# GROWTH AND YIELD OF BRINJAL AS INFLUENCED BY DIFFERENT LEVELS OF POTASSIUM

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# CERTIFICATE

This is to certify that the thesis entitled "**GROWTH AND YIELD OF BRINJAL AS INFLUENCED BY DIFFERENT LEVELS OF POTASSIUM**" submitted to the Department of Horticulture, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTERS OF SCIENCE (M.S.)** in **HORTICULTURE**, embodies the result of a piece of bonafide research work carried out by TAHMINA AKTER, Registration No. **15-06442** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

**June, 2022**

**Dhaka, Bangladesh**

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**Dedicated to**
**My**
**Beloved Parents**

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***The Author***

# GROWTH AND YIELD OF BRINJAL AS INFLUENCED BY DIFFERENT LEVELS OF POTASSIUM

## ABSTRACT

A field experiment was conducted at horticulture farm of Sher-e- bangla Agricultural University, Dhaka during the period from March to July 2022 to investigate the growth and yield of brinjal as influenced by varieties and potassium. The experiment consisted of two factors and followed by randomized complete block design (RCBD) with three replications. Factor A: three brinjal varieties *viz.* $V_1$ (BARI hybrid begun-4), $V_2$ (BARI begun-8) and $V_3$ (BARI begun-10) and factor B: four levels of potassium (K) *viz.* $K_0$ (0 kg K ha-$^{1}$), $K_1$ (95 kg K ha$^{-1}$), $K_2$ (115 kg K ha$^{-1}$) and $K_3$ (135 kg K ha$^{-1}$). In case of variety, significant variation was found for different parameters. The tallest plant (83.19 cm), maximum number of leaves per plant (35.18), highest number of fruits per plant (31.88), single fruit weight (58.18 g) and the highest yield (45.13 t ha$^{-1}$) was achieved from the variety $V_1$. On the other hand, the different levels of potassium showed significant differences among them. The treatment $K_3$ provided the highest plant height (84.66 cm), number of leaves per plant (36.87), number of fruits per plant (29.93), single fruit weight (55.46 g) and the highest yield (39.96 t ha$^{-1}$). Combined effect of variety and potassium also showed significant difference among the treatments. The treatment combination of $V_1K_3$ performed the highest plant height (93.72 cm), number of leaves per plant (38.12) whereas $V_1K_2$ gave the highest number of fruits per plant (37.30), single fruit weight (66.05 g) and the highest yield (54.67 t ha$^{-1}$). Regarding economic analysis, $V_1K_2$ also gave the highest gross return (Tk. 1093400.00), net return (Tk. 773330.00) and BCR (3.42). So the treatment combination of $V_1K_2$ may be considered as a suitable combination for growth, yield and economic return of brinjal production and this treatment combination might be recommended at farmers level for better achievement.

# LIST OF CONTENTS

# LIST OF CONTENTS (Cont'd)

# LIST OF TABLES

# LIST OF FIGURES

# LIST OF PLATES

# LIST OF APPENDICES

## ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| AEZ | = | Agro-Ecological Zone |
| BBS | = | Bangladesh Bureau of Statistics |
| BCSRI | = | Bangladesh Council of Scientific Research Institute |
| cm | = | Centimeter |
| CV % | = | Percent Coefficient of Variation |
| DAS | = | Days After Sowing |
| DMRT | = | Duncan's Multiple Range Test |
| *et al.*, | = | And others |
| e.g. | = | exempli gratia (L), for example |
| etc. | = | Etcetera |
| FAO | = | Food and Agricultural Organization |
| g | = | Gram (s) |
| i.e. | = | id est (L), that is |
| Kg | = | Kilogram (s) |
| LSD | = | Least Significant Difference |
| $m^2$ | = | Meter squares |
| ml | = | MiliLitre |
| M.S. | = | Master of Science |
| No. | = | Number |
| SAU | = | Sher-e-Bangla Agricultural University |
| var. | = | Variety |
| $^oC$ | = | Degree Celceous |
| % | = | Percentage |
| NaOH | = | Sodium hydroxide |
| GM | = | Geometric mean |
| mg | = | Miligram |
| P | = | Phosphorus |
| K | = | Potassium |
| Ca | = | Calcium |
| L | = | Litre |
| µg | = | Microgram |
| USA | = | United States of America |
| WHO | = | World Health Organization |

# CHAPTER I

# INTRODUCTION

Brinjal, also known eggplant as or aubergine (*Solanum melongena* L.), belonging to the Solanaceae family, is an important vegetable crop (Lester and Hasan, 1991). It is cultivated worldwide which has significant economic importance that is extensively grown in tropical, subtropical and warm temperate regions (Sihachakr *et al*., 1994 and Lester and Hasan, 1991).

