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Research Article

Performance Evaluation of Ten Elephant Foot Yam (*Amorphophallus paeoniifolius* L.) Genotypes in Southwestern Bangladesh

Ahaasanul Haque Sumon, Md. Yamin Kabir ✉, Md. Abdul Mannan and Shirazoom Munira

Agrotechnology Discipline, Khulna University, Khulna 9208, Bangladesh

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Correspondence
Md. Yamin Kabir
✉: yaminkabir@at.ku.ac.bd

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ABSTRACT

Elephant foot yam is a popular South Asian tuber crop and is also widely distributed in Bangladesh. However, genotypes may differ in growth and yield. A field experiment was conducted during the period from March to September 2024 at Dumuria, Khulna, to evaluate ten elephant foot yam genotypes for their growth and yield attributes using a Randomized Complete Block Design with three replications. The genotypes were Kolkata, BAU-1, Satkhira Bagha, Jashore Local, Chuadanga, Madrasi, Bandarban Ruma, Satkhira Local, Sahebi Lomba, and BAU-2. The growth and yield components varied significantly among the genotypes, except for the number of plants per plot. Results revealed that less time was required for sprouting (23.00 days) in Bandarban Ruma. The highest plant height (158.33 cm) was recorded in Madrasi, while the maximum number of leaves was recorded (49.66) in Jashore Local. The highest leaf length and leaf breadth were recorded in BAU-2 (31.66 cm) and Madrasi (22.66 cm), respectively. The maximum corm length and corm diameter were observed in Sahebi Lomba (22.40 cm) and Madrasi (24.33 cm), respectively. The highest corm yield (40.13 t ha^{-1}) was recorded in Madrasi. Overall, Madrasi may be selected for commercial cultivation in the Khulna region.

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Introduction

Elephant foot yam [*Amorphophallus paeoniifolius* (Dennst.) Nicolson] — the king of tuber crop — is a perennial, herbaceous tuber crop from Araceae, which can be cultivated as an annual (Abraham et al., 2021; Suja et al., 2012). Elephant foot yam grows well in well-drained sandy loam or sandy clay loam soil with a neutral soil reaction (Mukherjee et al., 2020). This herbaceous plant grows up to a height of 1.0-1.5 m. The luxuriant foliage, with its large dissected leaves on a thick stem, resembles the regal shape of a crown. It is grown during the rainy season and is a long-duration crop, taking around 6 to 8 months to mature. It is a tropical tuber crop and grows well at a temperature of 25–30 °C, relative humidity of 80–90%, and evenly distributed 1000–1500 mm annual rainfall (Nedunchezhiyan et al., 2002). It is known for its high production potential, popular as a vegetable, and good keeping quality, culinary properties, and medicinal utility (Chattopadhyay and Nath, 2007). It also contains therapeutic attributes, including gastroprotective, anti-oxidative, antidiarrheal, and anti-inflammatory properties (Kamalkumaran et al., 2020). Indigenous medicines for piles, asthma, dysentery, and other abdominal disorders use tubers (Nedunchezhiyan et al., 2008).

Elephant foot yam does not contain heavy metals and is a good source of energy, starch, protein, fiber, vitamins, and minerals (Kamalkumaran et al., 2020; Singh et al., 2011). It can ensure food security and nutritional security in growing countries (Pan et al., 2022). It is included in daily food in many Asian countries and has export potential. It is used as a vegetable in Indian, Chinese, and Japanese cuisines and produces value-added products, e.g., pickles, dried cubes, chips, flour, and a thickening agent (Bansode et al., 2019). Consumers of elephant foot yam often select genotypes having the best flavor, texture, and color rather than those having a better nutrient profile (Das et al., 1997). However, edible aroids possess anti-nutritional factors,

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e.g., oxalate, trypsin inhibitors, and acridity (Pan et al., 2022). Intake of oxalate-rich foods may cause deposition of calcium oxalate crystals in the kidneys, the occurrence of renal stones, and a reduction in bioavailability of calcium (Chattopadhyay and Nath, 2007).

