academicJournals

Vol. 10(3), pp. 68-76, March 2016
DOI: 10.5897/AJPS2016.1401
Article Number: 337582057900
ISSN 1996-0824
Copyright © 2016
Author(s) retain the copyright of this article
http://www.academicjournals.org/AJPS

African Journal of Plant Science

Full Length Research Paper

Growth responses of two varieties of Heliconia flowers to selected growth media in Port Harcourt, South-South Nigeria

Omovbude S.[1]*, Oni O. O.[2] and Azagba E.[1]

[1]Department of Crop and Soil Science, Faculty of Agriculture, University of Port Harcourt, P. M. B. 5323 Port Harcourt, Rivers State, Nigeria.
[2]Department of Horticulture and Landscape Technology, Federal College of Agriculture, Ibadan, Oyo State, Nigeria.

Received 28 January, 2016; Accepted 16 March, 2016

Lack of suitable variety as well as appropriate growth medium constitutes major problems to flower production. It is against this backdrop that a pot experiment was carried out in the Department of Crop and Soil Science Demonstration Plot, Faculty of Agriculture, University of Port Harcourt, Nigeria between April and May, 2013 to determine the growth responses of two varieties of Heliconia flowers to selected growth media. The experiment comprised of two Heliconia varieties (Jade and Golden Torch) and six (6) growth media namely, topsoil (control), river sand, coconut husk, topsoil + river sand (1:1), topsoil + coconut husk (1:1) and river sand + coconut husk (1:1). The experiment was in a 2×6 factorial arrangement fitted into a completely randomized design replicated thrice. Results showed that topsoil + coconut husk (1:1) performed best at 4WAP by producing the highest stem height (8.7 cm), stem girth (2.9 cm) number of leaves (3.3), leaf area (41.5 cm^2) and longest root length (14.5) and more roots number (4.1) and this was followed by river sand+coconut husk (1:1) while the sole river sand gave the lowest vegetative traits. There was no significant difference on the vegetative parameters of the two varieties of Heliconia flowers and also on interaction. According to this experiment, topsoil + coconut husk (1:1) growth media is the better one for the growth of these Heliconia two varieties of flowers in the area of study. However, it needs more study on soil to recommend for farmers and the continual use of top soil as a candidate growth medium need to be discouraged because it is non-renewable hence, in the absence of top soil, river sand in combination with coconut husk (1:1) could serve as next available alternative.

Key words: Flowers, Golden Torch, growth, jade, media, responses, varieties.

INTRODUCTION

Flowers are an integral part of human life due to their diversity in beauty, form, texture, color and fragrance (Urooj-Ul-Nissa et al., 2015). Jade (*Heliconia psittacorum*) and Golden Torch (H. *psittacorum* × H. *spathocircinata* are well-known Heliconia cut flowers belonging to the family *Heliconiace*, formaly included in the family Musaceae where they were grouped with the bananas. Heliconia derived from the Greek word *Helikonios,* is a genus of about 100 to 200 species of flowering plants. Heliconia flowers are fairly insignificant. What most people would call the 'flower' is actually a group of colorful specialized leaves, called bracts.

Heliconia leaves look more or less like banana leaves. They are generally green, but some are tinged slightly with colour (particularly when young) and sometimes the leaves and stems are coloured or patterned slightly. The true flowers are hidden inside these bracts. Heliconias are tropical plants related to bananas, cannas and gingers. There are about 100 different individual species, and most species then have a large number of hybrids and cultivars, with flower styles varying significantly from the original. Jade' is a beautiful flower characterized by pale white/cream/yellow bract shading to a light pink towards the edges. It is a vigorous grower and prolific producer of flowers most of the year, and makes an excellent cut flower. It grows about 1 to 2 m high while Golden Torch' grows up to 3 m tall, with bright yellow flowering bracts.

