EVALUATION OF ELEPHANT FOOT YAM GENOTYPES BASED ON GROWTH AND YIELD

A THESIS

BY

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STUDENT ID- MS 230810

MASTER OF SCIENCE

IN

HORTICULTURE

AGROTECHNOLOGY DISCIPLINE
LIFE SCIENCE SCHOOL
KHULNA UNIVERSITY
KHULNA-9208
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DECEMBER,2024

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A thesis submitted to the Agrotechnology Discipline of Khulna University in partial fulfillment of the requirements for the degree of Master of Science in Horticulture

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AGROTECHNOLOGY DISCIPLINE
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KHULNA UNIVERSITY
KHULNA, BANGLADESH

DECEMBER, 2024

Dedicated

To

My Beloved

Family

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The Author
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TABLE OF CONTENTS

ABSTRACT

A field experiments was conducted at a field in Kharnia, Dumuria upazilla of Khulna district during March 2024 to September 2024 to evaluate elephant foot yam genotypes on the basis of their growth and yield characteristics. The experiment was conducted on ten elephant foot yam varieties viz. Kolkata, BAU-1, Satkhira Bagha, Jashore Local, Chuadanga, Madrasi, Bandarban Ruma, Satkhira Local, Sahebi Lomba, BAU-2 in a Randomized Block Design with three replication. Data were recorded on different growth parameters and yield. The growth and yield components varied significantly among the varieties except number of plants per plot. Results revealed that less time was required for sprouting (23.00 day) in Bandarban Ruma. The highest number of sprouting (16.00) was found in BAU-2. The highest plant height (158.33 cm) was recorded in Madrasi. The maximum number of leaf was recorded (49.66) in Jashore Local. The highest leaf length and leaf breadth was recorded in BAU-2 (31.66 cm) and Madrasi (22.66 cm) respectively. The maximum corm length was observed in Sahebi Lomba (22.40 cm) and corm breadth in Madrasi (24.33 cm). The highest corm yield was recorded from Madrasi (40.13 ton/ha). The maximum number of cormels were found in Bandarban Ruma (10.33) and cormel yield was also found the highest in Bandarban Ruma (2.66 ton/ha). It could be concluded that Madrasi produced highest yield. Therefore Madrasi may be selected for commercial cultivation in Khulna region.

LIST OF TABLES

The corm has high carbohydrate content (about 18%) and is rich in vitamin A, minerals and protein. It is used as a medicine in Ayurveda for ailments such as piles, jaundice, diabetes and dyspepsia. The production potential of this crop is very much dependent on good management practices. Corm size is the important factor affecting the yield (Ashokan et al., 1984). Many indigenous medicines for piles , asthma, dysentery and other abdominal disorders are made using its tubers (Nedunchezhiyan et al., 2008).

Edible aroids have not realized their full potential because of palatability problems associated with antinutritional factors like oxalate, trypsin inhibitors, and acridity. The acridity is believed to be due to a combination of calcium oxalate crystals (Bradbury et al., 1988); and a chemical irritant, as yet undetermined but believed to be either a diglucoside of 3,4-dihydroxy benzaldehyde (Suja et al., 2012), an unidentified proteinase (Bradbury et al., 1990), or a hormone or sapotoxin (Chattopadhyay and Nath, 2007). Intake of oxalate-containing foods is known to produce chronic effects, including deposition of calcium oxalate crystals in the kidneys (Connor, 1977), occurrence of renal stones (Chakraborty et al., 2015), and reduction in bioavailability of calcium (Chattopadhyay and Nath, 2007). Humans excrete crystals of calcium oxalate in the urine. Most urinary oxalate is thought to be derived from ascorbic acid and glycine and only a relatively small fraction from dietary oxalate (Chowdhury and Hossain, 1979).

Increases in urinary oxalate, calcium, uric acid, and cystine increase risk of stones; ingestion of large amounts of oxalate or calcium may exacerbate stone formation. People who are traditionally dependent on consumption of starch-rich foods may be unaware of the nutritive value of new high yielding varieties of elephant foot yam. Consumers of elephant foot yam often select varieties having the best flavor, texture, and color rather than those having a better nutrient profile (Das et al., 1997).

It has become crucial to diversify the current agriculture in order to fulfil the different human requirement due to the strain of an ever-increasing population and the rapid depletion of natural resources (Suja et al., 2012). The crop has a large potential for export because it is not widely cultivated commercially in many countries (Misra et al., 2016).

It offers an excellent scope for adoption in subtropical and tropical regions of India and the world as a cash crop. It is known for its high production potential, popularity as a vegetable and good keeping quality, culinary properties, medicinal utility, and therapeutic values (Chattopadhyay and Nath., 2007). This tuber crop is valued as a part of daily food in many Asian countries. Crop is known as "King of tuber crops" due to high mean profit (Suja et al., 2012).

Elephant foot yam is a herbaceous plant that 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. Crop 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, so does best at temperature of 25–30°C, 80–90 % humidity and evenly distributed 1000–1500 mm of yearly rainfall (Nedunchezhiyan et al., 2002). The crop requires well-drained and well-aerated sandy loam or sandy clay loam soils having near neutral soil reaction and ample of organic matter (Ravi et al., 2011).

Research gap

Elephant foot yam might be a potential economic crop in South Asia, including Bangladesh. Many other researches on elephant foot yam considering the nutritional and functional properties are also be found from different parts of the world. However, no study on elephant foot yam, considering its growth and yield and has yet been studied on locally available elephant foot yam accessions (genotypes) in Bangladesh. Now, it is time to identify the suitable elephant foot yam genotypes that could meet the required vegetables in the south-western region of Bangladesh, by using the following objectives.

Objectives of the Proposed Research

The objectives of the study was

- To determine the growth and yield of elephant foot yam genotypes.

CHAPTER II

REVIEW OF LITERATURE

2.1 Introduction

Elephant foot yams, or Amorphophallus paeoniifolius, are tropical tubers that are well-known for their therapeutic and nutritional qualities. Elephant foot yam is a staple in many societies' diets because it is a great source of vitamins, minerals, and dietary fiber. According to recent research, that examined its pharmacological characteristics, which include hypoglycemic, antioxidant, and anti-inflammatory activities (Mukherjee et al., 2020).

The total production of elephant foot yam was about 16203 metric tons (MTs) produced from 2199 acres of land and the average yield of elephant foot yam was (35-45 tha^{-1}) in the year 2019-2020 which is lower compare to India (50-80 t ha^{-1}) (BBS, 2021).

The research of Elephant foot yam has been summarized in this review of the literature, with an emphasis on the growth and nutritional value of it. This review aims to enhance our understanding of this amazing plant and its many health and agricultural benefits by offering a thorough overview, pointing out information gaps, and suggesting future research directions.

2.2 Elephant Foot Yam Genotypes through Growth and Yield Attributes in the Southwestern Region of Bangladesh

Elephant Foot Yam (EFY) holds significant agricultural importance in Bangladesh, particularly in the southwestern region. This study aimed to assess the growth and yield attributes of different EFY genotypes in this region (Beevy et al., 2011). Parameters including plant height, leaf count, tuber weight, and yield per plant were measured and analyzed. The study revealed notable variations in growth and yield among the genotypes, providing valuable insights for EFY cultivation in the southwestern region (Ashish Narayan et al., 2019).

Zala et al. (2021) found that the association of various characters with corm yield in 21 germplasm of elephant foot yam. Correlation between different quantitative characters provides a thought of association that would be effectively exploited to formulate selection strategies for improving yield components.

Utomo and Ginting (2021) reported that the breeding for release new varieties with specific characters needs a various of genetic materials, particularly from germplasm collection. The physical observations showed that the colour of the flesh varied from yellow to orange with the lightness values (L*) ranging from 70.53 to 81.63.

Kandekar et al., (2021) isolate the starch from elephant foot yam (Amorphophallus paeonifolius) and investigate its potential as a disintegrant in tablet formulation as compare to standard corn starch.

2.3 Growth Parameters of Elephant Foot Yam

The growth parameters for elephant food yam can vary depending on factors such as the specific variety of yam, climate, soil type, and local growing conditions.

