Original Research Article

Effects of Different Growth Media on Vegetative Propagation of *Gongronema latifolium* in Delta State Capital Territory, Nigeria

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Abstract

A study was carried out in the Teaching and Research Farm of Delta State University, Asaba Campus, Asaba to evaluate the effects of vegetative propagation of Gongronema latifolium on soils of Delta State Capital territory as growth media. The experimental design was a completely randomized design (CRD) with seven treatments replicated four times. The data were collected on number of sprouted vine, number of leaves, leaf area, stem girth and vine length and were subjected to analysis of variance (ANOVA) and means showing significant difference were separated using Duncan Multiple range test. The results showed that the identified soils were sandy soil, loamy soil and clayey soil. Gongronema latifolium grown on loamy soil media had higher ($P < 0.05$) number of leaves, leaf area and vine length than those grown on clayey soil and sandy soil media. The study revealed that loamy soil is the most suitable medium for the propagation of Gongronema latifolium using stem cutting and is thus recommended for Delta state capital territory, Nigeria.

Key words: *Gongronema latifolium*, growth media, growth parameters

Introduction

Gongronema latifolium Benth is a herbaceous non-woody plant found in the tropical and subtropical regions of Africa and South America (Agbo *et al.*, 2005). In Nigeria, *G. latifolium* is a very common crop found in the south-eastern part of the country, and is used as a spice and a leafy vegetable due to its nutritional properties (Ugochukwu *et al.*, 2003; Okafor, 2005). Medically, leaf extracts of *G. latifolium* are used for boosting appetite, and in the treatment of dysentery, worm infestation, cough, catarrh, congested chest, running nose, high blood pressure and typhoid fever and as well as for sickle cell anemia (Okafor and Ham, 1999; Agbo *et al.*, 2005; Okafor, 2005; Afolabi, 2007; Nwachukwu *et al.*, 2010). Similarly, Dike (2010) posited that *G. latifolium* has antibacterial, antioxidant, anti-inflammatory, hepato-protective, anti-plasmodial, anti-asthmatic, anti-sickling, anti-ulcer, analgesic and antipyretic activities, while its leaves are used in the management of diabetes mellitus (Gamaniel and Akah, 1996).

The leaves are also used for making soups including fresh fish pepper soup, and can also be eaten as a dessert with other preparations like African salad in south-eastern Nigeria (Ugochukwu and Babady, 2002; Ugochukwu *et al.*, 2003). This important vegetable and spice crop is becoming very promising in southern Nigeria as a result of acculturation. Indeed, the successful growing of this crop will, to a large extent, depend on the identification of suitable growth media. Therefore, there is need to identify the growth media that best enhance fast foliage production and rooting of stem cuttings in southern Nigeria. The objective of this study was therefore to identify suitable growth media for the propagation and optimum growth of *Gongronema latifolium.*

Materials and Methods

The study was carried out at the Teaching and Research Farm of Delta State University, Asaba Campus, Asaba which lies on latitude 6^{o}14`N and longitude 6$^o$49`E (Federal Ministry of Aviation, Meteorological Station Bulletin, 2012).

Soil samples collected from three locations in Asaba capital territory, Musa camp, Okpanam village and Mile 5, were analyzed for their physico-chemical properties, and later classified as sandy, clay and loamy soils. Sawdust was collected from Ogbosisi wood market along Asaba/Onitsha expressway, Asaba.

The experiment was a completely randomized design with seven treatments (growth media), replicated four times. The treatments included Sandy soil, clay soil, loamy soil, sandy soil + sawdust, clay soil + sawdust, loamy soil + sawdust and sawdust only.

Gongronema latifolium cuttings were sourced from Ugbolu market. Cuttings of 35cm in length were obtained from a single parent stock to avoid the effect of genetic variation. This ensured that each cutting had about six nodes, so that one of the nodes could be placed inside the growth medium while the others, above the rooting medium, were for shoot production. The stem cuttings were planted during the dry season (February) into polythene bags filled with 10kg of the different soil media only and soil media + sawdust in a ratio of 1:1, v/v. Two cuttings were planted in one polythene bag. After planting, all growth media with cuttings were watered daily till the rains stabilized. Data was collected every fortnight on the following growth parameters: plant height, measured with a measuring tape graduated in meters, stem girth, measured with a veneer calliper, number of sprouted vines and number of leaves, which were visually counted, and leave area (cm^2), measured with a planometer. Data collected were subjected to analysis of variance (ANOVA), and significant means were separated using Duncan Multiple Range Test (Wahua, 1999).

