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Full Length Research Paper

Growth and Development of Shoots from Gongronema latifolia Benth Stem Cuttings in Various Rooting Media

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Vegetative propagation of *Gongronema latifolia* Benth commonly used as a forest leafy vegetable and spice, was studied in three rooting media (sawdust, ricehull and soil) under two seasons in Nsukka. The study showed that *G. latifolia* could be effectively propagated by stem cuttings. There was significant reduction in number of days to shoot initiation and growth in sawdust medium in the wet season. Sawdust and soil gave a better performance of the cuttings in opening of apical buds, initiation of shoots, percentage of rooted cuttings, number of vines, vine length and number of opposite leaves on vines in both seasons. Even though, both media performed similarly in most of the attributes, sawdust medium will be preferred to soil because it is readily available and affordable. Effective and high percentage rooting of *G. latifolia* stem cuttings, which will provide excellent conservation of a selected clone derived from virgin forest and hybridization, could be achieved in sawdust medium during the dry season.

Key words: *Gongronema latifolia*, rooting media, propagation, stem cuttings.

INTRODUCTION

Non-wood forest products (NWFPs) form a significant natural resource for the rural poor and central in traditional culture of developing countries. These products serve as food, source of income and medicare in many developing countries (Osemeobo and Ujor, 1999).

Gongronema latifolia Benth, a non-wood forest product is a leafy vegetable harvested from forests in southeastern states of Nigeria and some other parts of sub-saharan Africa (Okafor, 2005). The plant is called “Utazi” in Southeastern Nigeria and used as a leafy vegetable and spice. It is nutritionally high in minerals, vitamins and proteins (Okafor, 2005). The consumption of the plant promotes pregnancy and it is used in the treatment of stomach problems, dysentery, malaria, worm, cough and high blood pressure (Agbo *et al*., 2005). The plant has been very useful in the management of diabetes mellitus and a good stimulant in women that delivered a baby (Agbo *et al*., 2005; Okafor, 2005).

The propagation of plants is either sexual or asexual. Asexual propagation by stem cuttings has been used in many woody and herbaceous plants (Evans, 1999). Report of the propagation of *G. latifolia* through stem cutting is lacking in literature. The propagation of the plant by stem cutting will provide a system of perpetuating a selected clone or progeny from hybridization without fear of segregation, as there is no further recombination of genes.

The quality of potting medium for a nursery is important for good growing of plants in containers (Bunt, 1988). The heterogeneity and bulkiness of soil medium has prompted the use of soil-less media in propagating stem cuttings (Ekwu and Mbah, 2001). Ibikunle and Komalafe (1973) obtained better performance of germination of cashew nuts in sawdust or its mixtures with soil than in soil alone.

Season of the year in which cuttings are taken has in some instances been shown to have dramatic influence on rooting percentage of such cuttings (Hartman and Kester, 1975). The physiological conditions of the cuttings during the seasons in a year rather than the season itself influence the performance of the cuttings.

This study was therefore undertaken to ascertain the influence of three rooting media on the development of shoot on the cuttings over seasons. The specific objectives were to identify the best medium and better season for the

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Table 1. Physical and chemical characteristics of the different media.

Media	N%	P (mg/ml)	pH	K (ppm)	Na(ppm)	Bulk density (g/cm^3)	Total porosity (%)	Dry matter (%)	Ash content (%)	Moisture content (%)	Carbon (%)
Sawdust	0.6	0.6	5.6	4.0	3.0	0.3	88.7	1.8	0.9	0.002	0.0008
Rice hull	trace	0.6	5.8	4.0	3.0	0.4	85.3	1.7	0.7	0.003	0.007
Soil	0.7	0.7	6.1	9.0	4.0	1.4	50.0	1.8	1.8	0.002	0.011

Table 2. Days to opening of apical bud and shoot initiation in the different media over the season.

Media	Wet season		Dry season	
	Opening of apical bud	Shoot initiation	Opening of apical bud	Shoot initiation
Sawdust	16.0	18.5	3.3	5.0
Rice hull	21.0	24.2	12.0	15.1
Soil	19.0	21.0	2.7	4.5
LSD	2.2	2.5	2.3	3.1

initiation and growth of *G. latifolia* shoots from stem cuttings.