Elephant food yams thrive in warm and humid climates. They require temperatures between 20°C to 30°C (68°F to 86°F) for optimal growth. Yams are sensitive to frost and cannot tolerate temperatures below 10°C (50°F) (Raji Pushpalathai et al., 2023). Yam plants require plenty of sunlight for photosynthesis. They typically need full sun exposure for at least 6 to 8 hours a day (Faridah et al., 2017). Well-drained, fertile soils with a pH level between 5.5 and 7.0 are ideal for yam cultivation. Sandy loam or loamy soils with good organic matter content are preferred. Heavy clay soils should be avoided as they can hinder tuber development (V. Ravi et al., 2009). Adequate water is essential for yam growth, especially during the tuber formation stage. Yams should be watered regularly to keep the soil consistently moist but not waterlogged. Irrigation may be necessary during dry periods (Sunitha et al., 2020).

Plant yam sets (tubers used for planting) or vine cuttings at appropriate spacing to allow for proper development and tuber expansion. Spacing can vary depending on the variety but is typically between 1 meter between rows and 1 meter between plants within the row (Ravi et al., 2011). Yams benefit from regular fertilization to support vigorous growth. Apply organic compost or well-decomposed manure before planting and supplement with balanced fertilizer during the growing season as needed (Sahoo et al., 2015).

Keep the yam field free from weeds, especially during the early stages of growth when yam vines are establishing. Weeds compete with yam plants for nutrients, water, and sunlight, which can negatively impact yield (Kumar et al., 2023). Some yam varieties may require support structures such as trellises or stakes to prevent the vines from sprawling on the ground. This helps improve air circulation around the plants and reduces the risk of disease (Utomo and Ginting., 2021). Monitor yam plants regularly for signs of pests such as yam beetles, nematodes, and diseases like yam anthracnose or yam mosaic virus. Implement appropriate pest and disease management strategies to minimize damage and losses (Jayaprakas and Harsh, 2022).

2.4 Yield Parameters

The yield parameters of elephant food yams can vary based on various factors including the variety of yam, growing conditions, cultivation practices, and management techniques (Nedunchezhiyan et al., 2008). Elephant food yams typically produce large tubers compared to other yam varieties. The yield is often measured in terms of the average size and weight of harvested tubers (Jaganathan et al., 2021). The number of tubers harvested per plant is another important yield parameter. Some varieties of elephant food yams may produce multiple tubers per plant, contributing to higher overall yields (Singh et al., 2016). Besides size and quantity, the quality of the harvested tubers is also a significant factor. High-quality yams should have uniform shape, good texture, and desirable taste (Hathan, 2016).

The overall yield of elephant food yams is often measured in terms of weight per unit area, such as kilograms per hectare (kg/ha) or pounds per acre (lb/acre). This metric provides a standard measure of productivity and allows for comparison between different cultivation methods and growing regions (Kolambe et al., 2013). Harvest efficiency refers to the proportion of yams that are successfully harvested relative to the total number of plants cultivated (Dasgupta, 2013) .Efficient harvesting practices can help maximize yield by minimizing losses due to damage or spoilage during harvesting (Rahman and Hajong, 2022).

Consistency in yield from season to season is important for sustainable yam production. Factors such as weather variability, pest and disease pressure, and soil conditions can influence yield stability (Suja et al., 2012). Elephant food yams should have good storage potential to prolong shelf life and maintain quality after harvest. Proper curing and storage conditions can help minimize post-harvest losses and ensure a steady supply of yams throughout the year (Sangeeta and Hathan, 2017). Ultimately, the economic yield of elephant food yams is a critical parameter, taking into account factors such as market prices, production costs, and profitability. Maximizing economic yield often involves optimizing production practices to achieve the best balance between input costs and output value (Biswanath et al., 2016).

By optimizing these yield parameters through appropriate cultivation practices, pest and disease management, and post-harvest handling techniques, farmers can maximize the productivity and profitability of elephant food yam cultivation.

2.5 Quality parameters

The quality parameters of elephant food yams are important considerations for both producers and consumers (Paramita et al., 2017). Elephant food yams should have a firm yet tender texture when cooked. They should not be overly fibrous or mushy, but rather maintain a pleasant consistency that is easy to chew and digest (Sreerag et al., 2014). High-quality elephant food yams typically have a sweet and nutty flavor with subtle earthy notes. The flavor should be rich and satisfying, without any bitter or off-tastes (Ray, 2015). Elephant food yams should have a uniform shape and smooth skin. They should be free from bruises, cuts, or other physical defects. The color of the flesh should be consistent and vibrant, indicating freshness (Suriya et al., 2019).

Quality elephant food yams are rich in essential nutrients such as carbohydrates, dietary fiber, vitamins (such as vitamin C and B-complex vitamins), and minerals (such as potassium and manganese). They should provide valuable nutritional benefits to consumers (Sini, 2002). High-quality elephant food yams should have good storage stability, maintaining their freshness and flavor for an extended period under proper storage conditions. They should resist sprouting, rotting, or other forms of deterioration (Nagar et al., 2020).

2.6 Nutrition Value of Elephant Foot Yam

Elephant food yam, like other varieties of yams, is valued for its rich nutritional profile. It is a significant source of carbohydrates, providing sustained energy for the body. Additionally, yams are high in dietary fiber, which supports digestive health by promoting regular bowel movements and aiding in the prevention of constipation. Yams also contain various vitamins and minerals essential for overall health and well-being. For instance, they are a good source of vitamin C, which boosts the immune system and promotes collagen production for healthy skin and tissues (Sajiwanie, 2016).

Yams also contain B-complex vitamins, including folate, which is crucial for fetal development during pregnancy. In terms of minerals, yams are particularly rich in potassium, which helps regulate blood pressure and fluid balance in the body (Srivastava et al., 2022). They also contain manganese, which plays a role in bone health, metabolism, and antioxidant defense.Yams are low in fat and cholesterol-free, making them a healthy choice for those watching their fat intake or managing cholesterol levels. They are also naturally gluten-free, making them suitable for individuals with gluten sensitivities or celiac disease (Bhutkar et al., 2015).

2.7 Crop Improvement of Elephant Foot Yam

Crop improvement efforts for elephant food yam focus on enhancing yield, quality, disease resistance, and adaptability to varying environmental conditions (Misra et al., 2016). This involves both traditional breeding techniques and modern biotechnological approaches. Plant breeders work to develop yam varieties with higher yields and improved quality traits such as tuber size, shape, and taste. These efforts aim to increase productivity and meet the demands of consumers for premium-quality yams (R. S. PAN, 2022). Yams are susceptible to various diseases and pests that can reduce yield and quality. Crop improvement programs aim to breed yam varieties with enhanced resistance or tolerance to common diseases such as yam anthracnose, yam mosaic virus, and nematodes (Sankranti, 2020).

Yams are cultivated in diverse agroecological zones, ranging from tropical rainforests to semi-arid regions. Crop improvement efforts seek to develop yam varieties that can thrive in different environmental conditions, including variations in temperature, rainfall, and soil types (Faridah et al., 2017). Advances in biotechnology offer opportunities to accelerate crop improvement efforts. Techniques such as molecular marker-assisted selection (MAS), genetic engineering, and tissue culture can be utilized to expedite the breeding process and introduce desirable traits into yam varieties more efficiently (Behera et al., 2020).

It is revealed from the above discussions that little works so far have been done in respect of growth and yield of elephant foot yam in Khulna region of Bangladesh. So, the present study has been undertaken.

CHAPTER III

MATERIALS AND METHODS

This chapter includes all the required information about the materials and methods that were used in conducting the experiment during the period from March 2024 to September 2024 with the following headings and subheading.

3.1 Study area

The study was carried out at a leased land at Kharnia union,Dumuria, Khulna, Bangladesh. The area is located in the Agroecological Zone (AEZ 13). The site is located at 22°49' North latitudes and 89°21' East longitudes at an altitude of one meter above the sea level (geoview.info).

3.2 Soil

The area belongs to the Ganges flood plain (AEZ-13), soil is clay loam in texture having low organic matter (1.12%) moderately slow permeability and deficient in nitrogen, potassium and sulphur in comparison with the standard nutrient status. The soil is somewhat saline in nature having pH between 6.5 to 8.5.

3.3 Experimental design

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications.

3.4 Plant material used

In this study a total of 10 varieties of elephant foot yam are cultivated in different parts of Bangladesh were evaluated. The experimental material was collected from the farmers of different district of Bangladesh.

