



COMPARATIVE STUDY ON JUVENILE CHARACTERISTICS OF SELECTED LOCAL ACCESSIONS OF PAWPAP SEEDLINGSS IN OWERRI WEST WITH RED ROYALE

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ABSTRACT

The experiment was conducted at the Teaching and Research Farm of the School of Agriculture and Agricultural Technology, Federal University of Technology Owerri, to study the juvenile characteristics of selected local accessions of pawpaw seedlings. The treatments consisted of six local accessions of pawpaw from Owerri West L.G.A of Imo State and one improved variety namely; ACC-EZ, ACC-IH, ACC-NE, ACC-OB, ACC-IR, ACC-OR and RED ROYALE. These were laid out in a Completely Randomized Design (CRD) and replicated three times. Data were collected on viability and growth parameters. Results of the study indicated that, the improved variety (Red Royale) performed better than local accessions in terms of viability attributes by producing the highest number of emerged seedlings on the first day, attained 50% emergence within the shortest time and recorded the highest percentage emergence at 6 weeks with mean value of 91.80%. ACC-IH produced the highest number of leaves at 24 and 32 days after emergence with mean values of 13.33 and 23.00 each. ACC-OR performed better than other local accessions including the Red Royale in terms of increase in plant height at 8, 16, 24 and 32 days after emergence with mean values of 5.37, 8.37, 12.70 and 15.37 cm respectively. Furthermore, ACC-IH produced the thicker stem at 16 and 32 days after emergence with mean values of 0.5 and 1.5 cm each. From this research, it was clearly observed that some of the local accessions such as ACC-EZ, ACC-IH and ACC-IR exhibited superior juvenile characteristics either at per or above the improved variety (Red Royale) and therefore should be used by rural farmers within this area for mass propagation to maximize profit and at the same time be utilized by breeders for improvement purposes.

Keywords: Juvenile, Characteristics, Accessions, Red Royale, Rural, Farmers,

INTRODUCTION

Pawpaw (*Carica papaya*) is a tropical fruit that belongs to the family of *Caricaceae* (Chavez-Pesqueira and Nunez-Farfan, 2017). It has high commercial importance due to its high medicinal and nutritive value (Brannan *et al*, 2015;). Cultivation of pawpaw is assumed to have started from South Mexico and Costa Rica (Carvalho and Renner, 2012; Fuentes and Santamaria, 2014; Aranyak *et al*, 2025). India is the highest producer of pawpaw while Nigeria is ranked fifth after India, Brazil, Indonesia and Dominican Republic with annual production of 775,000 tons (FAOSTAT, 2012). Currently, India still maintains the highest producer of pawpaw globally with Nigeria moving down to sixth position (FAOSTAT, 2024). Though there are many varieties in existence in tropical and subtropical regions of the world with different traits like size of fruits, colour, flavour, tree size etc, however three popular improved varieties available in Nigeria are Maradol, J.S.22, Pink solo and Red Royale. A single pawpaw tree can grow more than 30ft tall depending on its variety (Thomas, 2015).

Pawpaw has a vast native growing range that extends to 26 states according to US Department of Agriculture (USDA) plant hardiness zones 5-8 (Galli *et al*, 2007). This means that pawpaw can survive in different types of climates; it also shows variability in seedling growth and germination because it is propagated by seeds (Dayeswari *et al.*, 2017). It is worthy to note that pawpaw is the world's first transgenic cultivar that was released for commercial production by public institution in USA (Manshardt, 2014).

Pawpaw is a fruit and as such the power house of nutrients which can be consumed as fresh fruits, processed or used in variety of products as jams, fruit juice, jelly and ice cream (Santana *et al*, 2019). Apart from direct consumption of the fruit, there have been other industrial uses from dried



latex of its immature fruits which are used in meat tenderizing, production of papain, manufacturing of chewing gum, cosmetics and for de-gumming natural silk etc. (Anis Mirza *et al*, 2023). Agriculture is the major contributor to Nigerian Gross Domestic Product (GDP) and rural farmers play a dominant role in this contribution (NBS, 2023). It has earlier been stated that three popular improved varieties are dominant in Nigeria but the fact still remains that local accessions of pawpaw in our rural regions contribute to the national pawpaw fruit production. Research has shown that higher percentage of fruits consumed in the country is from traditional rural farmers. These local accessions serve as a source of livelihood for many rural dwellers thereby keeping them gainfully employed as they travel to different remote rural markets in search of cheaper pawpaw fruits.

