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Rooting and Seedling Growth of Weeping Fig (*Ficus benjamina* L.) as Affected by Types and Length of Stem Cutting

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Abstract: *Experimental trials were conducted in 2020 and 2021 at the horticultural garden of the Horticulture Department, Federal University of Agriculture Abeokuta, Ogun State, Nigeria to investigate the effects of types and length of stem cuttings on the rooting and early growth of Weeping fig (Ficus benjamina L.) in the nursery. Weeping fig is an important ornamental plant widely used for indoor and outdoor beautification. Difficulty in weeping fig propagation remains a major bane for its mass production in ornamental plant and landscaping industries. In the pre-nursery stage, stem cutting of weeping fig was assessed for rooting characteristics and the vigorous seedlings were selected and transplanted into the nursery. The treatments consisted of cuttings obtained from different types of cuttings (soft-wood, semi-hardwood and hardwood) and length of cuttings (10 and 20 cm). The experiment was a 3 x 2 factorial arranged in a Completely Randomized Design (CRD) replicated four times. Data collected on percentage rooted cuttings (%), number of roots/cutting, root length/cutting (cm), percentage sprouted cuttings(%), seedling height (cm), number of leaves/seedling, percentage seedling survival (%), root fresh and dry weights (g/seedling) were subjected to Analysis of Variance (ANOVA) using Genstat statistical software. Means of the treatments were separated using Least Significant Difference (LSD) at 5% probability level. The results showed that semi-hardwood had 42 and 38% rooted cuttings, hardwood (39 and 35%) and soft wood (35.38 and 31%) in 2020 and 2021, respectively. Stem cuttings with 20 cm length had higher percentage rooted cuttings (41%) and seedling survival percentage (87%) than stem cuttings with 10 cm length 29 and 57%, respectively. It was recommended that 20 cm length of semi hardwood cutting should be used for mass propagation and optimum seedling growth of F. benjamina.*

Keywords: *cutting type and length, rooting, nursery, weeping fig, ornamental plants.*

1. INTRODUCTION

Ficus is an important ornamental plant comprising over 1000 species including weeping fig (*Ficus benjamina* L.). It is widely used as an ornamental foliage plant, bonsai, potted plant, urban tree, also utilized for animal feed and as medicinal plants.

Weeping fig cultivars available in cultivation differ in waviness or color (variegation) of leaves, leaf-drop tendency and overall size (Di Beneditto, *et al.*, 2019). Besides genotypic differences, environmental constrains and handling such as propagation techniques; cutting type and length, growing container/media and low irradiance often affect Weeping fig propagation and growth at production in the nursery. Reduced rooting volume may represent a major growth-limiting factor in both the variegated and non-variegated species (Di Benedetto *et al*., 2020). Improper rooting and shoot development may affect overall performance of the seedlings.

Danthu *et al.*, (2002) opined that the most economic method of propagating Weeping fig is mass production through stem cuttings in addition to the traditional air layering technique. Although vegetative propagation is a basic method for mass scale production of cuttings, vegetative propagation of weeping fig has not been extensively studied (Danthu *et al.*, 2002). The three main types of stem cuttings are softwood, semi-hardwood and hardwood. These terms reflect the growth stage of the stock plant, which is one of the most important factors influencing whether or not cuttings will root or not (Okunla and Akinpetide, 2016), the success of rooting stem cuttings also depends mainly on the techniques applied and physiological state and stage of the mother plant, the time of planting, length of cuttings and the type of cuttings used. (Di Beneditto *et al*., 2018).

Joshee *et al*., (2002) reported that micro-propagation techniques advanced by the western world are practically useless for most remote areas, mostly as Nigeria and Africa and similar areas where there are no stable electricity and adequate irrigation facilities, therefore, sustainable and simple methods of propagation is suggested.

The Objectives of this study is to investigate the type and length of stem cutting of *Ficus. benjamina* with the optimum rooting ability and seedling growth.