3.5. Treatments

The following ten elephant foot yam varieties were taken as treatment in the field to assess their respective performance

1. T_1: Kolkata
2. T_2: BAU-1
3. T_3: Satkhira Bagha
4. T_4: Jashore Local
5. T_5: Chuadanga
6. T_6: Madrasi
7. T_7: Bandarban Ruma
8. T_8: Satkhira Local
9. T_9: Sahebi Lomba
10. T_{10}: BAU-2

Replication: 3

Total plot = 10×3 = 30

3.6 Land preparation

A piece of medium highland was selected at Kharnia, Dumuria, Khulna. The soil of the plots was prepared 15 days before sowing by ploughing with power tiller followed by laddering. Plant parts, inert materials, visible insect pests were eliminated from the soil and cow dung was incorporated to the soil. The field was then divided into three blocks and ten unit plots in each block.

3.7 Layout of field experiment

Thirty plots of 10 varieties with 3 replications were used to carry out the experiment. Each plot was 4 meter in length and 4 meter in width. All the treatments were allocated completely at random to the blocks. Healthy corms weighing 300-400 gm was used and spaced at 1 m apart between row and 1 m between plants. .The field length was 51 meter and width was 16 meter. The replication to replication distance was 1 meter and plot to plot distance was 1 meter.

3.8 Fertilizers application

Fertilizer application were applied in a rate of Dry Cow dung 5 tonha^{-1}, TSP 150 kg ha^{-1}, MoP 200 kg ha^{-1}, Gypsum70 kg ha^{-1} and Boron 10 kg ha^{-1}. Total of the fertilizer were applied during the final land preparation.

Table 1. Name of fertilizers, amount and timing of application

Fertilizers/ Manures	Application rate	Time of application
Cow dung	5 ton ha^{-1}	During land preparation
Urea	200 kg ha^{-1}	During the final land preparation
TSP	150 kg ha^{-1}	During the final land preparation
MoP	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

3.9 Seed Treatment

Seed was treated by diping Autostin 3g/L and Nitro 505 EC (Chlorpyrifos+Cypermethrin) 2ml/L.

3.10 Intercultural operations

The following intercultural operations were done for better growth and development of the plants during the periods of experiment.

3.10.1 Weeding and mulching

Weeding and mulching were done as and when necessary to keep the plants free from weeds, for better soil aeration and to break the crust. It also preserved the soil moisture. Mulching is very important the next day of planting to germination of the elephant foot yam.

3.10.2 Irrigation

Irrigation was given just after one week of sowing for better germination by flood irrigation method. Irrigation was done at 25 days interval till the rain starts.

3.10.3 Harvesting

Harvesting was done carefully at 180 days after planting with the help of a spade. It was done carefully so that no injury could happen.

3.10.4 Sorting

Injured and rotten corms were sort out carefully, to keep the other healthy corms free from infestation. The healthy corms then divided and gathered according to their variety. Then the cormels were separated and the roots were cleaned.

3.11 Data Collection

From the experiment, data were collected on the basis of plant growth parameters, yield and yield contributing characters. Following observations were recorded during the experimental period.

3.11.1 Time required for completion of sprouting

The time between first and last date of sprouting was recorded for each variety.

3.11.2 Number of sprouting per plot

Total number of sprouts per plot was recorded everyday from day to emergence up to completion. And after completion of emergence the total sprout per plot was counted as final.

3.11.3 Number of plants per plot

Number of plants per plot was recorded at 20 days interval manually up to maturity.

3.11.4 Plant height

Plant height was taken from randomly selected 5 plants from each plot and measured from the soil surface to the top-most growing point of plants at physiological maturity time and the mean value was noted in centimeter (cm).

3.11.5 Number of leaves plant^{-1}

To count the number of leaves plant^{-1}, 5 plants of each plot were selected randomly from each replication and their leaves were counted and then averaged up to 100 days after emergence at 20 days interval.

3.11.6 Length of leaf

Length of leaf was measured from the base of the petiole to the tip of the leaf with a scale and was recorded in centimeter at 50,70,90 and 110 days after emergence.

3.11.7 Breadth of Leaf

Breadth of the leaf was measured at the widest part of the leaf by a meter scale and was expressed in centimeter at 50, 70, 90 and 110 day after emergence.

3.11.8 Length of corm

For the measurement of corm size of each replication, five corms were selected from each of the plot and their corm size were measured with the help of measuring scale in centimeter from top to bottom of the corm. Then the average value was recorded.

3.11.9 Breadth of corm

To measure the breadth of corm for each replication, five corm from each of the plot were selected and their breadth was measured with measuring scale in centimeter (cm) at the middle portion of the corm. Then the average value was recorded after 180 days.

3.11.10 Weight of corm plant^{-1}(kg)

From the selected plants corm weight was measured and then the average value was recorded.

3.11.11 Yield of corm(t/ha)

Corm yield was turned into ton/ha of land from the weight value of corm per plant (kg).

3.11.12 Number of cormels plant^{-1}

The number of cormels from each of the selected plants were counted . Then the average value was recorded.

3.11.13 Length of cormels

Cormels length were measured by using slide calipars in centimeters from top to bottom. Then the average value was recorded.

3.11.14 Breadth of cormels

Cormels breadths were measured by using slide calipers from at the middle in centimeters. Then average value was recorded.

3.11.15 Weight of the cormels plant^{-1}(kg)

From the selected plants cormels weight were taken and average value was recorded.

3.11.16 Yield of cormel (ton/ha)

Cormel yield were turned into ton/ha of land from the weight value of cormels per plant(kg).

3.12 Data analysis

The data of growth, yield and yield contributing characters were statistically analyzed for ANOVA to find out the significance of the experimental results. Collected data on various parameters under study were statistically analyzed using Statistix-10 software. Significance of differences among treatment means were evaluated by Duncan's New Multiple Range test (DMRT) (Gomez and Gomez, 1984).

CHAPTER IV

RESULTS AND DISCUSSION

This chapter includes the presentation and discussion of the performances of ten elephant foot yam varieties in accordance with their growth and yield characteristics. The results are presented in tables and the discussion has been made under the following headings and sub-headings.

4.1 Growth attributes of Elephant foot yam varieties

4.1.1 Days to first sprouting

The variation of time of first sprouting was statistically significant. Kolkata (26.33 days), Satkhira Bagha (26.33 days) and Jashore Local (26.33 days) were required longest time for 1st sprouting. On the other hand Bandarban Ruma (23.00 days) was taken shortest time for 1st sprouting preceded by Madrasi (24.33 days) and BAU-2 (24.66 days) (Table 2).

The result of the present study was in agreement with those of Santosa et al. (2006). They found that the time of sprouting of elephant foot yam varied between different varieties and responsible genetic background of the varieties and some environmental factors. When 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 vertical 1/2, 1/4 and 1/8 corm sections and lower half sections were planted.

4.1.2 Days to complete sprouting

It was observed that the variation at the days to complete sprouting was statistically significant. Jashore Local (37.66 days) required longest time for the completion of sprouting followed by Satkhira Local (35.33 days) and Sahebi Lomba (35.37 days). On the other hand Bandarban Ruma (32.00 days) required shortest time for the completion of sprouting preceded by Madrasi (32.33 days) (Table2).

This result was supported by the findings of Das et al. (1997), where they found varietal differences in case of number of sprouts per corm. Since the elephant foot yam takes not less than 25-30 days to complete sprouting after planting.

Dutta et al. (2003) ascribed apical dominance for variation in number of sprouts produced per corm among varieties and make responsible the effects of corm size and Auxin and GA for the difference in number of sprouts in different varieties.

4.1.3 Number of sprouts plot^{-1}

The number of sprouts per plot did not show significant difference in respect of number of sprouts per plot among of the varieties. However numerically, the cultivated plant number was 16 per plot for every varieties (Table 2).

The highest number of sprouts plot^{-1} was observed in BAU-2(16.00) followed by Jashore local (15.33). The lowest number was found in Bandarban ruma (13.33) and Kolkata (14.00). Chuadanga (14.66), Satkhira local (14.66), BAU-1 (14.33), Madrasi (14.33), Satkhira bagha (15.00), Sahebi lomba (15.00) showed statistically similar result of number of sprouting.

