Regeneration of sectioned seeds of *Telfairia occidentalis* Hook F. (Fluted pumpkin)

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KEYWORDS

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Emergence,
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Minisetts,
Replications

ABSTRACT

There is an acute shortage of Telfairia seeds during growing season, due to seed recalcitrance and the alternative uses to which the seeds are put. An experiment was conducted to determine the extent to which the seed of Telfairia occidentalis can be sectioned for the regeneration of propagules and to assess the growth response of the sectioned seeds. Pre-germinated seeds were sectioned into minisetts up to 32 per seeds. These were nursed for three (3) weeks and transplanted to the field in randomized complete block design with 3 replications. Whole seeds and seeds sectioned into two had the highest seedling emergence and reached their peaks at the end of 2 weeks after sowing. The least value of 30% seedling emergence was produced by seeds sectioned into 32. The vine growths of the whole seed (141 cm) and those sectioned into two (107 cm) were consistently and significantly higher than those of smaller seed sections that ranged from 16 - 84 cm. The relatively higher vigor expressed by whole seed over the sectioned seeds is probably due to the relatively higher food reserve in the former. The result obtained in this experiment has shown that it is possible to regenerate Telfairia occidentalis propagules by the use of seed sectioned up to 16. It is recommended that future studies should address the need to upgrade the seedlings emergence of sectioned seeds to achieve 100% survival in the nursery, and excellent plant stand in the field.

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INTRODUCTION

Telfairia occidentalis, Hook F (Fluted Pumpkin) belongs to the family *Cucurbitaceae*. It is a leaf and seed vegetable that is well known for its high nutritional, medicinal and economical potentials in the coastal area of West Africa. And it is widely consumed in the tropical region (Akoroda, 1990a,).

Telfairia occidentalis is a dioecious plant, although occasional monoecious plants have been reported by Akoroda (1990b). The female plants produces large leaves and seeds, while the leaves of the male is relatively small in size, the female plant in preferred with respect to leaf and seed production. (Akoroda, 1990a).

Young shoots and leaves of fluted pumpkin are cooked alone or in combination with other vegetables and used as potherbs or soups for different kinds of starchy dough. Fresh leaf concoction is a high value health tonic for the treatment of acute anemia (Schippers, 2000). The seed has been noted for their oil content (13%) and is use for cooking (Giami and Barber 2004). In spite of its importance, *Telfairia* seeds are always in short supply at planting time and this has been a limiting factor in its production. The biological disequilibrium caused by harvesting edible foliage from plant that could potentially bear fruit and the dioecious nature of the crop make sex ratio of the plant to affect the number of fruit bearing female (Akoroda, 1990b). There is increased interest in the utilization of the seed for other alternative uses such as, cooking and roasting of seed for consumption and substituting seed for egusi. These make the seeds to be highly limited and hence increase cost of seed. Farmers find it difficult to procure seeds for planting because of the high cost.

In order to ameliorate the problem of limited seeds available to produce seedlings required, Esiaba (1982) developed techniques where pre-germinated seeds were carefully split. Ojeifo and Ajekenrenbiaghan (2007) have reported the success attained in sectioning of

seeds up to eight sections. Sectioning of seed aid in reducing the number of seed needed for propagation thereby reducing the cost of production for farmers. Hence the objectives of this study are to:

i. Determine the extent to which the seed of *Telfairia occidentalis* can be sectioned for the regeneration of propagules.

ii. Assess the growth response of the section seeds

MATERIALS AND METHODS

The experiment was carried out in the Teaching and Research Farm of Agronomy Department of Delta State University, Asaba Campus. The total area of the experimental plot was about 250m^2 containing a total of 18 plots which were represented by raise beds with an area of 3m by 3m each. The fruits of *Telfairia occidentalis* were obtained from a local market. The fruits were carefully cut open with a knife for the extraction of the seeds. The extracted seeds were cured by spreading them out under a shade for 2 days to reduce microbial load. Thereafter, they were pre-germinated in sawdust to enable the easy opening up of the cotyledons. The pre-germinated seeds were separated into six seed lots. One was left whole, while the others were sectioned with the aid of a surgical blade while holding the seed with the aid of a forceps. The seeds where sectioned into two, four, eight, sixteen and thirty-two. Precaution was taken while sectioning the seeds into various sections, to ensure that each seed section had an embryonic content. However, this was more difficult to achieve with higher number of seed sectioning, particularly of those of 32 seed section. Sectioning the seeds in this study beyond sixteen seed sections to contain the embryo axis was not possible. Therefore, to obtain 32 seed sections from a seed, cutting each seed along the embryo axis was first made to get 16 seed sections subsequently, a perpendicular cut of each of the 16 seed sections was therefore made so that 16 had embryo axis while the other sixteen were without any embryo axis.