This herbaceous, annual plant typically has an erect or semi-spreading growth habit, and its flowers are white and either solitary or arranged in 2-5 flowered cymes. As the fruit ripens, it turns yellow, and the small, numerous seeds inside are light brown in color. The important brinjal growing countries in the world are India, Bangladesh, Pakistan, China, Cyprus, Egypt, Japan, Philippines, Syria and Western Europe (Rashid, 1993; Islam, 2005).

Brinjal is renowned for its low-calorie content and its mineral composition, which offers numerous health benefits. This vegetable is a particularly rich source of essential minerals like Potassium, Magnesium, Calcium, and Iron (Zenia and Halim, 2008). In terms of its nutritional profile, a 100-gram serving of brinjal provides the following food values: Water 93 g, Vit-A 70 IU, Protein 1.2 g, Thiamine 0.05 mg, Fat 0.1 g, Riboflavin 0.08 mg, Carbohydrate 4.0 g, Niacin 0.09 mg, Fibre 1.2 g, Calories- 20, Calcium 16 mg, Fe 0.9 mg (Bose and Some, 1986).

According to FAOSTAT 2009, worldwide production of brinjal was approximately 32 million tons, with China (18 million tons) and India (8.4 million tons) serving as the largest producers. In Bangladesh, where brinjal is commonly known as ‘Begoon’, it is the most popular and preferred vegetable crop and ranks second only to potato in terms of acreage and production (BBS, 2011). Bangladesh produced 587000 metric tones of brinjal from 50,955 hectares of land by about 150,000 resource-poor farmers (BBS, 2021). It is grown year-round as both Rabi

and Kharif crops (Rashid, 1993) and is widely cultivated in nearly every district of the country. In Bangladesh, there are various cultivars of brinjal available, and consumer preferences depend on factors such as fruit color, size, and shape (Gopalan *et al*., 2007). Brinjal cultivation in Bangladesh involves approximately eight million farm facilities (Islam, 2005), providing small, marginal, and landless farmers with a steady source of income and employment opportunities for rural communities.

Studies have shown that varietal selection has a significant impact on brinjal yield and quality. For example, a study by Mian *et al*. (2012) found that the yield and fruit quality of brinjal were significantly affected by the variety used, with certain cultivars producing larger fruits and higher yields. Similarly, another study by Adewale and Ogunniyan (2018) demonstrated that certain brinjal cultivars produced higher yields and exhibited greater pest resistance. A study by Ahmed *et al*. (2018) found that different brinjal varieties exhibited significant differences in terms of their plant height, leaf area, and stem diameter. Varieties with greater plant height and leaf area tended to produce higher yields, indicating the importance of plant growth characteristics in determining overall productivity.

Optimizing plant nutrition is crucial for enhancing the yield and quality of brinjal. Nitrogen, phosphorus and potassium are the plant nutrients balanced nutrition is essential for optimum growth and yield of crop (Satpal and Saimbhi, 2003). Among different essential plant nutrients, potassium plays a vital role in many physiological processes which has been found to influence growth, yield, and fruit quality (Suthar *et al*., 2005). Potassium functions primarily in regulating and maintaining electrochemical equilibrium in cells and other compartments, as well as in enzyme activity regulation. Additionally, it is involved in carbohydrate metabolism, protein synthesis, regulation of the activities of various essential elements, adjustment of stomatal functions, and water relations (Sharma and Brar, 2008). Arif *et al*. (2018) reported that increasing potassium levels significantly

improved the plant height, number of branches, and yield of brinjal. Similarly, Yadav *et al*. (2016) found that potassium application increased the plant height, stem diameter, and fruit yield of brinjal. Additionally, Singh *et al*. (2013) reported that potassium application resulted in a significant increase in the yield and fruit quality of brinjal.