Table 2. Varietal effect of elephant foot yam on sprouting and number of sprouts per plot

Variety	Days to 1st sprouting	Days to sprout complete	Number of sprouts's 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
Level of significant	**	*	NS
CV	2.92	4.70	7.79

Note: In a column figure having similar letters do not differ significantly whereas figure having dissimilar letter differ significantly as per DMRT. Data are means of three replications.

In a column **= significant at $p \leq 0.01$ and *= significant at $p \leq 0.05$. NS= Non-significant and CV=Co-efficient of variation.

4.1.4 Height of plants

There was significant variation in plant height among the varieties. At the age of 30 days, the tallest plant was found Madrasi (27.66 cm), 2nd tallest was Bandarban Ruma (25 cm) and the shortest plant was found Kolkata (18.66 cm). At the age of 50 days, the tallest plant was recorded from Madrasi (103.00 cm) followed by BAU-2 (86.67 cm) and Satkhira Bagha (86.67 cm) and the shortest plant was Kolkata (57.00 cm) preceded by Sahebi Lomba (69.00 cm) and Chuadanga (71.00 cm) (Table 3).

At the age of 70 days Madrasi was observed the tallest plant (125.00 cm) and BAU-2 (107.33 cm) was the second tallest. On the other hand Kolkata (72.33 cm) gave the shortest plant preceded by Chuadanga (90.33 cm) and Satkhira Local (91.33 cm) (Table 3).

At the age of 90 days, Madrasi (145.33 cm) was the tallest plant followed by BAU-2 (128.00 cm) and the shortest plant was Kolkata (86.67 cm) preceded by Sahebi Lomba (109.00 cm) (Table 3).

At the age of 110 days, the tallest plant was found Madrasi (158.33 cm) which was 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) (Table 3).

This finding is agreed with the results of Hossain et al. (2014). This reported that the plant height depends on the genetic constitution and proper growth of the plant that is influenced by growing environment and crop management practices. Rahman and Hajong (2022) and Hossain et al. (2014) found that the planting materials of different sizes had significant effect in respect of plant height.

The tallest plant was recorded from large size corm and smallest plant was recorded from small size corm at the same time. Higher reserved food material of the larger seed corms might have resulted taller and vigorous plant at the early stages as well as later stages of growth. This finding is agreed with the result of Dalion et al. (1988).

Mukherjee et al. (2020) found plant height was maximum (84.6 cm) when 1 kg cut corm piece was used as planting material. Closer plant spacing (60 x 45 cm) increased plant height 53.8 cm. Similar results were also obtained by Ashokan et al. (1984), who observed that competition for light and space could have made the plants grow taller in closer spacing than those in wider spacing. Plants tend to grow taller under closer spacing due to etiolation under shade competition for light as reported earlier by Nedunchezhiyan et al. (2008).

Table 3. Varietal effect on plant high at different age

Variety	Plant height (cm)				
	30 DAS	50 DAS	70 DAS	90 DAS	110 DAS
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
Level of significance	*	**	**	**	**
CV	12.63	6.27	6.40	4.15	3.87

Note: In a column figure having similar letters do not differ significantly whereas figure having dissimilar letter differ significantly as per DMRT. Data are means of three replications.In a column **= significant at $p \leq 0.01$ and *= significant at $p \leq 0.05$. CV=Co-efficient of variation.

4.1.5 Number of leaves plant^{-1}

The number of leaves of elephant foot yam genotypes was statistically significant at the age of 50 days in respect of the number of leaves per plant. Out of 10 varieties the maximum number of leaves was found in Jashore Local (39.66) followed by BAU-1 (39.00) and BAU-2 (38.33) and the minimum number of leaves was observed in Kolkata (26.66) preceded by Bandarban Ruma (27.33) (Table 4).

At the age of 70 days, number of leaves plant^{-1} was statistically significant (Table 4). Maximum number of leaves was found at Jashore Local (44.66) followed by BAU-1 and the minimum number of leaves was observed in Madrasi (29.33) preceded by Bandarban Ruma (32.00) (Table 4).

After 90 days, the number of leaves were found significant (Appendix-1). The maximum number of leaves were found at Jashore Local (47.00) followed by BAU-1 (42.66) and the minimum amount of leaves was observed Madrasi (31.00) preceded by Bandarban Ruma (33.66) (Table 4).

At 110 days, the maximum number of leaves observed in Jashore Local (49.66) followed by BAU-1 (39.66) and the minimum number of leaves was observed Madrasi (31.33) preceded by Bandarban Ruma (32.33) (Table 4).

The results were in agreement with Singh and Singh (2019). They found that the number of leaflets and corm size were shown to be positively correlated, and the rise in leaflet count was most likely brought about by improved root ramification and early sprouting. The result of the present study on overall number of leaves was in agreement with the findings of Das et al. (1997). Santosa et al. (2006) found considerable variation in number of leaves among 14 genotypes normally differ genetically in their growth habit. Along with genetic similarity, it also could be due to uniformity in soil moisture and nitrogen supply, and the interaction of these factors as claimed that the number of leaves is affected by these factors.

Das et al. (1997) found that the number of leaves developing during the growing season is dependent on corm age. During a growing season upto 12 leaves may be produced successively. As such, more than 2 leaves may coexist at the same time. The number of leaves is also determined by the size of planting materials. Plants originating from small corms (10 g) produce three to eight leaves, while large corms (500 g) usually produce one or two leaves during a growing season. Under weedy conditions leaves are submerged under weeds and the number of leaves, total leaf area, leaf thickness and fresh masses of corms decreases markedly Santosa et al. (2006).

Table 4. Varietal effect on leaf number of different age

Variety	No. of leaves plant^{-1}			
	50DAS	70DAS	90DAS	110DAS
Kolkata	26.66b	33.66de	39.33bc	38.33b
BAU-1	39.00a	42.66ab	39.66bc	39.66b
Satkhira bagha	32.00ab	35.00cde	37.00cd	38.00b
Jashore local	39.66a	44.66a	47.00a	49.66a
Chuadanga	33.00ab	35.00cde	37.33cd	38.33b
Madrasi	28.33b	29.33e	31.00e	31.33d
Bandarban ruma	27.33b	32.00de	33.66de	32.33cd
Satkhira local	37.00a	38.00bcd	38.66bc	37.33bc
Sahebi lomba	33.00ab	40.33abc	44.33ab	39.66b
BAU-2	38.33a	41.33ab	41.33bc	38.00b
Level of significance	*	**	**	**
CV	14.21	9.49	7.34	7.83

Note: In a column figure having similar letters do not differ significantly whereas figure having dissimilar letter differ significantly as per DMRT. Data are means of three replications.

In a column **= significant at $p \leq 0.01$ and *= significant at $p \leq 0.05$. CV=Co-efficient of variation.

4.1.6 Length of leaves

The length of leaves at the age of 50 days was found significant (Table-5). BAU-2 (29.00cm) showed the longest and similar length of leaves. Whereas Kolkata (19.00 cm) showed shortest length of leaves preceded by Chuadanga (23.66 cm).

After 70 days the length of leaves was found significant (Table 5). Bandarban Ruma (30.33 cm) and BAU-2 (30.33 cm) gave the longest leaves followed by BAU-1 (29.66cm) and Sahebi Lomba (29.66 cm) whereas Kolkata (20.00 cm) showed the shortest leaf preceded by Jashore Local (23.66 cm).

After 90 days, the length of leaves found significant (Table 5), where BAU-2 (31.33cm) and Madrasi (31.00) showed the longest and almost similar leaf. The shortest leaf was found in Kolkata (21.33 cm) preceded by Satkhira Local (24.00 cm) and Chuadanga (24.66 cm).

At the age of 110 days, the length of leaves was found significant (Table 5). The longest leaf was found in BAU-2 (31.66 cm) followed by Sahebi Lomba (31.00 cm) and the shortest leaf was found in Kolkata (22.00 cm) preceded by Chuadanga (23.00 cm).

Similar results were found by Ravi et al. (2011) who stated that when plants are spaced closer together, due to limited space for lateral expansion the plants channel their growth energy into vertical growth, leading to longer leaf. Variety had a high significant effect on the length of leaves. These differences in the length of leaves among the varieties may also be a genetic peculiarity as well as influenced by environmental factors and the quality of the plant material. This result is in agreement with Dalion et al. (1988). Das et al. (1997) found similar result in case of the length of leaf which varied from 25.3 – 37.5 cm.