2. MATERIALS AND METHODS

Trials were conducted in the experimental nursery of Horticulture Department, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria between May and November in year 2020 and 2021. The site is located on Latitude 7'15 ^{o} N, Longitude 325 ^{o} E and altitude 100 m above sea level with annual mean temperature ranging from 26.90 ^{o} C to 29.20 ^{o} C. The stem cuttings were sourced from randomly selected weeping fig trees (about 10 years old) within the Federal University of Agriculture, Abeokuta. The cuttings were defoliated of the leaves to two per cutting and trimmed to the required length (10 and 20 cm) by removing the terminal portions just above a bud. This was done very early in the morning when the plant was fully turgid with a sharp thin-bladed secateurs (the cutting tool was dipped in a mixture of one part bleach mixed with nine part water to prevent transmitting diseases from infected plant parts to healthy ones)

Treatments consists of two factors; stem cutting (Hardwood(HW) (15 mm-16 mm girths, Semi-hardwood (SH) (5.7 mm-6 mm girth) and Soft wood (SW) (2.7 mm- 3 mm girth) and second factor ; Length of stem cutting (10 cm (2-3 nodes) and 20 cm (3- 4nodes).

The experiment was a 3x2 factorial arranged in Completely Randomized Design (CRD) for both the pre-nursery and nursery phases. Six (6) treatment combinations were used and 480 plants made up the experimental unit. In the pre-nursery phase, each treatment contained 5 polyethylene pots and replicated four times to give total of 30 cuttings per treatment to give 180 plants. On the nursery phase, there were two plants per treatment with four replications arranged in double row (1 m x 2 m spacing).

Data were collected on; percentage rooted cutting, number of roots per cutting, percentage sprouting (%), seedling height (cm) per seedling, seedling survival percentage/seedling, length of longest root (cm), root fresh and root dry weights (g/cutting)

Data collected on rooting and growth parameters were subjected to Analysis of Variance (ANOVA) using GenStat discovery (12th edition) and significant treatment means were compared using the least Significant Difference (LSD) at 5% probability ($p \leq 0.05$).

3. RESULTS AND DISCUSSION

3.1. Percentage Rooted Cutting (%), Number and Length (cm) of Roots

The results showed that semi-hardwood had 42 and 38% rooted cuttings, hardwood (39 and 35%) and soft wood (35.38 and 31%), in 2020 and 2021 respectively. Seedlings raised from semi hardwood cuttings had longest and more number of roots (5.29 cm; 9.22), compared with those raised from hardwood (4.48 cm; 5.12) and softwood cuttings (2.7 cm; 8.12), respectively with 20 cm stem cuttings proving superior to 10cm. The reason could be as a result of semi hardwood cutting having more active buds or cells which in turn brought about favorable conditions for root initiation and more rooting percentage. Perhaps more nutrient reserve in the 20 cm cutting was responsible as suggested by Leonard *et al*., (2005) that plant part's age affects success of rooting and older tissues has abundant carbohydrate food reserves. The present finding is however not in conformity with Reddy *et al.,* (2008 b)

3.2. Percentage Sprouted Cutting (%)

Percentage (%) sprouting of weeping fig cutting during the 2020 and 2021 experiments showed that 20 cm cutting length obtained from semi-hardwood performed better than 10 cm, but there were no significant differences when compared to other stem types. The reason could be related to possession of more active buds and higher food reserve leading to 20 cm cuttings recording more sprouts than 10 cm. It may also be associated with level of cytokinin production and transport from roots, since plant root apices are the main source of the hormone at a whole-plant level. This finding is in conformity with Di Benedetto *et al*., (2018).

3.3. Seedling Survival Percentage (%)

Highest seedling survival percentage (87%) was observed in semi-hardwood compared with those raised from softwood cuttings (78%) and the least in value was hardwood (50%). The study also revealed that stem cuttings with 20 cm length had higher seedling survival percentage (86%) than stem cuttings with 10 cm length 57%, respectively after transplanting. This might have resulted from development of effective root system and increase in number and length of roots per cutting which might have influenced the uptake of water and nutrients. The present investigation is in conformity with findings of Reddy *et al.*, (2008 a) in weeping fig.

3.4. Root Dry and Fresh Weight (g)

There was no significant difference in effects of cutting type on root fresh and dry weight, however, length of cutting was significantly effective.

Interaction effects of type * length of stem cuttings were only significant ($p \leq 0.05$) on seedling survival percentage, root fresh and dry weights. Semi-hardwood cutting of weeping fig at 20 cm length had optimum rooting characteristics and seedling growth.