Results

Results of the pre-planting analysis of the soil media are presented in Table 1. The soil types collected from Musa camp, Okpanam village and Mile 5 were classified as sandy soil, and had a pH of 6.7 which was slightly acidic. Okpanam village road soil was identified as loamy soil with a pH of 5.7, while Mile 5 soil was clayey, with a pH of 5.9. The sandy soil had low organic carbon, while loam and clay soils had moderate organic carbon contents. Total nitrogen was low in all the soils, and ranged from 0.08 to 0.14. The available P of clay and sandy soil were low, and moderate in loam. Effective cation exchange capacity (ECEC) of the soils was generally low.

Table 1: Pre-planting soil analysis of the study

Parameters	Sandy	Loamy	Clay
pH	6.7	5.7	5.9
Organic Carbon (gKg^{-1})	1.1	3.4	2.9
Total Nitrogen (gKg^{-1})	0.08	0.11	0.14
Phosphorus ($mgKg^{-1}$)	4.21	8.92	7.83
Exchangeable bases ($CmolKg^{-1}$)			
Potassium	0.04	0.11	0.24
Magnesium	0.11	0.23	0.18
Calcium	0.08	0.24	0.34
Sodium	0.09	0.11	0.28
Exchangeable acidity	2.01	4.24	5.15
Effective cation exchange capacity	2.33	4.93	6.19
Particle Size (g/kg)			
Sand	900	710	390
Silt	80	210	210
Clay	20	80	400

Effects of different growth media on sprouted vines

The effects of the different growth media on sprouted vines are shown in Table 2. At the early stage of growth (2-4 WAP), sprouted vines of *G. latifolium* grown in clay soil medium had significantly higher ($P < 0.05$) mean number of sprouted vines (2.00) than those grown in other growth media.

Table 2: Effects of growth media on number of sprouted vine

Growth media	Weeks after planting (WAP)				
	2	4	6	8	10
Sandy soil + sawdust	1.00^c	1.25^c	1.25^c	1.50^b	1.50^b
Sandy soil	1.50^b	1.50^b	1.50^b	1.75^b	1.75^b
Loamy soil	1.25^c	1.25^c	2.25^a	2.25^a	2.25^a
Loamy + sawdust	1.67^b	1.67^b	1.67^b	1.67^b	1.67^b
Clay soil	2.00^a	2.00^a	2.00^a	2.25^a	2.25^a
Clay soil + sawdust	1.33^c	1.00^c	1.25^c	1.50^b	1.50^b
Sawdust only	0.50^d	0.50^d	0.50^d	0.50^d	0.50^d
Standard Error	0.18	0.18	0.22	0.26	0.26

Means with the same superscript along each column are not significantly different at 5% level of probability according to DMRT

Within the other growth media, sprouting of vines was most significantly depressed in sawdust medium followed by sandy soil. However, from the 6–8 WAP, the loamy and clayey soils had the highest but statistically similar mean number of sprouted vines, while values obtained were significantly higher than those of other treatments. The number of sprouted vines in loamy +

sawdust medium was not significantly different from that of the sandy soil medium, while sawdust only had the least number of sprouted vines from 2–8 WAP (Table 2).

Effects of growth media on leaf production

Table 3 shows the effects of different growth media on number of leaves. The number of leaves increased with increase in weeks after planting (WAP). At 2 WAP, the mean number of leaves was highest in clay soil medium (8.25), and least in sawdust only (1.00) (Table 3). At 4–8 WAP, leaf production was significantly higher in loamy soil than in the other growth media. This was followed by clay soil and sandy soil, while leaf production in sawdust only was the least (3.00) ($P<0.05$).

Effects of different growth media on leaf area

The effects of different growth media on leaf area are shown in Table 4. Leaf area generally increased as the weeks after planting increased. At 2 and 4 WAP, *G. latifolium* in loamy and clay soils had higher ($P<0.05$) mean leaf area (10cm^2 and 29cm^2 for loamy soil, and 10cm^2 and 28cm^2 for clay soil respectively) when compared to values obtained from other growth media, while the sawdust medium produced plants with the least mean leaf area of 4.0cm^2.

Table 3: Effects of growth media on number of leaves

Growth media	**Weeks after planting (WAP)**			
	2	**4**	**6**	**8**
Sandy soil + sawdust	2.00^{d}	2.25^{de}	4.00^{de}	6.25^{d}
Sandy soil	5.25^{c}	8.25^{c}	10.75^{c}	16.50^{bc}
Loamy soil	7.75^{ab}	19.75^{a}	27.25^{a}	36.00^{a}
Loamy + sawdust	4.67^{c}	5.67^{cd}	10.00^{c}	11.33^{c}
Clay soil	8.25^{a}	11.50^{b}	15.50^{b}	21.25^{b}
Clay soil + sawdust	4.00^{c}	3.50^{d}	6.50^{d}	6.50^{d}
Sawdust only	1.00^{e}	1.00^{e}	2.00^{e}	3.00^{cd}
Standard Error	1.02	2.47	3.22	4.32