Table 5. Variation in leaf length of different elephant foot yam genotypes

Variety	Length of leaves (cm)			
	50DAS	70DAS	90DAS	110DAS
Kolkata	19.00c	20.00d	21.33e	22.00f
BAU-1	29.00a	29.66a	30.33ab	30.00ab
Satkhira bagha	24.00b	25.33bc	27.00bcd	27.66bcd
Jashore local	23.00b	23.66cd	26.00cd	26.00cde
Chuadanga	23.66b	24.00cd	24.66dc	23.00ef
Madrasi	28.33a	29.00ab	31.00a	30.33ab
Bandarban ruma	25.00b	30.33a	28.33abc	28.66abc
Satkhira local	24.33b	24.33c	24.00dc	24.66def
Sahebi lomba	25.33b	29.33ab	30.33ab	31.00ab
BAU-2	29.00a	30.33a	31.33a	31.66a
Level of significance	**	**	**	**
CV	5.21	9.37	7.19	7.76

Note: In a column figure having similar letters do not differ significantly whereas figure having dissimilar letter differ significantly as per DMRT. Data are means of three replications.

In a column **= significant at $p \leq 0.01$ and CV=Co-efficient of variation.

4.1.7 Breadth of leaves

There was significant variation in breadth among the varieties. At the age of 50 days the wildest leaf was found in BAU-2 (21.66 cm) followed by BAU-1 (20.66 cm). Whereas Chuadanga (18.66 cm), Sahebi Lomba (18.66 cm) and Satkhira Local (18.66 cm) showed similar breadth. The narrowest leaves was found in Kolkata (12.66 cm) preceded by Jashore Local (17.00 cm) (Table 6).

After 70 days the variation in leaf breadth was found significant. The wildest leaf was found in BAU-2 (23.33 cm) followed by BAU-1 (21.66 cm). Bandarban Ruma (19.00 cm) and Sahebi Lomba (19.00 cm) showed similar breadth of leaves. The narrowest leaf was found in Kolkata (13.66 cm) preceded by Chuadanga (18.33 cm) and Satkhira Local (18.66 cm) (Table 6).

At the age of 90 days the breadth of leaves among the varieties showed significant variation. Where Madrasi (22.00 cm) showed widest leaf followed by Satkhira Bagha (21.00 cm), Jashore Local (21.00 cm) and BAU-2 (21.00 cm) which is similar and narrowest leaf was found in Kolkata (11.66cm) preceded by Chuadanga (18.66 cm) and Satkhira Local (18.66 cm) (Table 6).

At the age of 110 days, there was significant variation among the varieties. Madrasi (22.66 cm) showed the wildest leaf length followed by Satkhira Bagha (21.33 cm). BAU-1 (20.33 cm), Bandarban Ruma (20.33 cm) and Sahebi Lomba (20.33 cm) showed similar leaf breadth, Kolkata (12.66 cm) showed the narrowest leaf breadth preceded by Chuadanga (18.00 cm) (Table 6).

The results are in confirmatory with the work done by earlier Hossain et al. (2014). Nedunchezhiyan et al. (2017) also observed similar result in case of width of leaf among different potato varieties which ranged between 16-22 cm. Greater leaves diameter under the widest spacing has also been recorded by Kumar and Santosh (2014). These findings are attributable to improved nutrient availability and less competition for resources among the plants, which encourages maximum pseudo stem diameter. Prathap et al. (2017) and Naik et al. (2013) reported that when large corms are planted at wider spacing, it provides individual plants more space to grow robust root system and spread their leaves. This leads to faster development and higher intake of nutrients, which increases the leaves diameter.

Table 6.Variation in leaf breadth of different elephant foot yam varieties

Variety	Breadth of leaves (cm)			
	50DAS	70DAS	90DAS	110DAS
Kolkata	12.66d	13.66c	11.66c	12.66d
BAU-1	20.66ab	21.66ab	20.66ab	20.33abc
Satkhira bagha	19.66abc	19.66ab	21.00ab	21.33ab
Jashore local	17.00c	19.33ab	21.00ab	19.66bc
Chuadanga	18.66bc	18.33b	18.66b	18.00c
Madrasi	20.00ab	21.66 ab	22.00a	22.66a
Bandarban ruma	19.00abc	19.00b	19.33ab	20.33abc
Satkhira local	18.66bc	18.66b	18.66b	19.00bc
Sahebi lomba	18.66bc	19.00b	20.33ab	20.33abc
BAU-2	21.66a	23.33a	21.00ab	21.00ab
Level of significance	**	**	**	**
CV	9.16	11.79	9.23	7.02

Note: In a column figure having similar letters do not differ significantly whereas figure having dissimilar letter differ significantly as per DMRT. Data are means of three replications.

In a column **= significant at $p \leq 0.01$ and CV=Co-efficient of variation.

4.2 Yield attributes of elephant foot yam varieties

4.2.1 Length of corms

The length of corms were found significant among the varieties. Sahebi lomba (22.40 cm) was found the longest length of corm 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) showed almost similar length of corms. Kolkata (10.66 cm) was found the shortest length of corms preceded by BAU-1 (13.13 cm).

This finding is agreed with the result of Das et al. (1997). Hossain et al. (2014) also observed overall similar result in case of length of corms among different potato varieties which ranged between 11.65 cm to 13.59 cm. Das et al. (1997) also found overall similar result. This might be because there is enough space and light for the plants to grow without any competition, allowing them to focus their energy on corm bulking. Similar results were found by Ravi et al. (2011).

4.2.2 Breadth of corms

The breadth of corms among the varieties was significantly different. Wildest corm was found in Madrasi (24.33 cm) followed by Chuadanga (19.66 cm) and Satkhira bagha (19.60 cm) almost similar, and the narrowest corm was found in Kolkata (13.00 cm) preceded at Sahebi lomba (13.33 cm).

There was a significant effect on the diameter of corm due to different sizes of planting material. Hossain et al. (2014) also observed overall similar result in case of breadth of corms among four elephant foot yam genotypes which ranged between 14.62 cm to 16.03 cm. Das et al. (1997) also found significant result. Nath et al. (2007) found the breadth of corms of elephant foot yam ranges 17.2 cm to 28.02 cm. This finding is in agreement with the result of Hossain et al. (2014). Large-sized seed corm produced the corm with maximum diameter probably due to more build-up of photosynthates in the corm Laxminarayana (2021). Hathan (2016) found that wider spacing promotes adequate airflow and light penetration which can enhance plant resilience against pests and diseases, ultimately contributing to larger corm sizes. Similar findings were reported by Singh et al. (2016), who speculated that the plant's capacity to focus their energy on corm bulking may have been facilitated by the availability of enough light and space without any competition.

4.2.3 Weight of corm plant^{-1} kg

The weight of corms among the varieties was statistically significant. The highest weight was found in Madrasi (4.01 kg) followed by Satkhira local (2.41 kg) and Satkhira bagha (2.40 kg). Jashore local (2.30 kg) and Bandarban ruma (2.30 kg) was the similar weight. The lowest weight was found in Kolkata (1.08 kg) preceded by Sahebi lomba (1.93 kg).

Singh et al. (2016) found overall similar result in case of weight of corm plant^{-1} kg among six elephant foot yam genotypes which ranged between 1.05 to 2.26 kg. Hossain et al. (2014), and Ashokan et al. (1984) found almost similar result in Amorphophallus. The effect of size of planting material in increasing the corm weight has been reported by several workers. Kumar et al. (2023) have reported that the largest sett size resulted in highest average corm weight than small sett size. Das et al. (1997) suggested that plants under wider spacing has no competition with one another for resources including light, water, and nutrients. As a consequence, each plant can produce larger corms which results in higher corm weight. Sahoo et al. (2015) found similar findings and concluded that wider spacing maximizes corm weight as it provides enough area for plant growth and resource intake.

