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Effect of Different Temperature Regimes on Seed Germination and Growth Parameters of *Dacryodes Edulis*

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Abstract: The seasonality of *Dacryodes edulis* limits the availability of propagules. To forestall its extinction, the effects of different temperature regimes on 3 seed sizes of fruit were evaluated to assess the recoverability of seeds in terms of percentage germination and seedling growth. The percentage germination was 97 for fruit softened at 25 and 50 while 87°C for fruits softened at 0°C and 85% for fruits softened at 75°C and least were 35 for fruits softened at 100°C. Plant height was significantly tallest ($p<0.05$) at 25.8 cm for fruits softened at 50°C, plant girth was largest at 4.0 cm for fruits softened at 0, 25, 50 and 75°C and number of leaves and leaf area were 8.1 and 63 cm^3 for fruits softened at 75°C. The seedlings large fruit performed better medium and small. The growth parameters of fruit softened at 100°C were most significantly depressed. It is therefore concluded, that different temperature regimes had effect on different percentage germination and on some growth parameters of the plant. However, it is recommended that fruits of *Dacryodes edulis* whose seeds are intended for planting should be softened at water temperature of between 50 to 75°C.

Key words: *Daeryodes edulis*, temperature regimes seed germination

INTRODUCTION

The African Pear (*Dacryodes edulis* G. Don. H.J. Lam.) is an economic fruit plant in south eastern Nigeria[1]. Etukudo[2] reported that it is a multipurpose tree which can be used as edible fruit, forage, shade, timber, mortar making, fuel wood and it exudes gum which can be used in glazing pots and lighting at night. The fruit is a very important food supplement, being available in between April and August, during the planting season in rainfed Agriculture in Southern Nigeria. The fruits are harvested black in colour and eaten softened. The fruit consist of large seeds usually 1-20 in number and is surrounded by a thin mesocarp[3], which is part of the fruit that is consumed. After consumption of the mesocarp, the seed are sown.

Temperature plays an important role in seed germination. According to Nwufo and Ayim[1], seeds of *Dacryodes edulis* germinate at temperature ranging from 32 to 34°C and continuous exposure of this seed to high temperature is known to be lethal, more also, when the seed is recalcitrant. Some of the seeds that are thrown away after eating the pulp sometimes germinate. This has positive implication for biodiversity enhancement of the plant, but there is a dearth of information on the optimum temperature regime on the germinability of the seed. This study is therefore designed to assess the optimum temperature regime that will enhance the recovery potential of African pear seeds from fruits subjected to various temperature regimes during softing process.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research farm of Delta State University, Asaba Campus, Asaba between July and November 2004 and repeated in July to November 2005. Asaba is located at 06^0 14^1N and 06^0 49^1E of the equator. It is characterized by wet season between April to October with annual rainfall between 1500 to 1849.3 mm.

Fruits of various sizes were sourced locally and categorized by Okorie and Ndubuizu[4] as large (>40 g), medium (21-40 g) and small (<20 g) were used for the study. A batch of 250 fruits replicated 3 times each were subjected to the following temperature regimes of 0, 25, 50, 75 and 100°C in water bath, until the mesocarp softened. The pear was eaten. Thereafter, the seeds were washed, cleaned and sown in a perforated wooden box of 60× 60×25 cm, filled with top soil. The seeds were sown at the rate of 15 per tray and replicated three times in a 5×3

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Table 1: Seedling emergence of pear seeds treated with various temperature regimes of water (percentage of seedling emergence in parenthesis)

Temperature (°C)	Seed size			
	Large	Medium	Small	Mean
0	32 (80)	32 (80)	40 (100)	35 (87)
25	40 (100)	38 (95)	38 (95)	39 (97)
50	40 (100)	38 (95)	38 (95)	39 (97)
75	40 (100)	32 (80)	30 (75)	34 (85)
100	32 (80)	8 (20)	2 (5)	14 (35)
Mean	37(92)	30 (74)	30 (74)	32 (80)

Table 2: Plant height (cm) of *Dacryodes edulis* seedlings grown from seeds of fruit subjected to various temperature regimes

Temperature regime °C	Weeks after sowing					
	1	2	3	4	5	6
0	11.8	14.2	16.2	18.7	20.0	22.4
25	13.9	16.7	19.0	20.7	23.0	25.6
50	14.4	17.7	19.7	21.3	22.8	25.8
75	11.9	16.0	16.5	20.0	21.4	22.5
100	5.9	9.2	10.9	12.4	14.2	15.7
Mean	11.6	14.8	16.5	18.6	20.5	22.4
LSD (5%)	4.3	6.6	6.9	7.9	9.0	10.6

Table 3: Leaf area (cm)