Table1. *Effects of types and length (cm) of stem cutting on percentage rooted cutting, number and length of roots of weeping fig at the pre-nursery stage in 2020 and 2021*

8 Weeks After Planting							
	Percentage rooted cutting (%)		Number of roots			Length of longest root (cm)	
TREATMENTs							
	2020	2021	2020	2021		2020	2021
TYPE OF CUTTING							
Hw	38.53	35.03	4.5	5.12		4.09	4.56
SH	41.72	38.12	7.53	9.22		5.69	7.22
SW	35.38	30.88	6.41	8.06		4.28	5.25
LSD(p<0.05)	NS	NS	NS	NS		NS	NS
LENGTH OF CUTTING(CM)							
10	28.42	28.62	4.62	6.17		2.98	4.15
20	48.67	41.02	7.67	8.77		6.4	7.21
LSD(p<0.05)	13.29	12.98	NS	NS		3.04	3.37
INTERACTION							
T x L	NS	NS	NS	NS		NS	NS

HW- Hardwood, SH – semi-hardwood, SW – softwood. NS – Not significant. T – Type, L - Length

Table2. *Effect of types and length of cuttings on Percentage (%) sprouting of Weeping fig seedling at pre-nursery stage in 2020 and 2021*

	2020					**2021**			
TREATMENTS	1WAP	2WAP	3WAP	4WAP		1WAP	2WAP	3WAP	4WAP
TYPE OF CUTTING									
HW	1.16	23.53	25.06	38.53		0.91	18.16	25.19	35.03
SH	1.25	23.47	27.09	41.72		1.16	22.16	29.59	38.12
SW	1.06	20.38	16.59	35.38		1.06	21.34	25.38	30.88
LSD(p<0.05)	NS	NS	NS	NS		NS	NS	NS	NS
LENGTH OF CUTTING (CM)									
10	0.85	14.67	18.54	28.42		0.85	17.56	21.48	28.62
20	1.46	26.25	31.29	48.67		1.23	23.54	30.54	41.02
LSD(p<0.05)	0.4	6.82	12.17	13.29		0.39	6.98	NS	12.98
INTERACTION T x L	NS	NS		NS			NS	NS	NS

HW- Hardwood, SH – semi-hardwood, SW – softwood. WAP – Weeks After Planting NS – Not significant. T-Type, L –length

Table3. *Root fresh weight (g), root dry weight (g), seedling survival %, number of roots and length of longest root of weeping fig as affected by type and length of cuttings after Transplanting into the nursery.*

TREATMENT	Root fresh weight (g)		Root dry weight (g)		Percentage survival (%)			Number of root	
	4WAT	6WAT	4WAT	8WAT	8WAT	12WAT	16WAT	16WAT	16WAT
TYPES OF CUTTING									
HW	0.28	0.22	0.13	0.1	30.47	25.2	50.00	1.83	5.72
SH	0.42	0.15	0.2	0.07	62.5	37.5	87.5	2.51	2.29
SW	0.63	0.15	0.28	0.07	57.03	23.44	78.91	1.83	4.48
LSD(p<0.05)	0.19	NS	0.1	NS	15.05	12.28	11.49	NS	2.76
LENGTH OF CUTTING(CM)									
10	0.33	0.08	0.18	0.03	36.98	23.96	57.29	2.23	3.76
20	0.56	0.27	0.23	0.13	63.02	33.33	86.98	1.88	4.56
LSD(**P<0.05)**	0.19	0.12	NS	0.06	15.05	NS	11.49	NS	NS
INTERACTION T x L	NS	NS		NS	*	*	*	NS	NS

*HW- Hardwood, SH – semi-hardwood, SW – softwood. WAP – Weeks After Planting, * - Sgnificant, NS – Not significant*

4. Conclusion and Recommendation

It was therefore concluded that:

1. Stem cutting of *F. benjamina* with variegated leaves rooted better than those with no variegation.

2. Semi-hard wood cutting of *F. benjamina* had superior rooting characteristics and optimum seedling growth.

3. Stem cutting of *F.benjamina* at 20 cm length was better for its optimum rooting and early seedling growth

Recommendations

Using 20 cm cutting length of semi-hardwood was recommended for propagation and early growth of weeping fig.

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