However, these rural farmers only depend on stands of local accession pawpaw that grow as volunteer plants in their different compounds and nearby farms. These volunteer pawpaw plants thrive on their own without the basic agricultural maintenance practices from germination to maturity stage. As it stands now, there is few or no research work of these local accessions in the Eastern part of Nigeria apart from work carried out by Adinde *et al*, (2024) to select some local accessions using Rank Summation Index (RSI). Nowadays, due to urbanization, infrastructural development and exponential population growth, pawpaw fruit has become a commodity in high demand in our rural regions especially in the Eastern part of Nigeria (Barlow *et al*, 2016). It is on this premise that this research was carried out to compare the juvenile characteristics of selected local accessions of pawpaw with an improved variety (Red Royale) for the sole aim of mass propagation which will invariably be of good benefit to the rural farmers who depend on these local accessions for livelihood and also to solve problem of food security within rural areas.

MATERIALS AND METHOD

Study Area

The experiment was conducted at the Teaching and Research Farm of the School of Agriculture and Agricultural Technology, Federal University of Technology Owerri, Imo State Nigeria. It is located between the latitude of 5° 27¹ and 5° 29¹ North and longitude of 7° 02¹ and 7° 20¹ East at an elevation of 55.6m above sea level.

Layout

The experiment was carried out in FUTO screen house. Within the screen house an area measuring 3.6m length and 2m width was used to position the nursery seed trays at an intra-row spacing of 0.6m and inter-row spacing of 1m.

Planting

Twenty one plastic seed nursery trays measuring 45cm length, 15cm depth and 30cm width were purchased from Ihiagwa Market in Owerri West, Imo State. Each plastic seed tray represents a plot. In each plot, 10 seeds of each treatment were planted. Each treatment was replicated into three giving a total of 210 seeds in all 21 plots. A standard nursery mixture of 3:2:1 which implies the use of sterilized top soil, cured poultry manure and river sand respectively was used as the nursery medium.

Treatments and Experimental Design

Seven varieties of pawpaw comprising six local accessions and one improved variety were used. The local accessions were obtained from different towns in Owerri West Local Government namely: Eziobodo, Ihiagwa, Nekede, Obinze, Irete, Orogwe and Red Royale (improved variety) was obtained from FUTO Teaching and Research Farm Owerri, Imo State. These seven treatments were randomly placed in each of the blocks in the screen house. The Red Royale was used as the control. These treatments were laid out in a Completely Randomized Design (CRD) and replicated three times. Note that each accession is represented as “ACC” with the first two initials of the town’s name; however the improved variety’s name was written in full as shown below:

- Accession from Eziobodo is denoted as ACC-EZ
- Accession from Ihiagwa is denoted as ACC-IH
- Accession from Nekede is denoted as ACC-NE
- Accession from Obinze is denoted as ACC-OB



- Accession from Irete is denoted as ACC-IR
- Accession from Orogwe is denoted as ACC-OR
- Improved variety “Red Royale”

Data Collection

Data Analysis

All collected data were statistically analysed using GenStat software. Mean separations was done using Least Significant Difference (LSD) at 5% probability level.

RESULTS AND DISCUSSION

Effect of Local and Improved Accessions of Pawpaw on Number of Seedlings Emerged on the First Day, Days to First Emergence, Days to 50% Emergence, Emergence Range and Seedling Vigor Index

Result from Table 1 showed that, there were no significant difference among the treatment means on days to first emergence, emergence range and seedling vigor index. However there were significant variations among treatment means on number of seeds that emerged on the first day and days to 50% emergence. Red Royale (improved variety) produced the highest number of emerged seedlings on the first day with mean value of 3.00 seeds; this was closely followed by ACC-EZ with mean value of 2.60 seeds. For days to 50% emergence, it took Red Royale least number of days to attain 50% emergence with mean value of 10.19 days while ACC-OR spent the longest days before attaining 50% emergence with mean value of 19.69 days. This research has proven that Red Royale has very high viability by producing the highest number of seedlings on the first day of emergence and also attained 50% emergence within the shortest time even though it was closely followed by ACC-EZ with mean value of 11.33 days. This is in conformity with the work of Marler (2007) who also recorded 10 days first emergence and high percentage establishment of Waimanalo improved variety of pawpaw with soil medium.