Several authors (Ekwu and Mbah, 2007; Baiyeri and Mbah, 2006) had advocated for the replacement of natural top soil as growth medium of floricultural crops with other available options due to some of its shortcomings such as non-sustainability and as a non-renewable resources. Continuous digging of agricultural soils meant for cropping arable land could make the land susceptible to erosion and other forms of soil degradation. Olosunde et al. (2008) reported other limitations of top soil such as heterogeneity with regard to physical and chemical properties; Water holding capacity and bulk density could hinder the normal growth of floricultural plants. Tariq et al. (2012) reported that although natural top soil is acceptable as a growing medium for plants in garden/field, but it is not the right choice for plants in pots or containers because the frequent water demanded by the container plants will cause soil compaction resulting in a tight and brick-like mass. Since top soils are generally unsatisfactory for the production of plants in containers, because the soils do not provide the aeration, drainage and water holding capacity required for plant growth in order to improve the situation several "soilless" growing media have been developed in which plants are grown. Growing media are materials, other than soils *in situ*, in which plants are grown. There are two types of growth media: organic and inorganic. The organic media used materials like peat, compost, tree bark, coconut (*Cocos nucifera* L.Coir), poultry feathers, wood chip, wood shaving, saw dust, Fleece and Marc. The inorganic media are classified into two namely Natural and Synthetic media. Materials used for inorganic natural medium are Sand, Gravel, Rockwool, Glass wool, Perlite Vermiculite, Pumice, Expanded clay, Zeolite Volcanic tuff and Sepiolite while the synthetic natural media used materials are Foam mats (polyurethane),"Oasis" (plastic foam) Hydrogel (Olympios, 1999). Generally, these media are mixed together rather than used alone, as each usually provides its own function. A perfect growth media performs four (4) functions namely: Serving as a reservoir for plant nutrient, holding of water in a way that makes it available to the plant, provision of gases and water at the same time and act as plant support. Some individual materials (substrates) can provide all four functions, but not at the required level of each. For example, sand provides excellent support and gas exchange but has insufficient water and nutrient supplying capacity. The coarse particles of sand have small surface area per unit of volume compared to the finer parties of soil or peat moss. Since water is held on the surfaces of particles, sand has a small water reserve. Since most nutrients in the sand medium are held in the water films, there is every like hood of little nutrient reserve. It is pertinent to note that a single soil less medium alone cannot supply all the nutrients hence the media are mixed together.

Amendment of growth medium with coarse minerals such as river sand to increase air filled pores and drainage was suggested by Dolor et al. (2009). Hartmann et al. (2007) also noted that an ideal potting medium should provide porosity to allow good aeration. One of the most important criteria for successful germination is a reliable germination medium. The influence of the medium is felt even before the plant sprout, because of its water retention and aeration properties. Locally and readily available materials such as wood shaven, sawdust, rice hull, river sand, coconut fiber and mixture of these materials have been proven to be a good media for germination of many crops (Ekwu and Mbah, 2007). Adams et al. (2003) and Akanbi et al. (2002) cited by Baiyeri (2005) noted that the use of organic material offers a great advantage over the conventional topsoil because it provides adequate nutrients to seedlings, better root substrate relation than conventional soil mix and less pre-dispose the seedlings soil borne pests and diseases. The two varieties of Heliconia flowers were chosen for the study based on their popularity, availability, ornamental value, and commercial profitability of long shelf life, the chosen cultivars are characterized by flowering precocity, relatively compact size, uniformity and diversity of flower color, and abundance of flowers. In addition to the afore mentioned characters, the colours and shapes of Heliconia made popular cut flowers can be used for decoration at occasions and homes. These attractive flowers are relatively cheap and represent good value for money. However, there is dearth of information on the actual growth medium for its propagation. Hence, the objective of this study was to compared the performance of selected growth media on two varieties of Heliconia flowers namely Jade and Golden Torch in south south agro- ecological zones of Nigeria.

*Corresponding author. E-mail: sundayomovbude@yahoo.com.

Author(s) agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

MATERIALS AND METHODS

Experimental site

The experiment was carried out in the Department of Crop and Soil Science Demonstration Plot, Faculty of Agriculture, University of Port Harcourt, Nigeria between 1st of April to 8th of May, 2013. University of Port Harcourt is located at latitude 4° 3" N to 5° N and longitude 6°, 45'E to 70°E, with an average temperature of 27°C, relative humidity of 78% and average annual rainfall between March and November that ranges from 2500 to 4000 mm.