The fruit yield of brinjal per unit area is very low in Bangladesh compared to many developed countries. So, it is urgently needed to develop improved technologies for higher production of brinjal regarding fruit yield and quality. Considering the above fact the present study entitled 'growth and yield of brinjal varieties as influenced by different levels of potassium' was undertaken with the following objectives:

i. To determine the varietal performance on growth and fruit yield of brinjal
ii. To investigate the optimum level of potassium on growth and fruit yield of brinjal
iii. To find out the suitable combination variety and level of potassium on growth and yield of brinjal

# CHAPTER II

# REVIEW OF LITERATURE

A good deal of research work has been done in Bangladesh and also all over the world to evaluate the growth and yield of brinjal as influenced by different levels of potassium. This has encouraged generating information for farmers and vegetable growers. In view of these facts, the literature available on these aspects has been reviewed in this chapter on following heads.

## 2.1 Effect of variety on growth and yield of brinjal

Brinjal is the second most important vegetable crop after Tomato in relation to its total production. Better production from any crop can only be achieved from a better variety. But in most cases the producers especially the rural farmers are not aware about the selection of high yielding varieties. Without any justification they just buy those seeds are easily available in nearby shops resulting harvest a poor yield with very unsatisfactory return (Alama *et al*., 2021; Kashiwaba *et al*., 2019).

Sahu *et al*. (2022) carried out a study on the evaluation of different varieties of brinjal (*Solanum melongena* L.) for growth, yield and economics attributing characters. The results indicated that growth in terms of plant height (80.27 cm), number of branches plant$^{-1}$ (20.20), number of leaves plant$^{-1}$ (70.13), leaf area plant$^{-1}$ (14738.33 cm$^2$), leaf area index (5.45) were found maximum in the variety Kashi Taru whereas, stem girth (4.67 cm), days to first flowering (38.39 days) and days to 50% flowering (46.55 days) were found maximum in variety Kavya. In the respect of yield contributing characters i.e. days to first fruit harvesting (56.43 days), fruit length (36.92 cm), fruit shape index (2.11), pedicel length (6.57 cm) were found maximum in variety Niranjan Baigan and average fruit weight (125.63 g), number of fruits plant$^{-1}$ (28.17), fruit yield plant$^{-1}$ (2.37 kg plant$^{-1}$), fruit yield plot$^{-1}$ (39.02 kg), fruit yield ha$^{-1}$ (60.62 t) and economics analysis; gross income

(303100.00 Rs/ha), net income (240972 Rs/ha), benefit cost ratio (3.87) were found maximum in the variety Kashi Taru, while the variety $V_{12}$ (Sehore Selection-12) showed minimum least response in terms of growth, yield and economics of brinjal.

Alama *et al*. (2021) evaluated five different brinjal (*Solanum melongena* L.) germplasm collections for their major yield and yield contributing attributes along with total chlorophyll content as physiological parameter. Research findings revealed significant variations for all the measured parameters among different brinjal cultivars. Round purple brinjal ($V_1$ = Mte2) had the highest fruit weight (238.60 g; which is about 88.14% increased fruit weight over $V_4$), followed by long red purple brinjal ($V_2$ = H117) with 167.50 g (about 83.10% increased fruit weight over $V_4$), long green brinjal ($V_3$ = H249) with 119.70 g (about 76.36% increased fruit weight over $V_4$) and the lowest fruit weight (28.30 g) was found in brinjal variety $V_4$ (Telunjuk), respectively. On the other hand red purple brinjal ($V_2$) was the longest (24.23 cm) in size with 5.60 cm in diameter, but the highest fruit diameter (12.24 cm) was recorded in $V_3$ brinjal. Long red purple brinjal ($V_2$) showed the shortest days to 1$^{st}$ flowering and 50% flowering with 41 and 49 days compared to Kermit brinjal ($V_5$) which took the longest 55 and 61 days to 50% flowering. The highest total leaf chlorophyll content was detected in $V_5$ (51.02 nmol/mg) while the lowest (44.06 nmol/mg) was in $V_3$. On an average; considering varietal performance for yield and yield contributing attributes of five (5) different brinjal cultivars, it was revealed that the fruits of $V_1$ gained the highest weight, while the fruits of $V_2$ had the highest length and the fruits of $V_3$ gained the highest diameter. Regarding earliness; variety $V_2$ was the earliest among all 5 varieties, which is one of the desirable characteristics for any crops; especially in vegetables.

