawdust + NPK, least yield in terms flower size occurred in topsoil + NPK and wood shavings + NPK treatments. Bigger flower was observed in sawdust medium while topsoil produced smaller flowers. Size of flowers produced by pink species planted in either wood shavings or sawdust is statistically similar. In white specie, application of poultry manure enhanced production of bigger flowers compared to NPK fertilizer. The performance of variety (specie) depends upon its genetic potential, nutrient management, agro-climatic features and other management practices. Beside, it is possible that varieties/species of similar genetic make-up may differ morphologically.

CONCLUSION

Data from this study support the conclusion that crop species response to organic and inorganic fertilizers could be different. Application of poultry manure is a good alternative to NPK fertilizer for production of flamingo flower. A sawdust or wood shaving is a better base potting media than topsoil for growth and flowering of flamingo flower.

REFERENCES

Ano, A.O and Agwu, J.A. (2005) Effect of animal manure on selected soil chemical properties. *Nigerian Journal of Soil Science* 15:14-19

Alabi, D.A. (2006) Effects of fertilizer phosphorous and poultry droppings treatmentson growth and nutrient component of pepper (*Capsicum annum* L.). *African Journal of Biotechnology* 5, 8: 671-677.

Bayeri, K.P and Mbah, B.N. (2006) Effects of soiless and soil-based nursery media on seedling emergence, growth and response to water stress of African breadfruit (*Treculia Africana* Decne), *African Journal of Biotechnology* Vol. 5 (15), 1405-1410.

Blanchard, M.G and Runkle, E.S. (2008) Container Opacity and Media Components Influence Rooting of Potted *Phalaenopsis* and *Doritaenopsis* Orchids. *Acta Horticuturae* 788: 115-120

Busari, M.A., Salako, F.K and Adetunji, M.T. (2008) Soil chemical properties and maize yield after application of organic and inorganic amendments to an acidic soil in southwestern Nigeria. *Spanish Journal of Agricultural Research* 6: 691-699.

Hsieh, S.C and Hsieh, C.F (1990) The use of organic matter in crop production. FFTC Extension Bulletin 360, 20pp

Mullins, G.I., Bendfeldt, E.S and Clark, R.A. (2002) Poultry litter as fertilizer and amendment. *Virginia Cooperative Extension Bulletin* 424-434.

Olowoake, A.A and Adeoye, G.O (2010) Comparative efficacy of NPK fertilizer and composted organic residues on growth, nutrient absorption and dry matter accumulation in maize, *International Journal of Organic Agriculture Research and Development vol* 2: 43-53

U.S. Department of Agriculture (2010) Floriculture crops 2009 summary. Agr. Stat. Board, Wash., DC.