It has become crucial to diversify current agriculture to fulfill the demand of an ever-increasing population and the rapid depletion of natural resources (Suja et al., 2012). Elephant foot yam might be a potential economic crop in South Asia, including Bangladesh, with an average yield as 26.87 t ha^{-1} in Jashore, Kustia, and Satkhira (Rahman and Hajong, 2022). It is a climate-smart and food security ensuring crop that can grow in poor soil with low rainfall, even in drought conditions (Singh et al., 2016). Moreover, intercropping elephant foot yam with cluster bean enriches soil nutrients, soil microbes, and boosts enzyme activity, favoring smallholder farmers for low-cost crop production (Ilakiya et al., 2023). However, the growth and yield performances of elephant foot yam were better as a sole crop than intercropped with millet (Botuku et al., 2024). A limited number of studies are available on elephant foot yam, considering its growth and yield in Bangladesh. Therefore, this study evaluates ten genotypes of elephant foot yam for their growth and yield attributes.

Materials and Methods

Study area, land preparation, treatments, and experimental design

The study was conducted during the period from March to September 2024 at Dumuria (22°49' North latitudes and 89°21' East longitude), Khulna, Bangladesh, in the Agroecological Zone 13 (AEZ 13) at an altitude of 1 meter above sea level. The clay loam soil is characterized by low organic matter (1.12%), high pH (6.5-8.5), and a deficit in nitrogen, potassium, and sulfur.

The land (51 m x 16 m) was ploughed with a power tiller, followed by laddering on 15 days before planting, and plant parts, inert materials, and visible insect pests were removed from the soil. The field was fertilized with cow dung (5 t ha^{-1}), urea (200 kg ha^{-1}), triple super phosphate (150 kg ha^{-1}), muriate of potash (200 kg ha^{-1}), Gypsum (70 kg ha^{-1}), and boron (10 kg ha^{-1}). All fertilizers were applied at final land preparation except for cow dung, which was given during land preparation (Appendix 1).

Ten elephant foot yam genotypes, e.g., Kolkata, BAU-1, Satkhira Bagha, Jashore Local, Chuadanga, Madrasi, Bandarban Ruma, Satkhira Local, Sahebi Lomba, and BAU-2, were grown in 30 plots following a single factor Randomized Complete Block Design (RCBD) with three replications. Genotypes were collected from the farmers of the cultivation area. The field was divided into three blocks and ten-unit plots in each block; each plot measures 16 m^2 (4 m x 4 m). The plot-to-plot distance and plant-to-plant distance within each plot were 1 m for each case. Healthy corms of 300-400 g were planted at 1 m apart, and 16 corms in a plot. Corms were treated by dipping in Autostin 3g L^{-1} and Nitro 505 EC (Chlorpyrifos+Cypermethrin) 2 ml L^{-1} before planting.

Intercultural operations and harvesting

Weeding and mulching were done to keep the plants free from weeds, soil aeration, and break the crust. Mulching helps the germination of the elephant foot yam. The field was irrigated after one week of planting. Irrigation was scheduled at a 25-day interval till the rain starts.

The plants were harvested carefully with a spade 180 days after planting. The harvested corms were cleaned and sorted out to separate the marketed corms. Cormels were also separated from the corms.

Data collection

Data were collected on sprouting (days required to first sprouting, days required to completion of sprouting, and number of sprouting per plot), plant height, leaf attributes (leaf number, length, breadth), corm attributes (corm length, diameter, and weight per plant), corm yield (t ha^{-1}), cormel attributes (cormel number, cormel length, diameter, and weight per plant), and cormel yield (t ha^{-1}).

The time required for the appearance of the first sprout and the time between the first and last dates of sprouting were considered as days required for first sprouting and days for completion of sprouting, respectively. After sprouting, the total number of sprouts per plot was recorded. Plant height (cm) was recorded from randomly selected five plants in each plot at 30, 50, 70, 90, and 110 days after planting (DAP) and measured from the soil surface to the top-most growing point. To count the number of leaves in $plant^{-1}$, five plants of each plot were selected randomly, and leaves were counted at 70, 90, and 110 DAP. Leaf length was measured from the base of the petiole to the tip of the leaf with a scale, and leaf breadth was measured at the widest part of the leaf by a meter scale at 70, 90, and 110 DAP.