MATERIALS AND METHODS

A single source of semi-hardwood stem cuttings was taken from a clone in a forest in Southeastern state of Nigeria. The semi-hardwood cutting (early season's growth that was less than one year but not new flush vines) was taken because of experience on their performance from previous unpublished trials. The rooting media used were sawdust, rice hull and topsoil. The sawdust and rice hull media were composted for six months by addition of one-quarter volume-by-volume poultry droppings. The three rooting media were sterilized by moistening them with sodium hypochlorite (3.5%) diluted in water at a ratio of 1:9 of sodium hypochlorite: water (volume by volume) as recommended by Evans (1999). Each of the rooting medium was used to fill the black polyethylene bags (12 cm x 24 cm and perforated at the bottom) to three quarter full and laid out under 65% shading in completely randomized design (CRD) replicated eight times. The healthy semi- hardwood cuttings were taken early in the morning when the plants were turgid and dark plastic bags with wet paper towels were used to store the cuttings from forest until they were stuck. Ten cuttings of two opposite nodes were inserted in two rows into each polyethylene bag at 4 cm intervals in each row. After stucking the cuttings, each rooting container was watered and misted on regular basis until the cuttings developed shoots. The first experiment was conducted in dry season (January to March) while the repeat experiment was done in wet season (August to October) in 2005. All the stem cuttings served as sampling unit as each cutting has the potential of rooting or not. Data were collected from the following traits of the ten cuttings planted in each polyethylene bag:

- days to first opening of apical bud,
- days to first shoot initiation,
- percentage of cuttings with shoots at 8 weeks after planting (WAP),
- number of vines per container up to 8 WAP,
- longest vine per container up to 8 WAP, and
- number of opposite leaves on the vines up to 8 WAP.

The physical and chemical characteristics of the three rooting media were determined using Muller and Tobin (1980) method. Data collected were analysed using computer software, Genstat 5 release (3.2), 1995. Separate analysis was done for each season in a CRD format.

RESULTS

The results in (Table 1) show that soil medium had higher nitrogen, phosphorus, potassium, sodium, bulk density and ash content. Whereas, sawdust medium had higher total porosity. Sawdust medium had significantly ($p = 0.05$) lower number of days to opening of apical bud and shoot initiation in the wet season, but it took similar number of days with soil medium to the opening of apical bud and shoot initiation in the dry season (Table 2). Days to opening of apical bud and shoot initiation were relatively lower during the dry season. Sawdust medium had significantly ($p = 0.05$) higher percentage of rooted cuttings and number of shoots during the wet season (Table 3). In the dry season, sawdust and soil media had high percentage of rooted cuttings. Rice hull medium had lower percentage of rooted cuttings in wet and dry seasons. It also had low number of shoots in both seasons. Table 4 shows that soil and sawdust medium had significantly ($p = 0.05$) longer vines in both seasons. There was incremental growth of the vines from the second WAP to the eight week. The vines grew longer during the dry season. Rice hull medium had significantly ($p = 0.05$) lower number of opposite leaves on the vines in both seasons (Table 5). The other media produced in some instances thrice the number of leaves in rice hull medium. Dry weight of leaves and vines were significantly higher in sawdust and soil

Table 3. Percentage of cuttings with shoots and number of vines in a container at 8 weeks after planting (wap) in the different media over the seasons.

Media	Wet season		Dry season	
	Percentage of cuttings with shoots	Number of vines/10 cuttings	Percentage of cuttings with shoots	Number of vines/10 cuttings
Sawdust	76.6	7.5	92.5	8.5
Rice hull	34.7	4.4	61.3	3.8
Soil	57.3	6.6	87.5	9.0
LSD	8.7	1.0	9.6	0.62

Table 4. Effect of Media on Vine Length of *G latifolia* Over Time During the Two Seasons.

Media	Wet season				Dry season			
	2*	4	6	8	2	4	6	8
Sawdust	20.8	29.8	31.4	31.4	51.0	79.0	119.0	132.0
Rice hull	8.8	11.9	17.5	17.5	14.0	21.0	44.0	50.0
Soil	25.9	26.1	28.2	32.2	63.0	80.0	146.0	150.0
LSD	6.19	6.36	8.01	11.01	14.3	19.8	27.5	29.2

*****WAP = Weeks after planting.

Table 5. Effect of media on number of opposite leaves of vines in a container over time during the two seasons.

Media	Wet season				Dry season			
	2*	4	6	8	2	4	6	8
Sawdust	22.25	29.63	32.13	34.13	70.30	83.21	109.13	121.69
Rice hull	2.50	3.63	6.50	9.25	12.40	26.34	43.75	50.13
Soil	31.25	31.25	34.38	38.75	78.62	90.43	133.69	140.44
LSD	11.02	11.39	12.01	13.40	14.21	19.43	26.40	28.70

*****WAP = Weeks after planting.

Table 6. Effect of media on oven dried vine parameters at 8 WAP over the two seasons.