Source of materials

The rhizomes set planted were obtained from within the University of Port Harcourt premises. Each rhizomes set had three nodes and some developed roots at an average weight of 9 kg and average length of 8 cm. The black polythene bags (25 cm × 15 cm × 7cm) used for the experiment were purchased from Choba market in along East West road in Port Harcourt. The topsoil used was collected with soil auger at depth of 0-15 cm from land in the Department of Crop and Soil Science Demonstration Plot, Faculty of Agriculture, University of Port Harcourt. The river sand was obtained from Choba river along East West Road, University of Port Harcourt while the matured brown coconut husk were obtained from a coconut's seller as waste for free of any cost at Ogoni Village in Port Harcourt.

Experimental design, treatment and cultural details

The experimental plot was cleared and mapped out. Clearing was done on the 1st of April 2013. The experiment comprised of two (2) Heliconia varieties (Jade and Golden torch) and six (6) potting media which are itemized as follows:

1. Topsoil (control)
2. River sand
3. Coconut husk
4. Topsoil + River sand (1:1)
5. Topsoil + Coconut husk (1:1)
6. River sand + Coconut husk (1:1

The experiment was in a 2×6 factorial arrangement fitted into a completely randomized design giving a total of twelve (12) treatment combinations replicated thrice. A 2×6×3=36 polythene pots were used for the experiment. Each poly bag presents one treatment which was randomly assigned within each replication.

The potting media were analyzed before sowing for their physical and chemical characteristics using standard Laboratory described by Mylavarapus and Kennelley (2002). The mixed media was measured in equal ratio of 1:1 before it has been put inside the polythene bags. The experimental plot was cleared and mapped out. Clearing was done on the 1st of April 2013. Planting of the H*eliconia psittacorum* rhizomes were done immediately after the poly bags were ready and filled with each substrate on the 10th of April 2013.The polybags were then arranged on thick polythene sheet to prevent the growth of the roots into the ground, to avoid possible uptake of nutrients under partially shaded Oil palm tree of 50% light intensity and spaced at 30 cm × 30 cm. Weeding was done through hand picking; the 1st weeding was done on the 24th of April, 2013; two weeks after planting and the second was on the 8th of May, 2013. The volume of water required to water the growth sources to field capacity was calculated according to Udo et al. (2009). The result obtained from the calculation was 200 ml and it was used to water one (1) polybag in each of the media routinely at alternate day before the termination of the experiment.

Data collected

The data collected were: number of leaves, leaf area, stem height, root length, number of root and stem girth. The three (3) plants which served as replicate per medium were tagged for growth measurement. All the data were collected at weekly interval except number and length of roots. The number of leaves was determined by counting. The leaf area was determined by multiplying leaf length by leaf width and a constant (0.75) (Remison and Lucas, 1982). Stem height was measured from the base of the plant to the tip of the terminal leaf bud with meter rule.

Stem diameter was measured five centimeters above ground level using micrometer screw gauge and converted to girth using the following formula:

Stem girth = Stem diameter × 22/7(π)(Ede et al., 2015)

Number and length of roots was determined at termination of the experiment at four weeks after planting (4WAP) by destructive sample and thereafter root were counted and measured with a meter rule.

Statistical analysis

Data collected were analyzed using the analysis of variance procedure while the means were separated by the least significant differences (LSD) at 5% level of probability.

RESULTS

Physiochemical properties of the selected growth media

Some physiochemical properties of the selected growth media are presented in Table 1. Results showed that the sand particles ranged from 0.00 to 99.1% with river sand producing the highest sand value and the lowest insole coconut medium. Silt particle ranged from 0.00 to 1.8% with top soil producing the highest value and the lowest in sole coconut husk medium. Clay particle followed the same trend as silt particle. The pH value ranged from 5.40 to 7.09 with sole river sand having the highest value and sole top soil the lowest. Total organic carbon ranged from 0.63 to 45.83% with sole coconut medium producing the highest value and sole river sand the lowest. Total nitrogen ranged from 0.09 to 0.52% with sole coconut husk having the highest value and sole river sand the lowest. Available phosphorus (P) followed similar trend with that of total nitrogen Exchangeable Calcium (Ca) ranged from 0.5 to 1.40 cmol/kg with sole coconut husk producing the highest value and sole river sand the lowest. Exchangeable Magnesium (Mg) followed similar trend. Exchangeable Potassium (K) ranged from 0.23 to 3.22 cmol/kg with sole coconut husk producing the highest value and top soil medium the lowest. Electrical conductivity (Ec) ranged from 0.06 to 2.01 dS/m with coconut husk having the highest value and top soil the lowest.