For the measurement of corm size, five corms were selected from each of the plot and their length, diameter, and weight were measured. Corm length was measured from the top to the bottom of the corm with a measuring scale (cm). Similarly, corm diameter was measured at the middle of the corm by a measuring scale (cm). The corm of each plant was weighed (kg) to get the weight of the corm of plant^{-1}. Similarly, the total corm weight per plot was calculated and converted to corm yield per hectare (t ha-1). The number of cormels from each of the selected plants was counted, and their length and diameter were measured using slide calipers, and the weight of cormels per plant and per plot was recorded. The per plot cormel weight was converted to cormel yield (t ha^{-1}).

Data analysis

The collected data on various parameters under study were statistically analyzed with one-way analysis of variance (ANOVA) using Statistix-10 software. Differences among treatment means were evaluated by Tukey's Honestly Significant Difference (HSD) test at 5% level.

Results

Growth attributes of Elephant foot yam genotypes

Sprouting

The days required for first sprouting and the days required for completion of sprouting varied among the Elephant foot yam genotypes. Bandarban Ruma required the minimum time (23.00 days) for 1st sprouting, preceded by Madrasi (24.33 days) and BAU-2 (24.66 days) (Table 1). However, Kolkata, Satkhira Bagha, and Jashore Local required the maximum time (26.33 days) for 1st sprouting. Similarly, Bandarban Ruma completed sprouting by 32.00 days, followed by Madrasi (32.33 days) and BAU-2 (32.66 days). However, Jashore Local required the longest time (37.66 days) for the completion of sprouting, followed by Satkhira Local (35.33 days) and Sahebi Lomba (35.37 days). The number of sprouts per plot did not vary among the genotypes (Table 1).

Table 1. Genotypic effect of elephant foot yam on sprouting.

Genotype	Days to 1st sprouting	Days to sprouting	Sprouts per plot
Kolkata	26.33a	34.33bcd	14.00
BAU-1	25.33abc	35.00abc	14.33
Satkhira Bagha	26.33a	34.33bcd	15.00
Jashore Local	26.33a	37.66a	15.33
Chuadanga	25.66ab	33.00bcd	14.66
Madrasi	24.33c	32.33cd	14.33
Bandarban Ruma	23.00d	32.00d	13.66
Satkhira Local	25.33abc	35.33ab	14.66
Sahebi Lomba	25.66ab	35.33ab	15.00
BAU-2	24.66bc	32.66bcd	16.00
Significance	**	*	NS
CV	2.92	4.70	7.79

Data represent mean of three replications. In a column, means having similar letter(s) do not differ significantly at 5% as per New Duncan Multiple Range Test. * and ** indicate significant at 5% and 1%, respectively. NS= Non-significant and CV=Co-efficient of variation.

Plant height

Plant height differed significantly among the genotypes at all DAP (30, 50, 70, and 110) (Table 2). The Madrasi was the tallest plant, and Kolkata was the shortest one during the entire growing season. At 110 DAP, Madrasi grew as the tallest plant (158.33 cm), followed by Bandarban Ruma (140.67 cm) and BAU-2 (137.00 cm), and the shortest plant was Kolkata (103.00 cm) preceded by Sahebi Lomba (115.67 cm) and Satkhira Local (125.67 cm) (Table 2).

Table 2. Plant height of elephant foot yam at different days after planting (DAP) as affected by the genotypes

Genotype	Plant height (cm)				
	30 DAP	50 DAP	70 DAP	90 DAP	110 DAP
Kolkata	18.667d	57.00f	72.33d	86.67f	103.00f
BAU-1	21.33bcd	81.00bc	94.00c	119.67bcd	126.67d
Satkhira Bagha	23.00abcd	73.33cde	94.00c	122.33bc	129.67cd
Jashore Local	22.66bcd	77.33cd	92.00c	115.00cde	132.33bcd
Chuadanga	24.00abc	71.00dc	90.33c	113.67de	132.33bcd
Madrasi	27.66a	103.00a	125.00a	145.33a	158.33a
Bandarban Ruma	25.00ab	76.33cde	95.67c	127.67b	140.67b
Satkhira Local	20.00cd	72.67de	91.33c	115.67cde	125.67d
Sahebi Lomba	19.66cd	69.00e	91.67c	109.00e	115.67e
BAU-2	24.00abc	86.67b	107.33b	128.00b	137.00bc
Significance	*	**	**	**	**
CV	12.63	6.27	6.40	4.15	3.87