Means with the same superscript along each column are not significantly different at 5% level of probability according to DMRT

Table 4: Effects of growth media on leaf area

Growth media	**Weeks after planting (WAP) (cm^2)**			
	2	**4**	**6**	**8**
Sandy soil + sawdust	6.67^{c}	15.00^{cd}	27.00^{cd}	57.50^{c}
Sandy soil	7.50^{b}	23.50^{b}	37.50^{c}	62.50^{b}
Loamy soil	10.00^{a}	29.00^{a}	62.00^{a}	92.50^{a}
Loamy + sawdust	7.33^{b}	18.67^{bc}	22.67^{d}	47.33^{d}
Clay soil	10.00^{a}	28.00^{a}	49.00^{b}	67.00^{b}
Clay soil + sawdust	8.00^{b}	18.00^{bc}	26.00^{cd}	32.00^{de}
Sawdust only	2.00^{d}	8.00^{d}	15.00^{e}	25.00^{e}
Standard error	1.02	2.81	6.22	8.59

Means with the same superscript along each column are not significantly different at 5% level of probability according to DMRT

At 6 and 8 WAP, *G. latifolium* in loamy soil had significantly higher leaf area (62.00cm^2 and 92.50cm^2 respectively) than other growth media. This was followed by clay soil and sandy soil media which were not statistically different whose values were statistically similar (67.00cm^2 and 62.50cm^2 respectively). The sawdust only medium had the least mean leaf area from 2, 4, 6 and 8 WAP.

Effects of different growth media on vine length

The effects of different growth media on vine length are indicated in Table 5. Generally, the vine length increased as the time after planting increased in all the growth media. At 2, 4 and 8 WAP, vine length in clay soil and loamy soil media, which were statistically similar, were higher than those of other treatments (Table 5).

Table 5: Effects of growth media on vine length

Growth media	Weeks after planting (WAP) (cm)			
	2	4	6	8
Sandy soil + sawdust	8.00^d	9.88^d	11.50^{de}	14.50^d
Sandy soil	13.00^c	15.38^c	17.13^{cd}	19.00^c
Loamy soil	27.60^a	29.50^a	32.25^b	40.50^a
Loamy + sawdust	16.33^b	18.17^b	20.00^c	23.33^b
Clay soil	27.80^a	28.94^a	42.50^a	46.00^a
Clay soil + sawdust	11.75^c	13.0^c	14.75^d	18.50^c
Sawdust only	2.50^e	2.50^e	3.60^e	7.50^e
Standard Error	3.60	3.71	4.96	5.28

Means with the same superscript along each column are not significantly different at 5% level of probability according to DMRT

However, at 6 WAP, vine length in clay soil (42.50cm) was significantly higher than vine length in other treatments. This was followed by vine length in loam soil (32.25cm). At 8 WAP, the vine length of *G. latifolium* in sawdust medium was the most significantly depressed.

Effects of different growth media on stem girth

Table 6 shows the effects of different growth media on stem girth. The stem girth progressively increased with the age of the crop. At 2 and 6 WAP, sandy soil medium significantly had the highest stem girth of 2.38cm and 2.73cm respectively. This was followed by stem girth in loamy soil and clay soil media which were statistically equal. At 4 and 8 WAP, sandy soil medium (2.48cm and 2.95cm respectively) had statistically the same stem girth with loamy soil medium (2.03cm and 2.33cm respectively). These were significantly higher than the other growth media. Among the combined growth media (sawdust mixed with clay, loamy and sandy soil), stem girth of *G. latifolium* in loamy soil mixed with sawdust was superior to other sawdust treatments. However, stem girth of *G. latifolium* in sawdust only was most significantly depressed.

Table 6: Effects of growth media on stem girth

Growth media	Weeks after planting (WAP) (cm)			
	2	4	6	8
Sandy soil + sawdust	8.00^{d}	9.88^{d}	11.50^{de}	14.50^{d}
Sandy soil	13.00^{c}	15.38^{c}	17.13^{cd}	19.00^{c}
Loamy soil	27.60^{a}	29.50^{a}	32.25^{b}	40.50^{a}
Loamy + sawdust	16.33^{b}	18.17^{b}	20.00^{c}	23.33^{b}
Clay soil	27.80^{a}	28.94^{a}	42.50^{a}	46.00^{a}
Clay soil + sawdust	11.75^{c}	13.0^{c}	14.75^{d}	18.50^{c}
Sawdust only	2.50^{e}	2.50^{e}	3.60^{e}	7.50^{e}
Standard Error	3.60	3.71	4.96	5.28

Means with the same superscript along each column are not significantly different at 5% level of probability according to DMRT

Discussion

The physical and chemical properties of the soil used as growth media as shown from the results proved the growth media to be slightly acidic. The pH of the growth media ranges from 5.7 to 6.7. This pH is within the range required for crop production (Kamprath, 1970). According to Roberts (2006), the availability of mineral nutrients in growing media is influenced by its pH. Acid soil normally lack calcium and magnesium, while higher pH causes deficiency in iron and phosphorus (Kramer and Kozlowski, 1979). The soil is low in total nitrogen and available phosphorus. The soil organic matter was low but can support the sprouting of *G. latifolium*. The low nutrient content of the growth media is a characteristic of the tropical soil (Tollessa, 1999).