Table 1. Some physico-chemical properties of the selected growth media.

Growth media	Sand (%)	Silt (%)	Clay (%)	pH (H_2O)	TOC (%)	Total N (%)	Avail P (mg/kg)	Exch.Ca (cmol/kg)	Exch.Mg (cmol/kg)	Exch.K (cmol/kg)	EC (dS/m)
Top soil (control)	91.40	1.80	6.80	5.40	3.40	0.13	8.67	0.86	2.02	0.23	0.06
River sand	99.10	0.10	0.80	7.09	0.63	0.09	1.23	0.13	0.18	1.86	0.23
husk	0.00	0.00	0.00	6.80	45.83	0.52	784.50	1.40	2.75	3.22	2.01
Top+River sand (1:1)	95.25	0.95	3.80	6.25	2.02	0.11	4.95	0.50	1.10	1.05	0.15
Topsoil + coconut husk (1: 1)	45.70	0.90	3.40	6.10	24.62	0.32	396.59	1.13	2.39	1.73	1.04
River sand +coconut husk (1: 1)	49.55	0.05	0.40	6.94	23.23	0.31	392.87	0.78	1.47	2.54	1.12

TOC = Total organic carbon, Avail = Available, Exch = Exchangeable and EC = Electrical conductivity.

Table 2. The effect of selected growth media on mean stem height (cm) of two varieties of Heliconia.

Factor	1WAP	2WAP	3WAP	4WAP
Growth media				
Top soil (control)	2.7	2.9	5.5	7.1
River sand	2.0	2.8	5.1	6.9
Coconut husk	2.9	4.1	5.8	7.6
Top soil + River sand (1:1)	3.1	4.7	6.0	8.0
Top soil + coconut husk(1:1)	3.9	6.0	6.9	8.7
River sand+ coconut husk(1:1)	3.5	5.4	6.7	8.3
LSD P = (0.05)	0.84	0.93	0.97	0.29
Variety				
Jade	2.9	4.0	5.7	7.5
Golden Torch	3.0	4.5	6.7	8.0
LSD P = (0.05	NS	NS	NS	NS

[1]Week(s) after planting=WAP; [2]Not significant=NS.

Response of the selected growth media

Stem height and stem girth

The effect of the selected growth media on stem height of the two varieties of Heliconia flowers is presented in Table 2.There were significant ($p< 0.05$) differences in mean stem height among the selected growth media throughout the periods of observation. At 1WAP (Week after planting) mixed top soil and coconut husk (1:1) produced the tallest stem (3.9 cm) which was not statistically different ($p> 0.05$) from river sand+ coconut husk (1:1) (3.5 cm) and Top soil + River sand (1:1) (3.1 cm) while sole river sand had the shortest stem

Table 3. The effect of selected growth media on mean stem girth (cm) of two varieties of Heliconia.

Factor	WAP[1]	2WAP	3WAP	4WAP
Growth media				
Top soil (control)	1.2	1.6	1.9	2.3
River sand	1.1	1.4	1.8	2.2
Coconut husk	1.7	1.9	2.2	2.5
Top soil + River sand (1:1)	1.6	2.0	2.4	2.7
Top soil + coconut husk (1:1)	1.8	2.2	2.5	2.9
River sand+ coconut husk (1:1)	1.8	2.2	2.5	2.8
LSD P = 0.05	0.39	0.30	0.19	0.29
Variety				
Jade	1.6	1.9	2.1	2.3
Golden Torch	1.6	1.8	2.0	2.4
LSD P =0.05	NS	NS	NS	NS

[1]Week(s) after planting, [2]Not significant.

(2.0 cm) which was statistically ($p>0.05$) similar with that of top soil (2.7 cm).

At 2WAP, Top soil + coconut husk (1:1) produced significantly ($p<0.05$) tallest plant (6.0cm) which was statistically at *par* with that of River sand + coconut husk (1:1) (5.4 cm) while sole river sand (2.8 cm) had the shortest plant which was at *par* with top soil (2.9 cm).