Table 1: Effect of Local and Improved Accessions of Pawpaw on Number of Seedlings Emerged on the First Day, Days to First Emergence, Days to 50% Emergence, Emergence Range and Seedling Vigor Index

Treatments	Number of seeds on first day.	Days to first emergence.	Days to 50% emergence.	Emergence range.	Seedling vigor index.
Red Royale	3.00	10.67	10.19	42.33	5.56
ACC-1H	1.33	10.67	17.74	42.33	3.31
ACC-IR	2.30	11.00	15.61	43.00	4.43
ACC-OB	1.30	11.33	18.07	43.77	3.06
ACC-EZ	2.60	10.33	11.33	42.33	7.06
ACC-NE	1.70	10.67	14.33	42.33	5.62
ACC-OR	1.70	12.00	19.69	44.00	2.48
Means	1.99	10.95	15.28	42.87	4.50
LSD _{0.05}	0.91	NS	2.83	NS	NS

LSD_{0.05} = Least significant difference of mean (5% level), NS = Not significant.

Effect of Local and Improved Accessions of Pawpaw on Percentage Emergence at One, Three and Six Weeks after Emergence

Table 2 indicated that, at the early stages of one and three weeks after emergence there were no significant variations among the seven treatments, however at later stage of six weeks after emergence there was significant variations among the treatment means such that Red Royale recorded the highest percentage emergence with mean value of 91.8%, this was followed by ACC-EZ with mean value of 87.10% while ACC-OR had the least percentage emergence with mean value of 39.5%. This result is also in conformity with the work of Meena *et al* (2017) who stated that Red Royale is a vigorous growing variety with high emergence rate.

Table 2: Effect of Local and Improved Accessions of Pawpaw on Percentage Emergence at One, Three and Six Weeks after Emergence

Treatments	% emergence at one week.	% emergence at three weeks	% emergence at six weeks
Red Royale	53.30	56.70	91.80
ACC-IH	33.30	40.00	41.30
ACC-IR	45.00	50.00	50.80
ACC-OB	33.30	40.00	40.30
ACC-EZ	70.00	86.70	87.10
ACC-NE	55.00	63.30	64.40
ACC-OR	26.70	33.30	39.50
Means	45.19	57.10	59.31
LSD _{0.05}	NS	NS	10.21

Effect of Local and Improved Accessions of Pawpaw on Plant Height (cm) at 8, 16, 24 and 32 Days after Emergence

The result as presented in Table 3 indicated that, at all stages of growth, there was significant difference in plant height for all the treatments. ACC-OR produced the highest plant height at all stages with mean values of 5.37, 8.37, 12.70 and 15.37 cm at 8, 16, 24 and 32 days after emergence respectively. Naturally local accessions of most edible fruit trees grow very tall when compared with improved varieties of the same plant. From the result, it could be deduced that among the local accessions ACC-OR may be a very tall accession for producing the tallest plant height at 8, 16, 24 and 32 days after emergence though it did not perform well in other accessed parameters. This may be as a result of its inherent genetic make-up. This trait is not advantageous to the farmer because large number of stands of this local accession will be prone to wind break which will cause serious loss to the farmer.

Table 3: Effect of Local and Improved Accessions of Pawpaw on Plant Height (cm) at 8, 16, 24 and 32 Days after Emergence

Treatments	Plant height at different days after emergence (cm)			
	8 days after emergence	16 days after emergence	24 days after emergence	32 days after emergence
Red Royale	1.83	4.33	5.77	9.93
ACC-IH	2.03	3.80	9.67	9.77
ACC-IR	2.97	2.73	7.50	10.47
ACC-OB	2.97	2.53	6.60	8.90
ACC-EZ	2.97	3.50	8.23	10.07
ACC-NE	3.17	3.70	9.07	10.30
ACC-OR	5.37	8.37	12.70	15.37
Means	3.04	4.14	8.51	10.69
LSD _{0.05}	1.40	2.68	3.50	2.72

Effect of Local and Improved Accessions of Pawpaw on Number of Leaves at 8, 16, 24 and 32 Days after Emergence

Result from Table 4 showed that, at the earliest stage of growth, there were no significant variations on number of leaves among the treatments however at later stage there was pronounced variation on number of leaves produced by the treatments. It was observed that at 16 days after emergence Red Royale produced the highest number of leaves followed closely by ACC-IR with mean values of 7.67 and 7.33 each. However, at 24 and 32 days after emergence, ACC-IH overtook both Red Royale and ACC-IR and produced the highest number of leaves with mean values of 13.33



and 23.00 at 24 and 32 days after emergence each. From the above scenario, it can be deduced that ACC-IH will have high establishment rate as time goes on due to the fact that proliferation of leaves in a plant is a function of its establishment in the field as a result of its high ability to carry out photosynthesis Yahaya *et al.* (2011).