The higher number of sprouted vines at 2 – 4 WAP in clayey soil media than other growth media suggested that clayey soil is a good medium for early sprouting. This may be attributed to its good water retention capacity which is needed for stem sprouting. The finding agrees with Leeper and Uren (1993), who reported that clays generally retain water and that the clay type, organic matter content and soil structure also influence soil water retention. Also, Charman and Murphy (1991) opined that soil water retention is essential to life. It provides an ongoing supply of water to plants between periods of replenishment (infiltration) so as to allow their continual growth and survival. The higher sprouted vines in loamy soil at 6 WAP, in loamy soil and clayey soil at 8 WAP indicated that loamy soil and clayey soil enhanced sprouted vines more than the other treatments.

The relationship as revealed in table 3 shows that loamy soil significantly had the highest number of leaves at 4-8 WAP. This could be attributable to the good water retention, aeration and nutrient content in loamy soil. This finding is supported by Senjobi *et al.* (2010), who reported that loamy soil had a very profound effect on the vegetative growth of *Corchorus olitorius*, due to its high nutrient contents and more water availability to the plant at the root zone. The highest number of leaves in clayey soil medium at 2 WAP may be attributed to the early emergence of vine in clay soil medium.

The higher leaf area at 2 -8 WAP in loamy soil medium depicts that loamy soil enhanced leaf area production more than the other growth media. The finding may be as a result of high nutrient availability and water retention capacity of the loamy soil. Loamy soils generally make good agricultural soils as its physical and chemical properties optimally favour plant growth (Gardner, Laryea and Unger; 1999).

The longer vine lengths in clayey and loamy soil media at 2, 4 and 8 WAP which are statistically equal depicts that both media enhanced vine length more than the other growth media. This finding which is relatively similar to the effects of growth media on number of leaves may be attributed to increase in number of leaves, which increased the rate of photosynthesis resulting in increase in vine length, is an expression of the vegetative growth. This result is supported by Moorby and Milthorpe (1979), who opined that increase in plant height is a function of increased photosynthetic activities resulting from increased number of leaves and leaf area.

Sandy soil media showed the largest stem girth at 2 - 8 WAP that was statistically similar to loamy soil media at 4 and 8 WAP. This suggests that sandy soil and loamy soil enhanced stem girth more than the other growth media. This may be attributed to better aeration, water drainage and higher total porosity. The finding is in conformity with Florence, Samson, John, Paul and Alice (2011), who reported bigger stem girth of *Warburgia ugandensis* under sharp sand. Similarly, Senjobi *et al.* (2010), reported larger stem diameter of *Corchorus olitorius* under loamy soil conditions.

The consistent lower response of all the growth parameters (sprouted vine, number of leaves, leaf area, vine length and stem girth) in the sawdust media suggests that sawdust may not be suitable as a growth media for *G. latifolium*. This may be attributed to poor aeration, low water retention capacity, low porosity and low nutrient status. A situation whereby a growth media do not have enough aeration and porosity for sufficient gas exchange may not be able to support the sprouting of vines/cuttings or may lead to rotting of the cuttings or perhaps may lead to low performance of sprouted vine, number of leaves, leaf area, vine length and stem girth in other growth parameters. This is in tandem with Amri *et al.* (2009) on poor aeration and porosity for sufficient gas exchange for sprouted vine cuttings. Similarly, Aklibasinda, Tunc, Bulut and Sahin (2011), reported that the amount of water retained in the sawdust media was very low, plants could consume the available amount of useable water retained in a very short time leading to undesirable effects on the plants and eventual poor growth. This corroborates the findings of Ekpo and Sita, (2010), who noted that sawdust compose of high cellulose and lignin content along with insufficient nitrogen supplies which create depletion problems and severely restrict plant growth.

Conclusion

The study has shown that loamy soil media is the best medium for the propagation of *Gongronema latifolium* using stem cuttings. The significant differences in the mean number of leaves, leaf area and vine length between loamy soil media and other growth media lend credence to this conclusion. From the outcome of this study, it is recommended that stem cuttings of *Gongronema latifolium* is best in loamy soil media.

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