At 3WAP, the combination of top soil and coconut husk (1:1) produced significantly tallest plant (6.9 cm) which was statistically similar with mixed river sand+coconut husk (6.7 cm) and Top soil + River sand (1:1) (6.1 cm) while river sand produced the shortest plant (5.1 cm) which was at *par* with those of topsoil (5.5 cm) and sole coconut husk (5.8 cm). At 4WAP (termination period) Top soil + coconut husk(1:1) produced significantly tallest plant of 8.7cm and differed from other media while sole river sand had the shortest plant of 6.9 cm was statistically similar to that of the sole top soil (control) (7.1 cm)

The effect of the selected growth media on stem girth of the two varieties of Heliconia flowers is presented in Table 3. At 1WAP, top soil+coconut husk (1:1) and river sand+coconut husk (1:1) produced significantly highest stem girth of 1.8 cm each which were statistically at par with those of sole coconut husk (1.7 cm) and top soil +river sand (1:1)(1.6 cm) while the shortest stem girth of 1.2 cm and 1.3 cm recorded in sole river sand and top soil respectively. At 2WAP Sole River sand and top soil produced the lowest stem girth of 1.4 and 1.6 cm, respectively and differed significantly from the other medias. At 3WAP, top soil + coconut husk (1:1) and river sand+coconut husk (1:1) had highest stem girth of 2.5 cm but statistically similar with that of top soil + river sand (1:1) (2.4.cm) and differed significantly from the other media. At 4 WAP, sole river sand had the lowest stem girth of 2.2 cm which was statistically similar with that of the sole top soil (control) (2.3 cm) which differed significantly

Number of leaves and leaf area

The effect of selected growth media on number of leaves of two varieties of Heliconia flower is presented in Table 4. There were no significant differences among the growth media in terms of number of leaves throughout the observation periods except at 4WAP, where top soil + coconut husk (1:1) had the highest number of leaves (3.3) but statistically at par with those of river sand+ coconut husk (1:1)(3.2) and Top soil + River sand (1:1) (3.0); while the lowest number of leaves were recorded in sole river sand medium (2.1) which were statistically similar with those of sole top soil (2.2) and coconut husk (2.5).

The effect of the selected growth media on leaf area of the two varieties of Heliconia flower is presented in Table 5. Top soil + coconut husk (1:1) produced significantly greatest leaf area throughout the observation periods while the lowest was in sole river sand.

Root length and number of roots

The effect of selected growth media on root length of the two varieties of Heliconia flower is presented in Table 6. Top soil+coconut husk (1:1)and river sand + coconut husk had the longest plant root of 14.5 and 14.4 cm, respectively and were statistically comparable with that of Top soil and river sand (12.6 cm) medium. Sole river sand produced shortest root length of 10.4 cm which was statistically at par with those of top soil 10.7 cm and sole

Table 4. The effect of selected growth media on mean number of leaves of two varieties of Heliconia flower.

Factor	WAP[1]	2WAP	3WAP	4WAP
Growth media				
Top soil (control)	1.3	1.4	2.0	2.2
River sand	1.2	1.5	1.8	2.1
Coconut husk	1.1	1.5	2.0	2.5
Top soil + River sand (1:1)	1.1	1.6	1.7	3.0
Top soil + coconut husk (1:1)	1.5	1.8	2.0	3.3
River sand+ coconut husk (1:1)	1.2	1.8	1.8	3.2
LSD P = 0.05	NS	NS	NS	0.42
Variety				
Jade	1.0	1.4		2.5
Golden Torch	1..3	1.6		2.5
LSD P =0.05	NS[2]	NS	NS	NS

[1]Week(s) after planting, [2]Not significant.

Table 5. The effect of selected growth media on mean leaf area ($cm^{2)}$ of two varieties of Heliconia flower.