Table 7.Varietal effect on corm length, breadth and weight of elephant foot yam genotypes

Variety	Corm length(cm)	Corm breadth(cm)	Corm weight plant^{-1} (kg)
Kolkata	10.66d	13.00c	1.08d
BAU-1	13.13c	18.16bc	2.23bc
Satkhira bagha	14.46c	19.60b	2.40b
Jashore local	14.20c	19.40b	2.30b
Chuadanga	14.40c	19.66b	2.18bc
Madrasi	21.40a	24.33a	4.01a
Bandarban ruma	13.93c	16.80cd	2.30b
Satkhira local	18.40b	15.26d	2.41b
Sahebi lomba	22.40a	13.33c	1.93c
BAU-2	13.60d	17.66c	2.39b
Level of significance	**	**	**
CV	5.85	5.69	8.43

Note: In a column figure having similar letters do not differ significantly whereas figure having dissimilar letter differ significantly as per DMRT. Data are means of three replications.

In a column **= significant at $p \leq 0.01$ and CV=Co-efficient of variation.

4.2.4 Yeild of corms (ton/ha)

The yield of corms among the varieties were different from each other (Fig 1). The maximum yield was found in Madrasi (40.13 ton) followed by Satkhira Bagha (24.13 ton). The minimum yield was found in Kolkata (10.83 ton) preceded by Sahebi Lomba (19.33 ton). Jashore Local (23.00 ton) and Bandarban Ruma (23.00 ton) showed the similar yield.

Salam et al. (2016) reported that yield differences among genotypes were attributed both by the inherent yield potential of genotypes and growing environment as well as the interaction of genotype and environment. Though the environmental condition was similar, the yield difference may be due to varietal differences. Nath et al. (2007) found significant result ranges from 19.23 ton/ha to 25.92 ton/ha in Amorphophallus. Salam et al. (2016) found overall similar yield ranges from 20.14 ton/ha to 31.44 ton/ha. Nath et al. (2007) found similar yield 19.23 to 25.92 t ha-1 in Amorphophallus.

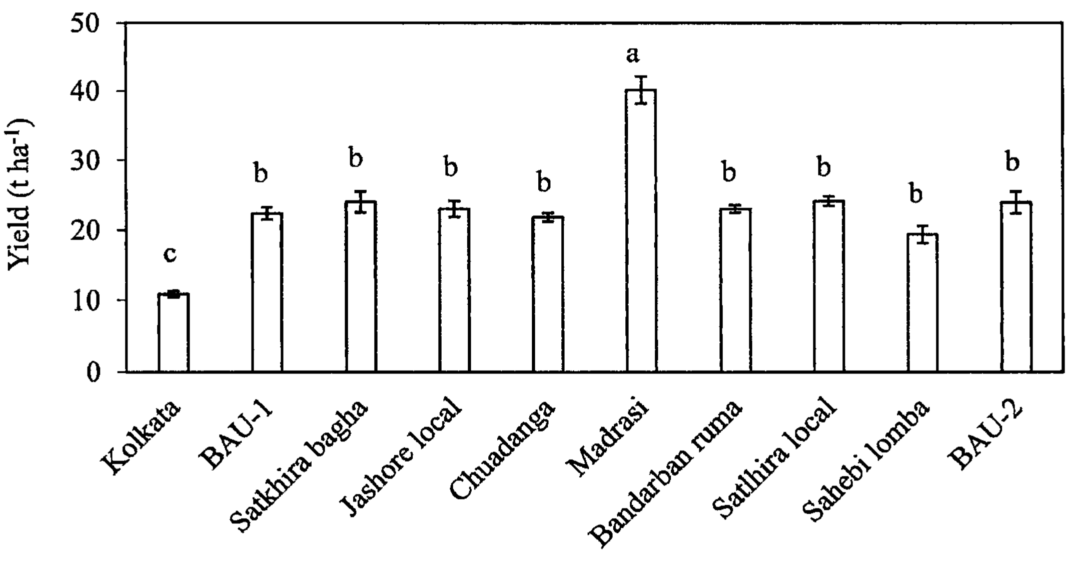

Fig. 1. Corm yield of different elephant foot yam genotypes. The error bar represents mean ± standard error (SE) of three replications. Different letter(s) on a bar represent statistically significant difference at 1% level of probability according to Tukey's HSD Test.

4.2.5 Number of cormels plant^{-1}

No of cormels per plant was showed significant difference among the varietiesThe highest number of cormels was found in Bandarban Ruma(10.33) followed by Kolkata (5.33) and the lowest number of cormels was found in BAU-2(3.33), Madrasi (3.33) and Satkhira Bagha(3.33) was similar preceded by Sahebi Lomba (3.66) and BAU-1(3.66) both are also similar (Table 8).

Sankaran et al. (2011) stated that the number of cormels per elephant foot yam plant typically 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, which aids in both yield and future propagation. Chakraborty et al. (2015) and Singh et al. (2016) also revealed that individual plants can establish more strong root systems and foliage with more space to grow, which ultimately leads to enhanced cormel output.

4.2.6 Length of cormel (cm)

The length of cormels were found statistically significant. The largest cormel was found in Bandarban Ruma(5.40 cm) and Kolkata (5.40 cm) was similar which is followed by Satkhira Bagha(5.06 cm), and shortest cormel was found in Madrasi (4.13cm) which is preceded by BAU-1(4.40 cm).

Nedunchezhiyan et al. (2008) found among the different spacings, seed corms planted at a wider spacing of 90 x 45 cm produced the maximum cormel length of 5.62 cm, while the corms planted at a closer spacing of 60 x 45 cm resulted in a minimum cormel length of 4.79 cm. Singh et al. (2016) found a direct correlation between the size of the corm and the amounts of energy and nutrients available for the development of cormels. This relationship can be attributed to the fact that larger corms provide more nutrients for emerging cormels, allowing them to grow more vigorously and reach longer lengths.

Among the different spacings, seed corms planted at a wider spacing of 90 x 45 cm produced the maximum cormel length of 5.62 cm, while the corms planted at a closer spacing of 60 x 45 cm resulted in a minimum cormel length of 4.79 cm. Prathap et al.

(2017) reported similar results, stating that plants grown under wider spacing showed higher cormel development since there was less competition for resources.

4.2.7 Breadth of cormel (cm)

Cormel breadth of elephant foot yam genotypes showed significant variation. The wildest cormel was found in Kolkata (3.33 cm), Bandarban Ruma (3.33 cm) and Satkhira Local (3.33 cm). The three showed similar breadth. Jashore Local (3.06 cm) and Madrasi (3.06 cm) showed also similar breadth. The narrowest cormel was found in Sahebi Lomba (2.66 cm) preceded by BAU-1 (2.86 cm) (Table 8).

Among different planting distances, seed corms planted at a wider spacing of 90 x 45 cm produced the maximum cormel breadth of 2.54 cm, whereas the minimum cormel length (2.26 cm) was recorded when the corms were planted at the closest spacing of 60 x 45 cm. Singh and Singh (2019) and Meena et al. (2017) observed similar results, stating that wider spacing improves cormel growth and development by allowing each plant to acquire nutrients without facing intense competition.

4.2.8 Weight of cormels plant^{-1}(gm)

The weight of cormels among the varieties was statistically significant. The highest weight of cormels per plant was found in Bandarban Ruma (266 gm) followed by Jashore Local (187 gm), BAU-1 (139 gm) and Satkhira Local (135 gm) showed almost similar weight. The lowest weight was found in Madrasi (104 gm) preceded by Sahebi lomba (111 gm) (Table 8).

Among the corm sizes, the maximum weight of cormel (8.45 g) was recorded with the largest corm size of 500 g, whereas minimum cormel weight (4.30 g) was recorded in 100 g corm size. The higher average cormel weight with larger planting material is due to the increased energy reserves available for growth and development.

Sankaran et al. (2011) and Dutta et al. (2003) also found that larger corm sizes produced higher cormel weights than smaller corms. Similar findings were reported by Singh and Singh (2019), who noted that larger corm sizes indicate plant's ability to store more nutrients and energy for the growth and development of its daughter cormels. Greater reserves in larger corms allow for the development of bigger and potentially heavier cormels.

Among different planting distances, seed corms planted at a wider spacing of 90 x 45 cm produced the highest average weight of cormel (7.01 g), whereas the corms planted at the closest spacing of 60 x 45 cm resulted in minimum average weight of cormel (4.71 g). According to Jaganathan et al. (2021), wider plant spacing promotes improved root development and easier access to the soil's available nutrients, leading to larger, heavier and a greater number of cormels due to reduced competition for resources among plants.