The propagules were thereafter treated with a mixed formulation of fungicide and insecticide (Imidadoprid 10%+Meta laxy10%+ carbendazim 10%) commercially called seed plus. Ten (10) gram of seed plus was mixed in 10 liters of water and the treated propagules were cured for about 3 hours before planting. The whole and sectioned seeds were nursed in a polythene bags containing equal proportion of sawdust and topsoil by volume. Watering was done on daily intervals by applying 20 ml and later increased to75 ml water per pot.

Germinated seedlings were transplanted from nursery to prepared field at 2 leaf stage with a planting space of 1m x 0.3m. Weeding was done at two weeks after planting. The creeping plants were raise from ground by staking them with erect bamboo stands and the vines where trained in a manner that enabled the collection of data.

A randomized complete block design replicated thrice was used for the treatments, namely whole seed and seeds sectioned into two, four, eight, sixteen and thirty-two parts. Variables observed during the course of the study were seedlings emergence, vine and root length at transplanting, and vine length in the field. These were measured with a meter rule. The number of leaves and branches were also counted manually and the plant girth was measured with veneer caliper.

Data collected were subjected to analysis of variance (ANOVA), and the treatment means were separated with least significant difference (LSD) at 5% level of probability.

RESULTS

Percentage Emergence

Seedling emergence of *Telferia occidentalis* started a week after planting in all the seed sections except that of seeds section into thirty-two. At two weeks after transplanting (WAT), the whole seed and seed sectioned into two had reached their peek of seedlings emergence (Table 1). Seedlings emergence of thirty-two seed sections started the second week after transplanting. At three weeks after sowing (WAS)), a sharp increase was observed across all the seed sections. The seedling emergence of whole seed and seed sectioned into two were significantly different from other seed sections at 5 weeks after transplanting

Possible limit of propagules regeneration from sectioned seed of *Telfairia occidentalis*

Table 2 shows the number of propagules that could be regenerated from one seed in the experiment carried out in the nursery, and shows the number of propagules that could be obtained assuming 100% survival of regeneration.

Table 1. Number and percentage (in parenthesis) of seedling emergence of whole and sectioned seed of *Telfairia occidentalis*.

	Weeks after Transplanting									
No of seed Section	**1**		**2**		**3**		**4**		**5**	
1	14	(70)	20	(100)	20	(100)	20	(100)	20	(100)
2	18	(90)	20	(100)	20	(100)	20	(100)	20	(100)
4	8	(40)	11	(55)	14	(70)	16	(80)	17	(85)
8	4	(20)	7	(35)	8	(40)	11	(55)	12	(60)
16	2	(10)	4	(20)	5	(25)	8	(40)	9	(45)
32	0	(0)	2	(10)	3	(15)	5	(25)	6	(30)
LSD(P<0.05)	7.76		6.84		8.43		5.57		5.23	

Table 2. Propagules regenerated from sectioned seeds of *Telfairia occidentalis*

No. of seed Section	**Number of plant from single seed assuming 100% regeneration**	**Regeneration from one seed In this study**	**Plant stand in the nursery (%)**
1	1	1	100
2	2	2	100
4	4	3	75
8	8	4-5	50-60
16	16	5-6	30-40
32	32	6-10	20-30

Vine length at transplanting

Vine length at transplanting which were significantly different, was highest (41.67cm) for whole seed, followed by halved seed (30 cm), followed by quartered seed (20 cm), followed by those of seeds sectioned into eight (12.5 cm) and followed by those of seeds sectioned into sixteen (5 cm). This was however, similar to those of seeds sectioned into thirty two (4 cm). Fig (1)