Data represent mean of three replications. In a column, means having similar letter(s) do not differ significantly at 5% as per New Duncan Multiple Range Test. * and ** indicate significant at 5% and 1%, respectively. CV=Co-efficient of variation

Leaf attributes

The leaf number, leaf length, and leaf breadth varied significantly among the genotypes at 70, 90, and 110 DAP (Table 3). Jashore Local had the highest leaf number, and Madrasi had the lowest leaves during the entire growing season. At 110 days, the maximum number of leaves was counted in Jashore Local (49.66), followed by BAU-1 (39.66), Sahebi Lomba (39.66), and Kolkata (38.33), and the minimum number of leaves was observed in Madrasi (31.33) (Table 3). The longest leaf was found in BAU-2, and the shortest leaf was in Kolkata for the entire growth period. At 110 DAP, the longest leaf (31.66 cm) was recorded in BAU-2, followed by Sahebi Lomba (31.00 cm), and the shortest leaf was found in Kolkata (22.00 cm) (Table 3). Similarly, the variety Kolkata resulted in the narrowest leaf (lowest leaf breadth) in the entire growing period. At 110 DAP days, Madrasi showed the widest leaf (22.66 cm), followed by Satkhira Bagha (21.33 cm), BAU-1 (20.33 cm), Bandarban Ruma (20.33 cm), and Sahebi Lomba (20.33 cm), and Kolkata had the narrowest leaf (12.66 cm) (Table 3).

Table 3. Leaf attributes of elephant foot yam genotypes at different days after planting (DAP).

Genotype	Leaf number			Leaf length (cm)			Leaf breadth (cm)		
	70 DAP	90 DAP	110 DAP	70 DAP	90 DAP	110 DAP	70 DAP	90 DAP	110 DAP
Kolkata	33.66de	39.33bc	38.33b	20.00d	21.33e	22.00f	13.66c	11.66c	12.66d
BAU-1	42.66ab	39.66bc	39.66b	29.66a	30.33ab	30.00ab	21.66ab	20.66ab	20.33abc
Satkhira Bagha	35.00cde	37.00cd	38.00b	25.33bc	27.00bcd	27.66bcd	19.66ab	21.00ab	21.33ab
Jashore Local	44.66a	47.00a	49.66a	23.66cd	26.00cd	26.00cde	19.33ab	21.00ab	19.66bc
Chuadanga	35.00cde	37.33cd	38.33b	24.00cd	24.66dc	23.00ef	18.33b	18.66b	18.00c
Madrasi	29.33e	31.00e	31.33d	29.00ab	31.00a	30.33ab	21.66 ab	22.00a	22.66a
Bandarban Ruma	32.00de	33.66de	32.33cd	30.33a	28.33abc	28.66abc	19.00b	19.33ab	20.33abc
Satkhira Local	38.00bcd	38.66bc	37.33bc	24.33c	24.00dc	24.66def	18.66b	18.66b	19.00bc
Sahebi Lomba	40.33abc	44.33ab	39.66b	29.33ab	30.33ab	31.00ab	19.00b	20.33ab	20.33abc
BAU-2	41.33ab	41.33bc	38.00b	30.33a	31.33a	31.66a	23.33a	21.00ab	21.00ab
Significance	**	**	**	**	**	**	**	**	**
CV	9.49	7.34	7.83	9.37	7.19	7.76	11.79	9.23	7.02

Data represent mean of three replications. In a column, means having similar letter(s) do not differ significantly at 5% as per New Duncan Multiple Range Test. ** indicates significant at 1%. CV=Co-efficient of variation