4.2.9 Yield of cormels(ton/ha)

The yield of cormels among the variations were different from each other and statistically significant. The highest yield of cormel was found in Bandarban Ruma (2.66 ton) followed by Jashore Local (1.87 ton). BAU-1 (1.39 ton) and Satkhira Bagha (1.35 ton) showed almost similar yield. The lowest yield was found in Madrasi (1.04 ton) preceded by Sahebi Lomba (1.11 ton).

Similar results were reported by Ashokan et al. (1984) and Singh et al. (2016) who stated that higher corm size is attributed to better crop growth as a consequence of more food reserve and higher translocation of photosynthates from source to sink, resulting in higher corm yield. The closest spacing of 60 x 45 cm recorded the maximum corm yield per plot (1.18 ton/ha), whereas the wider spacing of 90 x 45 cm resulted in the lowest corm yield per plot (1.43 ton/ha). The results are in conformity with the findings Salam et al. (2016) and Singh and Singh (2019) who reported higher corm yield with increase in plant population. Although the weights of individual corm directly influence the final yield per plant, but plant population per unit area is the major factor for determining the yield.

Table 8.Varietal effect on cormels number, length, breadth, weight and yield of elephant foot yam genotypes.

Variety	No of cormels plant^{-1}	Cormel length(cm)	Cormel breadth(cm)	Cormel weight plant^{-1} (kg)	Cormel yield (ton/ha)
Kolkata	5.33b	5.40a	3.33a	0.15bc	1.58bc
BAU-1	3.66cd	4.40bc	2.86bc	0.13cd	1.39cd
Satkhira bagha	3.33d	5.06ab	3.26ab	0.13cd	1.35cd
Jashore local	4.33bcd	4.66abc	3.06abc	0.18b	1.87b
Chuadanga	4.66bc	4.86abc	2.93abc	0.18b	1.85b
Madrasi	3.33d	4.13c	3.06abc	0.10e	1.04e
Bandarban ruma	10.33a	5.04a	3.33a	0.26a	2.66a
Satkhira local	4.00cd	5.00ab	3.33a	0.14c	1.49c
Sahebi lomba	3.66cd	4.73abc	2.66c	0.11de	1.11de
BAU-2	3.33d	4.46bc	3.20ab	0.13cde	1.32cde
Level of significance	**	*	*	**	**
CV	13.45	8.99	7.58	11.03	11.03

Note: In a column figure having similar letters do not differ significantly whereas figure having dissimilar letter differ significantly as per DMRT. Data are means of three replications.

In a column **= significant at $p \leq 0.01$ and *= significant at $p \leq 0.05$. CV=Co-efficient of variation.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATION

Summary

A field experiment was conducted to evaluate and select elephant foot yam varieties on the basis of their growth and yield performances. The experiment was carried out in a Completely Randomized Block Design (RCBD). The collected data were statistically analyzed using Statistix-10 package program and the means were evaluated by new Duncans Multiple Range Test.

During the experiment sprouting time differed significantly among the elephant foot yam varieties. Bandarban ruma required lowest time among the varieties and that was 23 days and highest time required for 1st sprouting was Kolkata 26.23 days. Bandarban Ruma was taken lowest time for completion of sprouting was 32 days. On the other hand, highest time required for the completion of sprouting was 37.66days found for Jashore Local.

The variation in number of sprouting of different elephant foot yam varieties was statistically significant. Numerically the highest number of sprouting (16) were recorded in case of BAU-2 and the lowest number of sprouting was found in Bandarban Ruma (13.33).

There was significant variation in plant height among the varieties. The highest plant height was found for Madrasi (158.33 cm) and the lowest plant height was observed in Kolkata (103.00 cm).

Elephant foot yam varieties showed significant difference in case of per plant leaf number. Maximum number of leaves was found in Jashore Local (49.66) and the minimum number of leaves was observed Madrasi (31.33).

The result revealed that the variation in leaf length of different elephant foot yam varieties was statistically significant. The longest leaf was found in BAU-2 (31.33 cm) and the shortest leaf was found Kolkata (22.00 cm).

There was significant variation in breadth of leaves among the varieties. Widest leaf was found in Madrasi (22.66 cm) and the narrowest leaf was found in Kolkata (12.66 cm).

The length of corm were found significant among the varieties. Sahebi Lomba was found the longest corm (22.40 cm) and Kolkata was found the shortest corm (10.66 cm).

The breadth of corms were also significantly different. Widest corm was found in Madrasi (24.33 cm) and narrowest corm was found in Kolkata (13.00 cm).

Corm weight per plant was statistically significant. The highest weight was 4.01 kg found in Madrasi and the lowest weight was 1.08 kg found in Kolkata.

Corm yield of different varieties was statistically significant. Maximum yield found in Madrasi (41.13 ton/ha) and the minimum yield was found in Kolkata (10.83 ton/ha).

Cormels number per plant was statistically significant. Maximum number of cormels was found in Bandarban Ruma (10.33) and the minimum number of cormels was found in BAU-2 (3.33).

The length of cormel is significant. The largest cormel was found in Bandarban Ruma (5.40 cm) and shortest cormel was found in Madrasi (4.13 cm).

Cormel breadth is statistically significant. Widest cormel was found in Kolkata (3.33 cm) and narrowest cormel was found in Sahebi Lomba (2.66 cm).

The weight of cormels per plant was statistically significant. Highest weight of cormels was found in Bandarban Ruma (266 gm) and lowest weight was found in Madrasi (0.104 gm).

Yield of cormels of different varieties of elephant foot yam is statistically significant. Maximum yield of cormels was found in Bandarban Ruma (2.66 ton/ha) and minimum yield was found in Madrasi (1.04 ton/ha).

Conclusion

After performance evaluation obtained from this study it can be conclude that, out of the 10 elephant foot yam varieties, no single variety was found to be superior in case of all quality parameters. However, Madrasi gave highest yield ascertaining maximum marketable corm yield in case of weight of corms and height of plants. In case of other attributes, Bandarban Ruma and BAU-2 also showed moderately conginal result. In considering the yield and marketable size of corm Madrasi may be selected for cultivating in Khulna region.

Recommendation

It could be recommended that further research could be conducted with other elephant foot yam varieties by considering this comparative growth and yield attributes where the present study could provide a working document for further studies to select a proper elephant foot yam variety for the region.