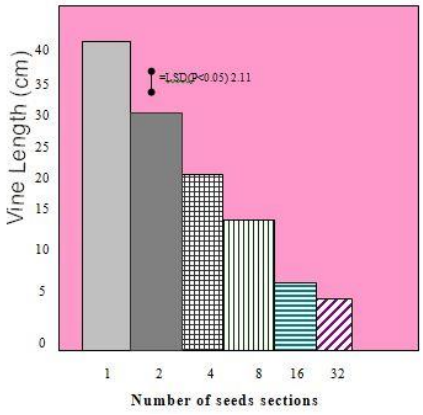
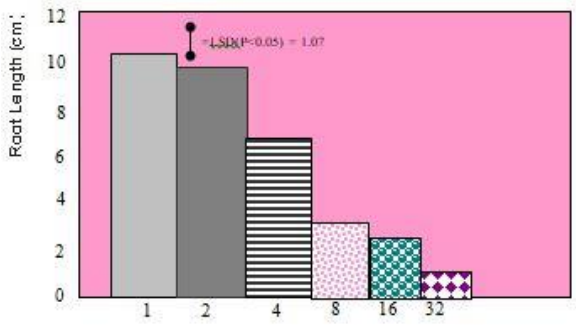


Fig 1. Vine length of *Telfairia occidentalis* at transplanting

Root length at transplanting

The root length of Tefairia was affected by the size of propagules. The root length declined drastically with reduction in the size of the propagules. Whole seed and seed sectioned into two had similar values of root length (10cm and 9.8cm respectively) which were significantly higher than the values produced by smaller propagules size of the sectioned seeds. The lowest values was produced by seed sectioned into sixteen and thirty-two per seeds and their value 2.33cm and 1.33cm respectively were also comparable (Fig 2).



Vine length of seedlings in the field

The vine length generally increased with time, irrespective of the size of the propagules. The vine lenght of the whole seed was consistently and significantly higher than those of the sectioned seeds (Table 3). These values significantly declined with the decline in the size of the propagules, and the least value was produced by the seed sectioned into thirty-two.

Table 3. Vine length of whole and sectioned seed of *Telfairia occidentalis*

	Weeks after Transplanting									
No of seed section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	60	79	98	122	141	155	175	198	211	226
2	40	54	24	94	107	120	141	163	193	204
4	28	36	47	64	84	93	115	126	133	149
8	21	28	36	39	49	56	69	78	96	104
16	13	17	33	27	34	41	57	64	72	84
32	6	8	9	14	16	21	25	30	36	40
LSD(P≤0.05)	2.7	4.1	3.5	5.4	7.3	6.8	8.2	7.2	6.9	6.3

Number of leaves

The number of leaves increased with time. The whole seed generally and significantly produced the highest number of leaves. This was followed by the seeds sectioned into two. The number of leaves generally declined with corresponding reduction in the size of the propagules. The least value was produced by seeds sectioned into thirty-two. During the early stage of plant growth, specifically from 1-4 WAS, comparable values were found between the seed sections. For example, the value of quartered seed and seeds sectioned into eight were comparable at 1 and 2 WAS. Similarly, a seed sectioned into 8 and 16 produced comparable values at 3 and 4 WAS, while seed sectioned into 16 and 32 produced comparable values at 1 WAS. From 5-10WAS, all the treatments produced significantly different values of numbers of leaves.

Table 4. Number of leaves of whole and sectioned seed of *Telfairia occidentalis*

	Weeks after sowing									
No of seed section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	26	35	46	59	70	87	102	131	150	150
2	21	32	42	54	63	78	107	119	135	135
4	16	22	30	39	45	57	81	93	108	108
8	14	20	25	31	38	49	68	77	89	89
16	10	16	22	28	34	43	60	68	78	78
32	7	11	16	19	22	28	41	49	57	57
LSD(P≤0.05)	3.1	2.5	3.2	7.1	3.4	4.7	4.4	4.8	3.1	4.3

Plant Girth

The plant girth had a slow increase with time from 1-10 WAP (Table 5). Like in the number of leaves, the plant girth declined with corresponding decline in propagules size. Whole seed produced the highest value of plant girth, while the seed sectioned into two had the least value.

Table 5. Plant Girth (cm) of whole and sectioned seeds of *Telfairia occidentalis*

	Weeks after sowing									
No of seed section	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.6
2	0.9	0.9	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.4
4	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.2
8	0.7	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.1
16	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	1.1
32	0.5	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.7	0.9
LSD(P≤0.05)	0	0	0.08	0.08	0.07	0.05	0.05	0.04	0.06	0.06

Number of branches

With regards to number of branches, whole seed produced the highest value (10.7) at 10 WAS which was closely followed by half seed (8.7) and the least value (3) was produce by seeds sectioned into thirty two. Thus, number of branches generally declined with corresponding reduction in the size of the propagules (Fig 3)