Temp. Regime (°C)	Weeks after sowing					
	1	2	3	4	5	6
0	22.4	31.5	37.4	40.0	43.2	51.6
25	25.1	34.4	43.4	48.5	51.0	58.3
50	22.7	33.5	42.5	50.3	50.5	60.1
75	22.3	33.8	44.5	48.7	53.4	63.0
100	9.8	18.7	25.0	27.6	32.1	39.7
Mean	20.5	30.4	38.6	43.0	46.0	54.5
LSD (5%)	7.3	11.1	13.8	15.2	17.8	21.9

Table 4: Plant girth (cm)

Temp. regime (°C)	Weeks after sowing					
	1	2	3	4	5	6
0	1.9	2.3	2.6	3.0	3.5	4.0
25	1.9	2.3	2.5	3.0	3.5	4.0
50	1.9	2.3	2.6	3.0	3.5	4.0
75	1.8	2.3	2.5	3.0	3.5	4.0
100	0.9	1.4	1.6	2.0	2.1	2.5
Mean	1.7	2.1	2.4	2.8	3.2	3.7
LSD (5%)	0.6	0.8	1.0	1.1	1.4	1.6

simple factional arrangement in a complete Randomized design. Watering of germinated seeds were carried out every other day except for rainy days.

Data were collected on seedling emergence, plant height, plant girth, number of leaves and leaf area for 7 weeks after sowing. The data were subjected to analysis of variance and the means were separated using standard error, percentage, Barchart and Histogram.

RESULTS AND DISCUSSION

Seedling emergence: The mean of seedling emergence ranged from 35-97% Table 1. The least was obtained from fruit softened in the water media of 100°C. Seed germination that exceeds 70% is excellent in assessing seed integrity (Copland, 1976). Therefore, any softening temperature range from 0-75°C is considered appropriate for retrieving seeds after commercial use or domestic consumption of fruits. The large fruits had the highest seedling emergence than medium and small fruit sizes even though, that, seed germination exceeded 70% for all the seed sizes Table 1.

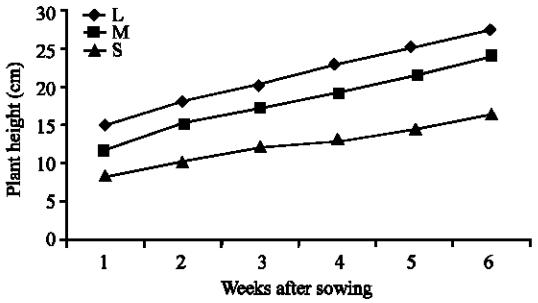

Fig. 1: Plant height of seedlings grown from seed of various fruit sizes of *Dacryodes*

At < 100°C, the heat transmitted from the water bath through the fruit coat to the embryo could not have any debilitating effect on the embryo and the enzyme thus leading to excellent germination. Also at 100°C, the heat transmitted may have affected the embryo and enzyme, could have resulted in low % germination. This agrees with Gills *et al.*[5], who reported 40% germination of seeds, when treated with boiling water (100°C) for = 1 min and attributed, the low % germination to loss of viability of seed at that temperature range.

Plant height: The plant height of seedlings grown from seeds of fruits subjected to various temperature regimes increased with weeks after sowing. The highest temperature of softening fruits in this study significantly suppressed the plant height of *Dacryodes edulis* Table 2. At 7 WAS, fruits softened at 50°C were taller than other treatments. Pear softened between 0 to 75°C had comparable height ($p = 0.05$) and significantly taller than pear softened at 100°C Table 3.

The plant height of seeds from large fruits was significantly taller than those of medium and small fruits up to the six weeks after sowing Fig. 1.

Plant girth: Plant girth followed the same pattern as in plant height Table 4. The large fruits had highest plant girth than medium and small fruits as at 1st week after planting. Between 2 WAP and 5 WAP, there was no significant difference between the large, medium and small fruit plant's girth. There after, the large fruit seed was significantly taller than medium and small fruit seedling girth Fig. 2.

Table 5: Number of leaves

Temp. regime (°C)	Weeks after sowing 1	2	3	4	5	6
0	5.9	6.0	6.0	6.0	6.2	7.6
25	6.0	6.0	6.0	6.0	6.3	7.4
50	5.6	5.8	5.8	5.9	6.4	7.8
75	6.0	6.0	6.0	6.0	6.6	8.1
100	2.3	2.9	4.0	4.0	4.1	5.4
Mean	5.2	5.3	5.6	5.6	5.9	7.3
LSD (5%)	1.2	2.0	2.5	2.5	2.6	4.6