Media	Weight of leaves/vine (g)	Root weight/vine (g)	Vine (s) weight/cutting (g)	Number of roots/cutting	Longest (cm) root/cutting
Wet season					
Sawdust	4.07	1.37	1.46	7.46	12.15
Rice hull	2.82	1.03	0.84	4.94	10.79
Soil	4.11	1.24	1.39	6.28	10.71
LSD	1.03	NS*	0.52	1.67	NS
Dry season					
Sawdust	22.28	11.55	20.95	13.17	29.47
Rice hull	9.38	3.92	7.76	7.81	20.01
Soil	22.30	11.50	16.14	15.04	27.38
LSD	6.26	4.58	6.53	3.61	NS

*NS = non significant.

media (Table 6). Roots were longer in sawdust medium in both seasons although, sawdust and soil media had significantly ($p = 0.05$) higher number of roots in both seasons. Roots dry weight was similar in wet season but differed significantly in the media in the dry season.

DISCUSSION

The significant lower number of days to opening of apical buds in sawdust medium, that agreed with Ibukunle and Komolafe (1973) on better germination of cashew nuts in

sawdust, may be attributed to better aeration and water drainage because of higher total porosity, which have been reported to promote root development (Olubunde and Fawusi, 2003). The longer days to shoot initiation and growth during wet season may be due to higher levels of rooting inhibitors and lower concentration of auxins in the wet season in the cuttings as compared to dry season. This is probable because of the evidence of influence of rooting inhibitors to root initiation and shoot by Hartman and Kester (1975) in many herbaceous and woody cuttings. In the dry season, the significant longer days to shoot initiation and growth in rice hull medium may be due to the trace levels of nitrogen when compared to other media. Hartman and Kester (1975) had earlier reported the distinct promotion of rooting of cuttings by addition of nitrogenous compounds to a medium with inadequate levels of nitrogen. The better aeration potential coupled with the higher water holding capacity of sawdust than soil could have caused higher percentage of rooted cuttings in sawdust medium.

Furthermore, higher percentage of rooted cuttings during the dry season may be due to better environmental conditions in terms of higher concentrations of auxins for shoot development and growth, and better drainage of the media. It may also be due to less consequences of rottening of cuttings by microbes due to over delayed root and shoot initiation during the wet season because such humid conditions have been reported to be ideal for the growth of microorganisms (Hartman and Kester, 1975). Longer vines in sawdust and soil medium may be attributed to earlier shoot initiation and growth in the two media and higher nitrogen levels which aids growth and development. Earlier, Baiyeri (2005) had reported a significant effect of weaning rice hull medium over sawdust medium on all growth parameters of *Musa* species due likely to immobilization of nitrogen in sawdust medium during composting. However, the media in this study were composted for a longer period (six months as against one) with poultry droppings, which might have caused high level of nitrogen in sawdust medium. Similarly, sawdust and soil media with longer vines also had higher number of opposite leaves, which is a function of vine length. The longer vines with more leaves in the two media could have also resulted in leaves and vines with more dry weight. The seedlings could as a result of higher photosynthate accumulation by the plants, because of the increased surface area cover, have higher dry weight of leaves and vines in the two media.

The study has shown that *G. latifolia* could be effectively propagated by stem cuttings as has been reported for other herbaceous and woody plants by Evans (1999). There was significant reduction in the number of days to initiation of shoots and growth in sawdust medium. The physiological conditions of the stem cuttings in the wet season could have caused the cuttings to have longer days to shoot initiation and growth when compared to dry season. This could have been due to higher levels of rooting inhibitors and lower concentrations of auxins in the wet season. Furthermore, sawdust and soil media gave better performance of the cuttings and growth of the seedlings. Even though, both media performed similarly in most of the attributes, sawdust medium will be preferred to soil because it is readily available and affordable. Also, continuous collection of top soil for rooting is not advisable because it is bulky, heterogeneous in mineral composition (Ekwu and Mbah, 2001) and could cause environmental hazard (soil erosion). Effective and high percentage rooting of *G. latifolia* stem cuttings could be achieved in sawdust medium during the dry season. The horticultural and breeding implications of the results of this study will be efficient conservation and perpetuation of any selected clone with a desired quality without fear of segregation because there will be no further recombination of genes.

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