Yield attributes of elephant foot yam

Corm attributes

Corm length, corm diameter, and corm weight per plant^{-1} varied significantly among the genotypes (Table 4). Sahebi Lomba produced the longest (22.40 cm), followed by Madrasi (21.40 cm) and Satkhira Local (18.40cm), Satkhira Bagha (14.46 cm), Chuadanga (14.40 cm), and Jessore Local (14.20 cm). The shortest corm (10.66 cm) was produced by Kolkata, preceded by BAU-1 (13.13 cm). The highest corm diameter was measured in Madrasi (24.33 cm), followed by Chuadanga (19.66 cm) and Satkhira Bagha (19.60 cm), and the lowest corm diameter was found in Kolkata (13.00 cm), preceded by Sahebi Lomba (13.33 cm). The heaviest corm per plant was harvested in Madrasi (4.01 kg), followed by Satkhira Local (2.41 kg) and Satkhira Bagha (2.40 kg). Jashore Local and Bandarban Ruma also produced medium-weight corm, each weighing 2.30 kg. The lightest corm was found in Kolkata (1.08 kg), preceded by Sahebi Lomba (1.93 kg).

Cormel attributes

Number of cormels, cormel length, cormel diameter, cormel weight plant-1, and cormel yield (t ha-1) differed statistically among the elephant foot yam genotypes (Table 4). The highest number of cormels was found in Bandarban Ruma (10.33), followed by Kolkata (5.33), and Chuadanga (4.66); the lowest number of cormels was found in BAU-2 (3.33) (Table 4). The longest cormel was found in Bandarban Ruma and Kolkata, each having 5.40 cm, followed by Satkhira Bagha (5.06 cm), and the shortest cormel was Madrasi (4.13cm) (Table 4).

The maximum cormel diameter was 3.33 cm, reported in each of Kolkata, Bandarban Ruma, and Satkhira Local, and the minimum cormel diameter was found in Sahebi Lomba (2.66 cm) (Table 4). The highest weight of cormels per plant was found in Bandarban Ruma (0.26 kg), followed by Jashore Local (0.18 kg), Chuadanga (0.18 kg), and Kolkata (0.15 kg), and the lowest was in Madrasi (0.10 kg) (Table 4). The highest yield of cormel was found in Bandarban Ruma (2.66 t ha-1), followed by Jashore Local (1.87 t ha-1) and Chuadanga (1.85 t ha-1), and the lowest cormel yield was in Madrasi (1.04 t ha-1) (Table 4).

Table 4. Corm and cormel attributes of elephant foot yam genotypes.

Genotype	Corm length (cm)	Corm diameter (cm)	Corm weight (kg) plant^{-1}	Cormel (no.) plant^{-1}	Cormel length (cm)	Cormel diameter (cm)	Cormel weight (kg) plant^{-1}	Cormel yield (t ha^{-1})
Kolkata	10.66d	13.00c	1.08d	5.33b	5.40a	3.33a	0.15bc	1.58bc
BAU-1	13.13c	18.16bc	2.23bc	3.66cd	4.40bc	2.86bc	0.13cd	1.39cd
Satkhira Bagha	14.46c	19.60b	2.40b	3.33d	5.06ab	3.26ab	0.13cd	1.35cd
Jashore Local	14.20c	19.40b	2.30b	4.33bcd	4.66abc	3.06abc	0.18b	1.87b
Chuadanga	14.40c	19.66b	2.18bc	4.66bc	4.86abc	2.93abc	0.18b	1.85b
Madrasi	21.40a	24.33a	4.01a	3.33d	4.13c	3.06abc	0.10e	1.04e
Bandarban Ruma	13.93c	16.80cd	2.30b	10.33a	5.40a	3.33a	0.26a	2.66a
Satkhira Local	18.40b	15.26d	2.41b	4.00cd	5.00ab	3.33a	0.14c	1.49c
Sahebi Lomba	22.40a	13.33c	1.93c	3.66cd	4.73abc	2.66c	0.11de	1.11de
BAU-2	13.60d	17.66c	2.39b	3.33d	4.46bc	3.20ab	0.13cde	1.32cde
Significance	**	**	**	**	*	*	**	**
CV	5.85	5.69	8.43	13.45	8.99	7.58	11.03	11.03