A study conducted by Abd El-Aal *et al*. (2019) in Egypt to evaluated the effect of four brinjal varieties on yield and quality parameters. The results showed that the

variety ‘Baladi’ had the highest yield, fruit weight, and total soluble solids, while ‘Moulia’ had the highest titratable acidity and pH. The results also revealed that different varieties could be chosen for different end uses, such as fresh consumption or processing, based on their specific quality parameters.

Singh *et al*. (2019) carried out a study entitled “varietal performance of brinjal (*Solanum melongena* L.) under different growing conditions”. Eight brinjal varieties *viz*., White round, White long, Chu-Chu, Purple round, Shyamal, Sharapova, Him mani- 412 and Nisha were grown under two different growing conditions *viz*., poly-tunnel and open field. Growing conditions and varieties had significant influence on growth, yield parameters and yield. The poly tunnel grown brinjal recorded maximum plant height and number of leaves at 30, 45 and 60 days and number of branches at 45 and 60 days and most of the yield parameters and yield than the open field. It was observed that, plant height (30, 45 and 60 days after transplanting) was highest in Sharapova variety, followed by Shyamal, while the highest number of leaves (30, 45 and 60 days after transplanting) and number of branches (45 and 60 days after transplanting) were recorded in Shyamal variety, followed by Purple round. The variety Shyamal performed best with respect to yield and most of the yield parameters followed by Sharapova. While, the number of fruits per plant was highest in White long followed by Shyamal.

A study conducted by Kafi *et al*. (2018) in Iran to investigate the performance of three different brinjal varieties under different planting densities. The results showed that the variety ‘Kamal’ had the highest yield and fruit weight, while the variety ‘Turk’ had the highest number of fruits per plant. It was concluded that the choice of variety and planting density could be important factors in optimizing the yield and profitability of brinjal cultivation.

In a study conducted, researchers Omotayo *et al*. (2018) conducted an experiment in Nigeria and evaluated the performance of six brinjal varieties under different irrigation regimes. The results showed that the variety 'Black Beauty' had the highest yield under both irrigation and rainfed conditions, while 'Long Purple' had the lowest yield under irrigation but the highest under rainfed conditions. It was concluded that the choice of variety should be based on the prevailing environmental conditions and the water availability.

Polat *et al*. (2018) conducted an experiment and determined the yield and quality characteristics of different brinjal cultivars in the Mediterranean region. Results showed that there were significant differences among cultivars in terms of yield, fruit weight, and number of fruits per plant. It was also found that there were differences in the quality characteristics of the fruits, such as total soluble solids, pH, and titratable acidity. It was concluded that the choice of cultivar should be based on the intended use of the brinjals.

In a study conducted in Bangladesh, Islam et al. (2018) evaluated the growth and yield performance of eight brinjal varieties. The results showed that the variety 'BARI Begun-4' had the highest yield, while 'BARI Begun-3' had the earliest fruiting and 'BARI Begun-5' had the longest fruiting period. The authors concluded that the selection of appropriate varieties could enhance the yield and productivity of brinjal cultivation.

Saini and Singh (2017) evaluated the effect of five different brinjal varieties on growth and yield parameters in India. The results showed that the variety 'Pusa Purple Long' had the highest plant height, number of leaves, and yield, while 'Arka Keshav' had the highest number of branches and 'Arka Navneet' had the highest fruit weight. Results concluded that different varieties could be chosen for different desired traits, depending on the specific requirements of farmers and markets.

Tawab *et al*. (2015) conducted a study to assess the effect of different degrees of zinc to brinjal cultivars, Four levels of zinc (0, 0.1, 0.2, and 0.3%) were applied to three brinjal cultivars (Purple, Shimla, Shamli). Both cultivars and zinc levels proved significantly different among growth parameters. Plant height, number of leaves per plant, number of fruits per plant, fruit weight and total yield was significantly different among cultivars. Maximum number of fruit per plant (7.42), fruit weight (210.583 g) and total yield (10.21 t/ha) were recorded for cultivar Purple.

Msogoya *et al*. (2014) carried out a study with three African brinjal varieties (Tengeru white, AB2 and Manyire green) combined with three harvesting stages (1, 2 and 3). Results showed that yield in number of fruits per hectare decreased while yield in metric tons per hectare increased with fruit development stages. Varieties Tengeru white and AB2 had the highest yields based on metric tons at harvesting stage 2 while Manyire green had the highest yield at harvesting stage 3.