Table 4: Effect of Local and Improved Accessions of Pawpaw on Number of Leaves at 8, 16, 24 and 32 Days after Emergence

Treatments	8 days after emergence	16 days after emergence	24 days after emergence	32 days after emergence
Red Royale	5.00	7.76	11.33	20.00
ACC-IH	4.00	6.67	13.33	23.00
ACC-IR	4.00	7.33	12.33	21.67
ACC-OB	3.33	6.33	10.33	19.33
ACC-EZ	3.67	6.67	10.33	18.67
ACC-NE	4.00	6.67	10.33	19.00
ACCOR	3.00	5.33	9.33	18.00
Means	3.86	6.67	11.04	19.95
LSD _{0.05}	NS	0.87	2.26	2.37

Effect of Local and Improved Accessions of Pawpaw on Stem Girth (cm) at 8, 16, 24 and 32 Days after Emergence

Result from Table 5 indicated that, there were no significant variations in 8 and 24 days after emergence, however at 16 and 32 days after emergence there were significant difference among the treatments. The significant variation observed in stem girth at 32 days after emergence conforms with the work of Khadijah *et al.*, 2020 who also recorded significant variation in plant girth beginning from fourth week after planting. Red Royale and ACC-IH produced the widest stem girth with mean values 0.5 cm each at 16 days after emergence but at 32 days after emergence ACC-IH overtook Red Royale and produced the widest girth size above all other treatments with mean value of 1.5 cm, this was closely followed by ACC-IR with mean value of 1.43 cm. According to research Red Royale is a dwarf variety with very thick or wide girth size, however table 5 shows that ACC-IH and ACC-IR must have a very thick trunk due to their wide girth size which will make them to be very resistant to wind influence unlike ACC-OR which is a tall variety but has least stem girth size of 1.10 cm at 32 days after emergence. ACC-OR will therefore be a lanky variety that will be prone to wind break.

Table 5: Effect of Local and Improved Accessions of Pawpaw on Stem Girth (cm) at 8, 16, 24 and 32 Days after Emergence

Treatments	Stem girth at different days after emergence (cm)			
	8 days after emergence	16 days after emergence	24 days after emergence	32 days after emergence
Red Royale	0.33	0.50	1.23	1.30
ACC-IH	0.33	0.50	1.33	1.50
ACC-IR	0.33	0.43	1.17	1.43
ACC-OB	0.30	0.36	0.83	1.13
ACC-EZ	0.33	0.43	1.07	1.33
ACC-NE	0.33	0.47	1.10	1.37
ACC-OR	0.33	0.43	0.80	1.10
Means	0.33	0.43	1.08	1.31
LSD _{0.05}	NS	0.58	NS	0.48



CONCLUSION AND RECOMMENDATION

This research showed that Red Royale had the highest viability and percentage establishment when compared with all the local accessions, however among the local accessions, ACC-EZ performed better than others in terms of viability and percentage establishment by producing the highest number of seedlings on the first day and also attaining 50% emergence within the shortest time with mean values 2.60 and 11.33 days respectively. ACC-IH produced the highest number of leaves and also the largest girth size while ACC-OR performed better than all the accessions and Red Royale in terms of increase in height. In conclusion therefore, it is recommended that ACC-EZ and ACC-IH that exhibited superior juvenile characteristics either at per or above Red Royale should be utilized by rural farmers for mass propagation for profit maximization and sustainability of pawpaw fruit production and also for breeders' improvement purposes within Owerri West region. However, it should be noted that ACC-OR is not recommended for farmers' utilization even though it performed best in terms of height attainment. This is because it is a tall and lanky variety of pawpaw with very thin girth size and low percentage establishment which makes it susceptible to wind at the detriment of the farmers.

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