Data represent mean of three replications. In a column, means having similar letter(s) do not differ significantly at 5% as per New Duncan Multiple Range Test. * and ** indicate significant at 5% and 1%, respectively. CV=Co-

Yield of corms

The yield of corms was different among the genotypes (Fig. 1). The maximum yield was harvested in Madrasi (40.13 t ha^{-1}), followed by Satkhira Local (24.13 t ha^{-1}) and Satkhira Bagha (24.00 t ha^{-1}), and the minimum yield was reported in Kolkata (10.83 t ha^{-1}).

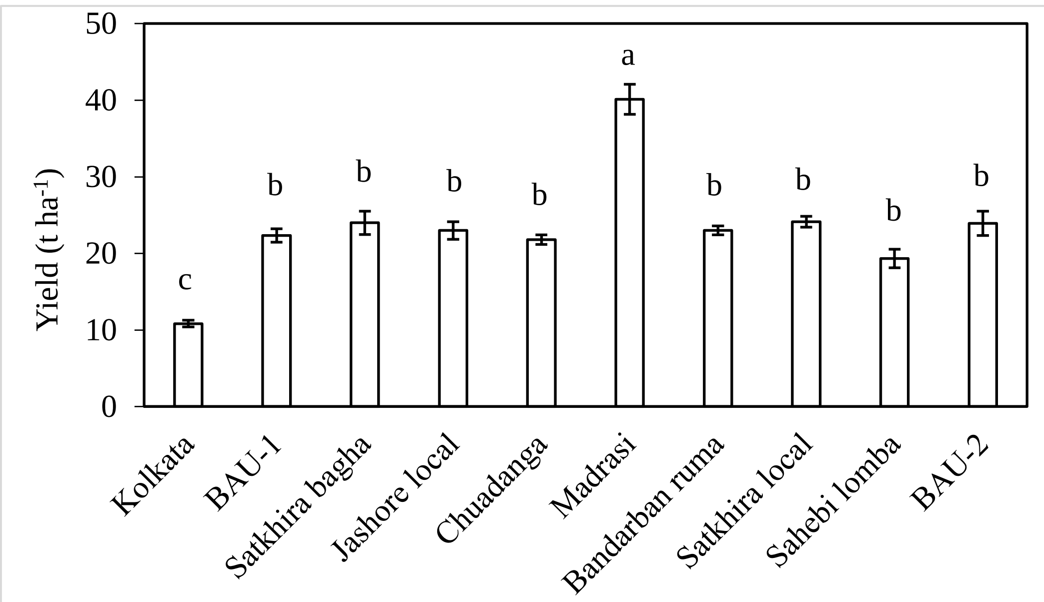

Fig. 1. Corm yield of elephant foot yam genotypes. The error bar represents mean ± standard error (SE) of three replications. Different letter(s) on a bar represent statistically significant difference at 5% level of probability according to Tukey's HSD Test.

Discussion

Growth attributes of Elephant foot yam

Growth attributes of elephant foot yam vary among the varieties. The time of sprouting differed among the genotypes due to genetic background and environmental factors (Santosa et al., 2006). If whole corms, bud portions, or upper half sections were planted, buds sprouted 2-3 weeks after planting. However, buds started to sprout 4-7 weeks after planting when vertically divided half, one-fourth, or one-eighth of corms, and the lower half sections of the whole corms were planted. The number of sprouts per corm varied due to apical dominance and the interplay of auxin and GA (Das et al., 1997; Dutta et al., 2003). However, the absence of variations in the number of sprouts in the present study may be due to genetic makeup and environmental factors, or interactions between genotype and environment. Plant height also varied among the genotypes due to characteristics of planting materials, genotypic variations, and environment. The large corm produced the tallest plant, and the small corm produced the shortest plant (Hajong, 2022; Hossain et al., 2014). The highest plant height (84.6 cm) was obtained from a 1 kg piece of cut-corm (Mukherjee et al., 2020). Reserved food material in larger corms might have resulted in taller and vigorous plants (Dalion et al., 1988). Plant height also depends on the genetic constitution, growing environment, and crop management practices (Hossain et al., 2014; Moni et al., 2024). Closer spacing increased plant height than wider spacing due to competition for light and space (Nedunchezhiyan et al., 2008).