CHAPTER VI

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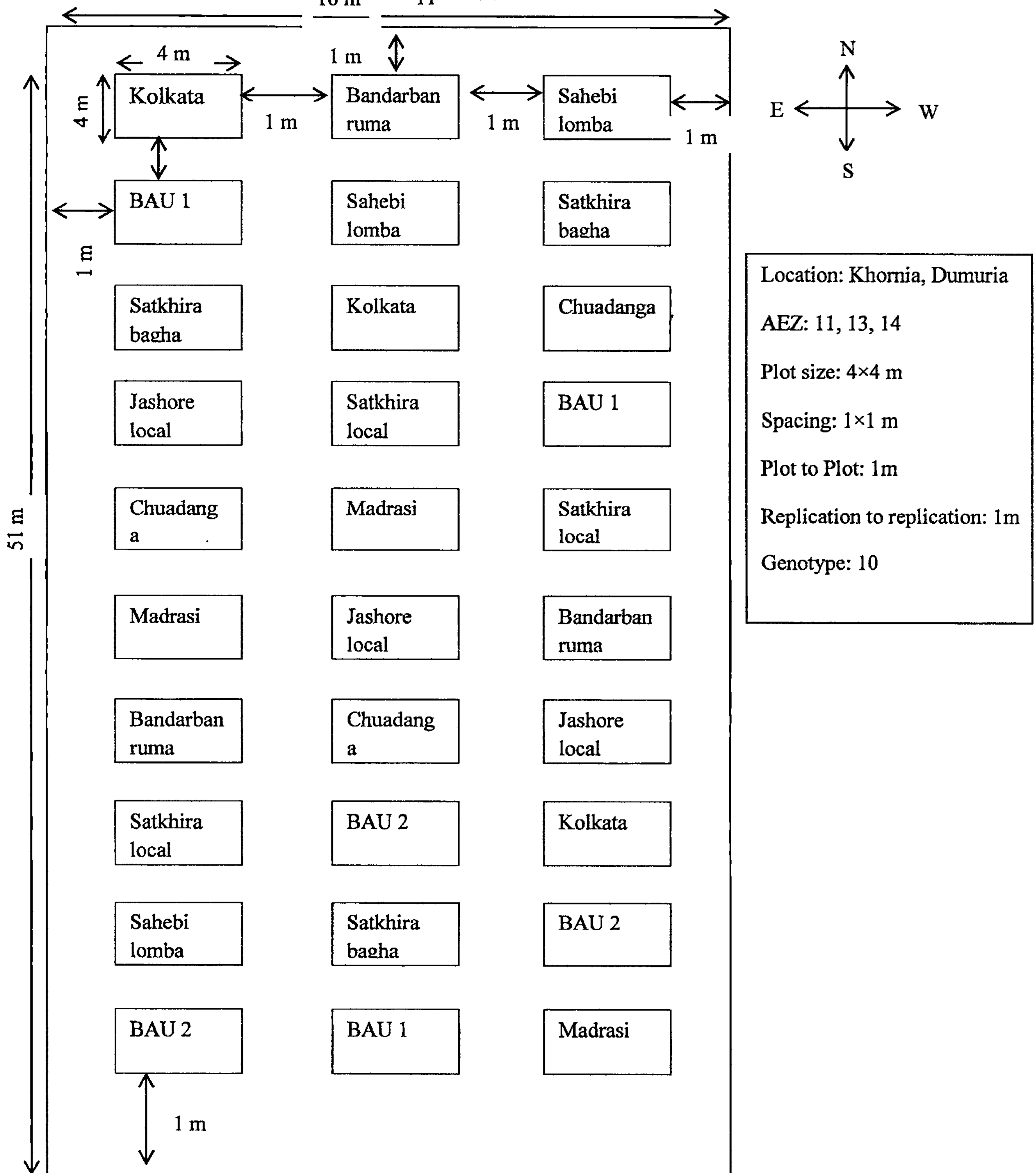
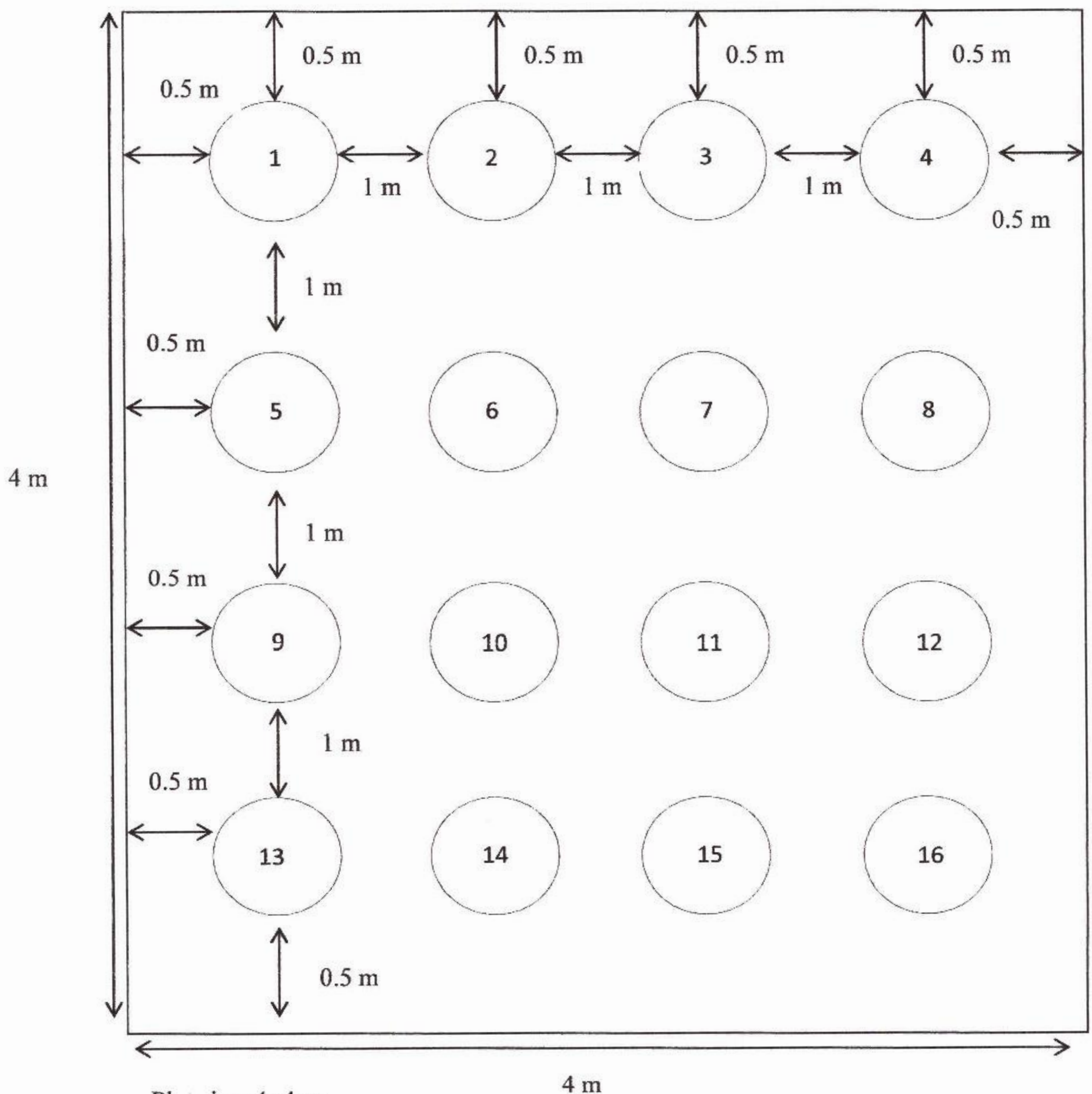
CHAPTER VII

APPENDICES

Appendix I



Appendix II



Plot size: 4×4 m

Spacing: 1×1 m

Appendix III

Figure: Seed of elephant foot yam

Figure: Prepared field

Figure: Seed planting of elephant foot yam

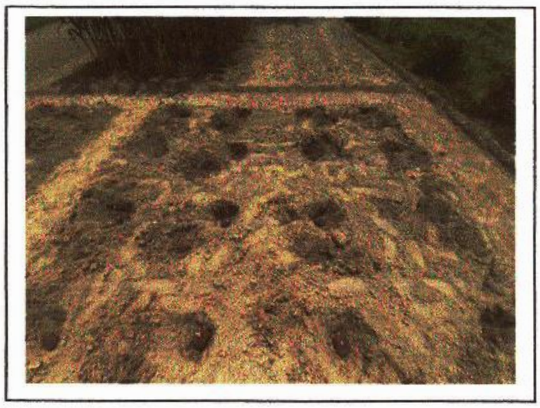


Figure: Plantation of seed in block

Figure: Mulching

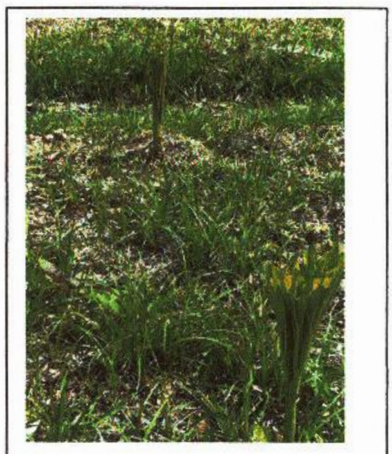


Figure: 30 days old plant

Appendix III

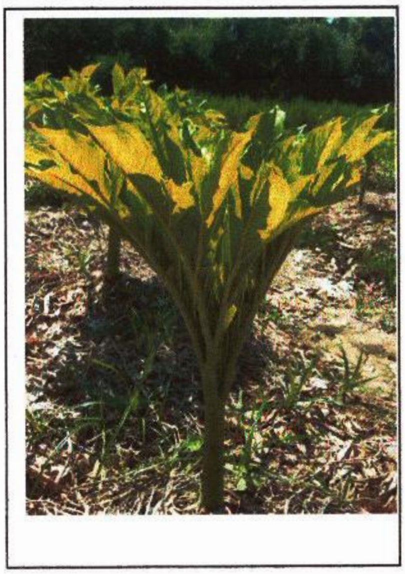


Figure: 50 days old plant

Figure: 90 days old plants in the field

Figure: Measuring weight and length of yam