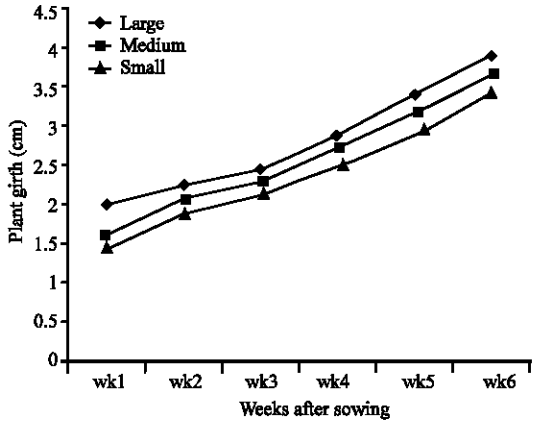

Fig. 2: Plant girth of seedlings grown from seed of various fruit sizes of *Dacryodes edulis*

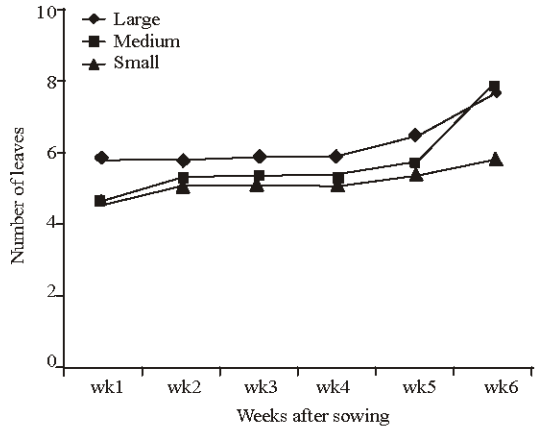

Fig. 3: Number of leaves of seedlings grown from seed of various fruit sizes of *Dacryodes edulis*

Number of leaves: The number of leaves was comparable for fruits softened from 0 to 75°C, from 1WAS to 5WAS and was superior to those of fruits softened at 100°C (p = 0.05). At 6 WAS, only fruits softened at 75°C had significantly the highest number of leaves than fruits softened at other temperature regimes Table 5.

The numbers of leaves of large fruits at 1WAS were significantly higher than those of medium and small fruits. The seedlings of medium fruits had the least number of leaves. At 6WAS, the number of leaves of medium fruit was significantly taller than those of large and small fruits Fig. 3.

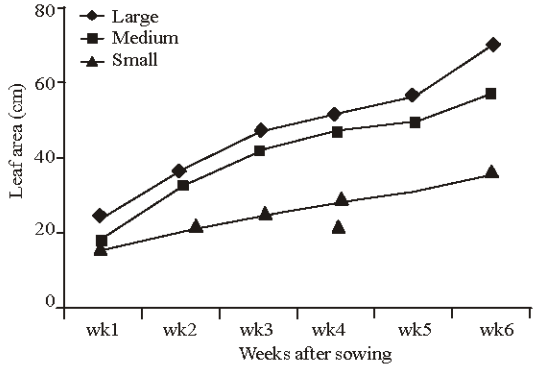

Fig. 4: Leaf area of seedlings grown from seed of various fruit sizes of *Dacryodes edulis*

Leaf area: There was no consistent trend in the leaf area of fruits softened at 0 to 75°C, but was superior to seedlings of fruits softened at 100°C (p = 0.05), throughout the period of the study Table 3.

The leave area of plants sown from large fruits was consistently superior to those of medium and small fruits throughout the period of study. The least leaf area was obtained in plant sown with seeds from small fruits Fig.4.

Generally, the growth parameters namely plant height, plant girth, number of leaves and leaf area of the germinated seeds of fruits softened at different temperature regimes of 0, 25, 50 and 75°C were significantly taller than those of 100°C. This indicates that hot water treatment of 100°C may have caused some injury in the embryo during fruit softening could have resulted in the lower growth parameters observed throughout the seven weeks of plant growth.

With regards to the different fruit sizes, the large fruit sizes germination and growth parameters were better than those of medium and small fruit. It would appear that the bigger the fruit size, the better the growth parameters.

CONCLUSION

The different temperature regimes had significant effect on germination of seed and on some growth parameters of the seedlings. The study showed that *Dacryodes edulis* fruit subjected to 0 to 75°C temperature regime, produced = 75% germination. However, earlier work by the same workers (Unpublished), had found fruit softening and sensory evaluation to favour temperature regime of 50 to 75°C as most appropriate. This implies that 50 to 75°C is best for fruit consumption and seed

recoverability. Also, the biggest fruit (> 40 g) had the best germination and growth parameters. This indicates that such seeds are retrievable for planting to enhance biodiversity and also fundamental to any seed multiplication, since other procedures for plant propagation such as cutting has not been carried out on the plant.

Consequently, it is therefore recommended that valuable fruits whose seed are intended for planting should be softened within the water temperature of 50 to 75°C.

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