Factor	1WAP[1]	2WAP	3WAP	4WAP
Growth media				
Top soil (control)	4.7	8.5	12.3	19.9
River sand	4.6	7.9	11.2	18.1
Coconut husk	5.1	10.5	16.2	22.0
Top soil + River sand (1:1)	5.3	16.6	19.7	24.2
Top soil + coconut husk (1:1)	16.5	29.8	31.6	41.5
River sand+ coconut husk (1:1)	10.1	20.1	22.4	31.4
LSD P = 0.05	5.60	8.84	8.48	9.96
Variety				
Jade	7.6	14.9	18.7	26.9
Golden Torch	7.9	16.1	19.2	27.4
LSD P =0.05	NS[2]	NS	NS	NS

[1]Week(s) after planting; [2]Not significant.

coconut husk medium (11.1 cm). The effect of the selected growth media on number of root of the two varieties of Heliconia flower showed that there was no significance ($p>0.05$) among the selected growth media though top soil had the highest numbers of root (4.1).

Effect of variety

Vegetative parameters (stem height, stem girth, number of leaves, leaf area, root length and number of roots) as influenced by variety are presented in Tables 2 to 6. There were no significance differences among the vegetative parameters throughout the periods of observation.

Interaction of variety and growth media

Variety x grow media interaction on stem height, stem girth, number of leaves leaf area, number of roots and root length were not significantly ($P < 0.05$) differed throughout the observation periods.

DISCUSSION

Use of suitable growing media or substrates is an essential for production of quality horticultural crop Bhardwaj (2014). Physiochemical properties of the growing media pose their effect on the plant growth (Wilkerson, 2002); therefore the composition of the

Table 6. Effect of selected growth media on mean root length and numbers of two varieties of Heliconia flower.

Factor	Root length (cm)	Number of roots
Growth media		
Top soil (control)	10.7	3.3
River sand	10.4	3.3
Coconut husk	11.1	3.4
Top soil + River sand (1:1)	12.6	3.7
Top soil + coconut husk (1:1)	14.5	4.1
River sand + coconut husk (1:1)	14.4	4.0
LSD P = 0.05	3.16	NS
Variety		
Jade	9.5	3.6
Golden Torch	10..1	3.5
LSD P =0.05	NS	NS[1]

[1]Not significant.

growth media is very important factor to be taken under consideration (Ingram et al., 2003). The selected growth media differed in physical and chemical characteristics. The differences were more pronounced in the chemical characteristics. Olosunde et al. (2015) reported that an effective growth media should provide anchorage to the plant; hold sufficient available nutrients; be porous and well drained; relatively low in soluble salts; standardized and uniform; free pests and pathogens; biologically and chemically stable. The three main components that can bring about to a media's chemical make-up are PH, electrical conductivity (EC) and exchange capacity (CEC). These three components satisfied the acceptable range required for plant growth in a medium as reported by Abad et al. (2002).

The vigorous and fast growth of seedlings in terms of stem height recorded in Top soil + coconut husk(1:1), River sand + coconut husk(1:1) Top soil + River sand (1:1) and Coconut husk may be attributed to better water holding capacity and availability of the nutrients for plant growth. While poor growth in sole river sand and top soil and may be due to low nutritional status for plant offered by the medium. Similar results were reported by Conover and Poole (1981) as better plant height in mixed media than in sole media. The greater stem girth noticed in mixed top soil + coconut husk (1:1), river sand + coconut husk (1:1), top soil + River sand (1:1) and sole coconut husk might be attributed to its richer nutritional status which enhanced photosynthetic activity resulted in more plant stored material, thereby increasing seedling girth. Similarly lesser stem girth in top soil (control) and sole river sand might be due to less soil aeration and poor root penetration which had restricted the plant growth.

Number of leaves was affected by the growth media throughout the period of observations except at 3WAP. The non-significance difference noticed at 3WAP among the media might be attributed to nutrient imbalance. Numbers of leaves or vegetative growth generally depend upon the nutrients taken or absorbed from media in which it's sown. The first stage of growth of the plant usually takes nutrients stored in the rhizomes, when the nutrients are depleted the plant depends upon the root up- take from the soil or from the media. Remison (1997) noted that plants propagated by rhizome have enough storage material that can easily root and forms new shoot. In the same vein, Diaz-Zorita et al. (2005), and Cernac et al. (2006) also stated that germination and seedling emergence is independent of soil nutrient status, but rather depends totally on cotyledons still attached to the seedling which are rich in stored food reserves until the seedling becomes autotrophic and have ability to utilize the food reserves.