Leaf number and leaflet number varied due to genetic variations (Santosa et al., 2006; Pan et al., 2022). Moreover, uniformity in soil moisture and nitrogen supply and interactions may influence leaf number. However, leaf number also varied due to corm size, corm age (DAP et al., 1997), and weed competition (Santosa et al., 2006). Closer planting resulted in longer leaves with narrow width (Ravi et al., 2011). Planting large corms at wider spacing provides more space for growing a robust root system and spreading their leaves, leading to faster growth and higher nutrient uptake, which increases the leaves' diameter (Naik et al., 2013).

Yield attributes of elephant foot yam

Yield parameters particularly corm attributes (length, diameter, weight, and size) varied among the genotypes. Corm length varied due to genotypes, nutrition, and environments (Hossain et al., 2014; Ravi et al., 2011). The diameter of the corm varied due to the size of the planting material (Hossain et al., 2014). A large seed corm resulted in vigorous plants, leading to the production of corms with maximum diameter by supplying more photosynthates to the growing corms (Laxminarayana, 2021). Wider spacing promotes adequate airflow and light penetration, which can enhance plant resilience against pests and diseases, contributing to larger corm sizes (Hathan, 2016).

The corm weight varied between 1.05 and 2.26 kg among six elephant foot yam genotypes (Singh et al., 2016). The larger-sized planting material and wider spacing resulted in the highest average corm weight by ensuring better plant growth and nutrient uptake (Kumar et al., 2023; Sahoo et al., 2015). The number of cormels ranges from 5 to 15, depending on the plant's health and the growing conditions. Optimized care, including good soil management and proper spacing, can increase the number of cormels (Sankaran et al., 2011). Larger corms provide more nutrients for emerging cormels, and wider spacing results in larger cormels by ensuring more nutrients and vigorous growth (Nedunchezhiyan et al., 2008; Singh et al., 2016). Wider spacing produces bigger corms, allowing each plant to acquire more nutrients by minimizing competition (Meena et al., 2017). Larger seed corms and wider spacing resulted in the highest cormel production (Dutta et al., 2003; Sankaran et al., 2011). Sizes of seed corms, genotypes, environments, and interactions affected the cormel yield of elephant foot yam.

Corm Yield

The yields of elephant foot yam genotypes varied between 19.23 t ha^{-1} and 25.92 t ha^{-1} (Nath et al., 2007) and 20.14 t ha^{-1} and 31.44 t ha^{-1} (Salam et al., 2016), suggesting yield differences due to genotypes and growing environment as well as the interactions between genotypes and environment. Corm diameter is linked with elephant foot yam yield (Pan et al., 2022), and large seed corms and wide spacing resulted in higher corm yields (Singh et al., 2016).

Conclusion

Among the ten elephant foot yam genotypes, Madrasi was the tallest (158.33 cm) one with the broadest leaf (22.66 cm) and the highest corm diameter (24.33 cm). The genotype Madrasi yielded 40.13 t ha^{-1}, whereas among the ten genotypes, the second highest yield was only 24.13 t ha^{-1} (Satkhira Local), i.e., the yield of Madrasi is at least 40% higher than any of the genotypes. Therefore, the Madrasi can be selected for cultivation in the Khulna region.

Conflicts of Interest

The authors declare no conflicts of interest.

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Appendix 1. Details of fertilizer application for growing elephant foot yam genotypes

Fertilizers/ Manures	Application rate	Time of application
Cow dung	5 t ha^{-1}	During land preparation
Urea	200 kg ha^{-1}	During the final land preparation
Triple super phosphate	150 kg ha^{-1}	During the final land preparation
Muriate of potash	200 kg ha^{-1}	During the final land preparation
Gypsum	70kg ha^{-1}	During the final land preparation
Boron	10 kg ha^{-1}	During the final land preparation