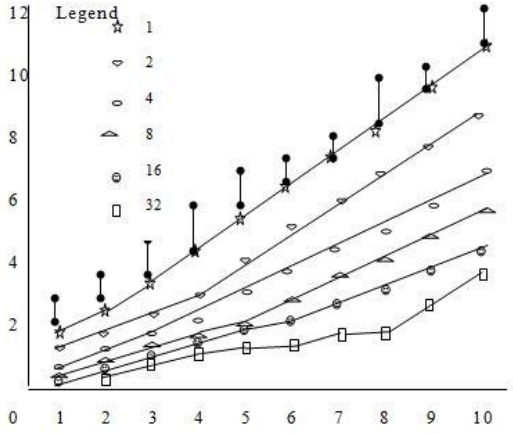


Fig 3. Number of branches of whole and sectioned seeds of *Telfairia occidentalis*

Adventitious root development

Adventitious root growth observed in the non-embryonic seed sections obtained from seed sectioned into thirty two. The propagules were nursed and observed for 5 weeks without germination. (Plate 1)

Plate 1

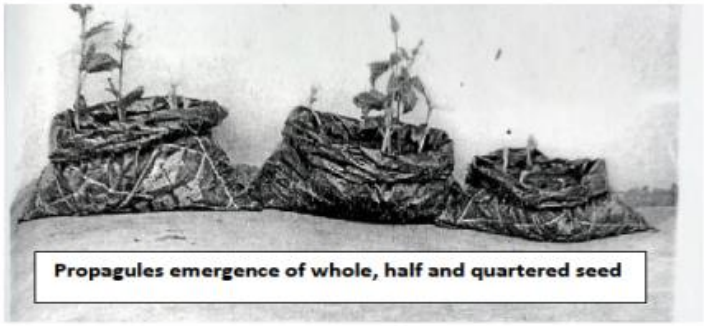


Plate 2

DISCUSSION

The result of this study has demonstrated the possibility of regenerating whole plant from sectioned seed of *Telfairia occidentalis*. This was true for seed sectioned up to sixteen Parts. This was due to the presence of polyembryony in *Telfairia occidentalis* as reported (Onovo *et al* 2009).

The relatively higher vigour expressed by whole seed and seeds sectioned into two over smaller seed sections, with regard to seedling emergence could be attributed to the relatively higher food reserve in the former propagules. This food reserve includes protein, carbohydrate, fats, minerals and vitamin which are basic resources for higher germination rate and seedling emergence. Akoroda and Adejoro (1990) reported that the cotyledonary food reserve of *Telfairia occidentalis* is a major factor of seed germination. The seedling emergence, vine length, number of leaves, number of branches and plant girth were strongly influenced by seed size. Ojeifo and Ajekenrenbiaghan (2007) reported a positive influence of seed size on the rate of seedling emergence, vine length, number of leave and plant girth.

There was similarities in the seedling emergence in number of leaves, number of branches, vine length and plant girth between whole seed and seed sectional but were significantly different from seed section. The vigour exhibited by whole seed and those sectioned into two could be attributed to the advantage of relative large food reserve in the whole seeds and seed sectioned into two. Esiaba (1983) reported that good food reserve enhanced early germination and growth. The least value in seedling emergence, vine length, number of leaves, number of branches as well as plant girth when compared to other seed sections were produced by Telfairia seed sectioned into 32 section. This is most probably due to its limited food reserve and limited portion of the embryo which resulted in relatively lower vigour. The food reserve enhance the development of vigorous roots at the early stage of growth to forage and provide nutrient for the plant where the seeds or propagules are depleted of food reserve for growth and development

CONCLUSION

The result obtained in this experiment has shown the possibility of regenerating *Telfairia occidentalis* propagules by the use of seeds sectioned up to sixteen having an embryonic section. It is possible to nurture such seedlings to maturity to produce economic yield if growth enhancement nutrient are applied.

Although seedling emergence declined with decrease in size of the seed sections, it is recommended that future studies should address the need to upgrade the seedling emergence of sectioned seeds to achieve 100% survival in the nursery.

RECOMMENDATION

The ability of *Telfairia occidentalis* to produce numerous plants from one seed could be enhanced by the use of large sized seeds, having large embryonic portion and with proper nursery management. The limitations observed in this study were poor growth which can be enhanced with the use of hormones and application of nutrient to beef up the vigour of the plant.

This can only be achieved through further research work. Tools for sex determination at seed and germination stages should be establishing to enable the elimination or salvaged for other purposes.

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