The highest number of leaves recorded in Top soil + coconut husk (1:1), river sand+ coconut husk (1:1), top soil+river sand (1:1) and sole coconut husks could be attributed to presence of adequate nutrients. While the lowest value recorded in sole river sand and top soil could be attributed to compactness nature of the soil which restrict nutrient up take. More number of leaves in plants implies good vigor and environmental suitability in growth media. Plant leaves are also important during the process of photosynthesis. More leaves tend to increase photosynthetic activity in plants. The greatest leaf area recorded in mixed Top soil + coconut husk (1:1) media might be due to immediate availability of nutrients and water for plant uptake. The result from the findings are also in support from previous work done by Wuryaningsih et al. (1999) who noted significant increase in pot Anthurium leaf number while using coconut husk as growing media. River sand + coconut husk (1:1) also had

larger leaf area due to its ability to retain nutrient and water for translocation to the shoot system. The number of roots were not affected by the different growth media though Top soil + coconut husk (1:1) and River sand+ coconut husk (1:1) tend to have more number of roots than the other media. This result also in line with that of Waziri et al. (2015) who noted that there were no significant differences in growth media consisting of three different soil types (river sand, top soil and a mixture of river sand + top soil + cow dung in ratio 1:1:1) number of roots of *Delonixregia* stem cuttings. The probable reason for this could be improve in structure and texture of the growth media. Mixed media of Top soil + coconut husk (1:1), River sand+ coconut husk (1:1), Top soil + River sand (1:1) and sole coconut medium had longest root. The reason could be that there were macro pores spaces within the germination media that allows roots growth, since there was no compaction of the media that can restrict the growth of roots as does in sole river sand medium. The slight increase in length observed in sole river sand than sole top soil medium could be attributed to the better aeration and good drainage of water, which could promote root growth and development. Air spaces are required for supply of sufficient oxygen for respiration.

There was no significant difference in the vegetative growth of the two varieties (jade and golden torch) throughout the observation periods probably because both varieties are of same species. Variety x growing media interaction on stem height, stem girth, number of leaves leaf area, number of roots and root length were not significantly ($P < 0.05$) differed throughout the growing periods. This indicated that variety and growth media are independent in their effects on these parameters.

SUMMARY AND CONCLUSION

Outstanding findings drawn from this study showed that the two varieties of heliconia flowers responded well to the selected growth media. Topsoil + Coconut husk (1:1) and River sand + Coconut husk (1:1) were the best candidate media for producing the two flowers judging from their satisfactory growth performances in terms of stem height, stem girth, number of leaves, leaf area, root length and roots number; while top soil and river sand were adjudged as the worst candidate media because of their unsatisfactory growth performance. In conclusion, Topsoil + Coconut husk (1:1) combination is the best growing medium of these two varieties of heliconia in the area of study. However, the continual use of top soil as a candidate growth medium need to be discouraged because of soil degradation, non-sustainability and non-renewability associated with it; hence, in the absence of top soil, river sand in combination with coconut husk (1:1) could serve as next available alternative. Replicate studies on growth response of Heliconia flower varieties to some growth media under field conditions is still needed to provide sufficient information to the farmers in the of study area and other regions with similar geographical axis.

Conflict of Interests

The authors have not declared any conflict of interests.

REFERENCES

Abad M, Noguera P, Pochades R, Maquieira A, Noguera V (2002). Physico-chemical properties of some coconut coir dusts for use as a peat substitute for containerized ornamental plants. Bioresour. Technol. 82:241-245.

Baiyeri KP (2005). Response of *Musa* species to macro-propagation. II: The effects of genotype, initiation and weaning media on sucker growth and quality in the nursery. Afr. J. Biotechnol. 4(3):229-234.

Bayeri KP, Mbah BN (2006). Effects of soilless and soil based nursery media on seedling emergence, growth and response to water stress of African breadfruit (*Treculia Africana* Decne). Afr. J. Biotechnol. 5:15.

Bhardwaj RL (2014). Effect of seed germination and seedling growth of papaya 'cv' Red lady. Afr. J. Plant Sci. 8(4):178-184.

Cernac AAC, Hoffman-Benning S, Benning C (2006). WRII is required for seed germination and seedling establishment1. Plant Physiol. 141:745-757.

Conover CA, Poole RT (1981). Effect of soil compaction on physical properties of potting media and growth of *Picea pubescens* Liebm "Silver Tree". J. Am. Soc. Hort. Sci. 106:604-607.

Diaz-Zorita M, Grove JH, Perfect E (2005). Soil fragment size distribution and compactive effort effect on maize root seedling elongation in moist soil. Crop. Sci. 45:1417-1426.

Dolor D, Elkie F O, Nnaji GU (2009). Effect of propagation media on the rooting of leafy stem cuttings of *Irvingia wombolu* (Vermoesen). J. Agric. Biol. Sci. 5(6):1146-115.

Ede AE, Ndubuaku UM, Baiyeri KP (2015). Media Effects on Emergence and Growth of Moringa (*Moringa oleifera* Lam) Seedlings in the Nursery. Am. J. Exp. Agric. 7(3):182-189.

Ekwu LG, Mbah BN (2007). Effect of nitrogen, potassium and media on the growth and flowering of marigold (*Tagetes erecta* L.). J. Agric. Food Environ. Ext. 6(1):45-55.

Hartmann HT, Kester DE, Davies F I, Genve RI (2007). Hartmann and Kester's Plant Propagation, Principles and Practices. 7th edition. Prentice-Hall of India Ltd. 880 pp.

Ingram DL, Henley RW, Yeager TH (2003). Growth media for container grown ornamental plants. Environmental Horticulture Department, Florida Cooperative Extension Services, Institute of Food and Agricultural Sciences, University of Florida, Gaines Ville F326. P 241.

Mylavarapus RS, Kennelley DE (2002). UF//IFAS extension soil testing laboratory (ESTL): Analytical procedures and training manual. Institute of Food and Agricultural Science, University of Florida, Gainsville, USA. 55 pp.

Olosunde OM, Adeleke AM, Amusat AS, Ogundiran OB (2015). Growth response of *Dracaena fragrans* and *Cordyline* to growing media. Int. J. Trop. Agric. 33(1):41-46.

Olosunde OM, Olasantan, FO, Olubode OO (2008). Effect of Growth Media on Rooting of Queen of Philippine (*Mussa endaphillippica* A. Rich). Nig. J. Hort. Sci. 13:68-74.

Olympios CM (1999). Overview of soilless culture: Advantages, constraints and Perspectives for its use in Mediterranean Countries. Cah. Options Mediterr. 31:307-324.

Remison SU (1997). Basic principles of crop physiology. Sadoh Press Benin City, Nigeria. P 163.

Remison SU, Lucas EO (1982). Effects of planting density on leaf area and productivity of two maize cultivars in Nigeria. Exp. Agric. 18:98-100.

Tariq U, Rehman S, Aslam MK, Younis A, Yaseen M, Ahsan M (2012). Agricultural and municipal waste as potting media components for the growth and flowering of *Dahlia hortensis* Figaro. Turk. J. Bot. 36:378-385.

Udo EJ, Ibia TO, Ogunwale JA, Ano AO, Esu, IE (2009). Manual of soil plant and water analyses. Sibonbook Ltd, Lagos. P 183.

Urooj-UI-Nissa B, Khan FU, Neelofar N, Nazki IT, Klan FA, Dar MA. (2015). Physiological and Flowering Response of Dahlia (*Dahlia variabilis* Desf.) cv. Pink Attraction to Growing Media. J. Plant Pest Sci. 2(1):33-42.

Waziri M, Kyari BA, Ibrahim M, Apagu B, Yunana B, Askira MN, Benisheikh AB (2015). Effect of different soil media on the rooting and growth of *Delonix regia* stem cuttings in Maiduguri. Intl. J. Innov. Agric. Biol. Res. 3(1):6.

Wilkerson D (2002). Growing Media Texas Greenhouse Management Hand book. Texas (http://aggiehorticulture,tamu.edu/greenhouse/nursery/guidesgreen/media.html).

Wuryaningsih S, Sutater T, Tjia B (1999). The growth ornamental pot *Anthurium andraeanumon* coir dust growing media. J. Penelitian Pertanian 18:31-38.