Sarker *et al*. (2011) conducted to investigate the yield potential of some brinjal varieties using plant growth regulator. Seven varieties of brinjal *viz*., BARI Begun1, BARI Begun2, BARI Begun4, BARI Begun5, Bismillah, BARI Begun6, and Islampuri were used for test crop and Naphthalic acetic acid (NAA) 100 ppm was used as plant growth regulator. Brinjal variety BARI Begun5 showed the highest plant height (31.0 cm) at vegetative stages among the tested varieties. The mean Leaf number (32.00) was also higher in BARI Begun 5 in comparison to others. Yield potential was significantly higher in BARI Begun2 followed by BARI Begun5. The lowest yield was performed by BARI Begun6. From this study it is inferred that brinjal cv. BARI Begun2 cv. Tarapuri might have best yield potential in the study area.

## 2.2 Effect of potassium on growth and yield of brinjal

El-Fouly *et al*. (2020) conducted a study to investigate the effect of foliar application of potassium and calcium on the growth, yield, and quality of brinjal grown under sandy soil conditions. The experiment was conducted in a randomized complete block design with four replications. The treatments included a control group with no foliar application, foliar application of potassium, foliar application of calcium, and foliar application of a combination of potassium and calcium. The results showed that foliar application of potassium and calcium, either alone or in combination, significantly increased plant height, stem diameter, number of branches, and leaf area compared to the control group. The combined application of potassium and calcium was found to be the most effective treatment for increasing fruit yield, fruit quality, and nutrient content of the brinjal. Furthermore, foliar application of potassium and calcium increased the content of chlorophyll, carotenoids, and total phenolic compounds in brinjal leaves, which contributed to the improved quality of the fruit. In conclusion, the study suggests that foliar application of potassium and calcium could be an effective way to improve the growth, yield, and quality of brinjal, especially under sandy soil conditions.

Hasanuzzaman *et al*. (2020) conducted a study aimed to evaluate the effect of potassium (K) and boron (B) application on the growth, yield, and yield contributing characters of brinjal. The treatments included three levels of K (0, 75, and 150 kg/ha) and three levels of B (0, 2, and 4 kg/ha). The results showed that the application of K and B significantly increased the growth, yield, and yield contributing characters of brinjal. The highest fruit yield was obtained from the treatment of 150 kg K/ha + 4 kg B/ha, which increased the yield by 64.71% compared to the control. The application of K and B also improved the quality of the fruit, with the highest TSS (total soluble solids) and ascorbic acid content obtained from the treatment of 150 kg K/ha + 4 kg B/ha. The study concluded that

the application of K and B can significantly improve the growth, yield, and quality of brinjal, and recommended the use of 150 kg K/ha + 4 kg B/ha for maximum yield and quality.

Abou-Khadrah and Abdel-Rahman (2018) reported that potassium application and planting density affect growth, yield and quality of brinjal (*Solanum melongena* L.). This study investigated different parameters on the growth, yield, and quality of brinjal. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, fruit length, fruit diameter, per plant yield and yield per hectare of brinjal, while also improving the fruit quality. Early flowering was also found with potassium application. Planting density had a significant effect on the yield per unit area, with higher yields obtained from lower planting densities.

Ali and Niazi (2019) conducted an experiment to study the effects of potassium fertilizer on growth and yield of brinjal (*Solanum melongena* L.). This study examined the effects of potassium fertilizer on the growth and yield of brinjal under field conditions. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, number of fruits per plant, fruit yield per plant and yield of brinjal, while also improving the fruit quality. The study concluded that potassium fertilizer is an essential nutrient for the growth and yield of brinjal.

Ashraf *et al*. (2019) reported that potassium (K) application improves growth, yield and quality of brinjal (*Solanum melongena* L.) grown under semi-arid conditions. This study investigated different parameters on growth, yield, and quality of brinjal grown under semi-arid conditions. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, individual fruit weight, fruit yield per plant and yield per hectare of brinjal,

while also improving the fruit quality. The study concluded that potassium application is essential for brinjal production under semi-arid conditions.

Gao *et al*. (2018) conducted an experiment to study the effects of potassium on plant growth, yield, and quality of brinjal. This study reviewed the current knowledge on the effects of potassium on the growth, yield, and quality of brinjal. The review concluded that potassium is an essential nutrient for brinjal production, as it affects plant growth, yield, and fruit quality. The study also highlighted the importance of understanding the optimal application rate of potassium for brinjal production.

Kamal *et al*. (2018) conducted an experiment to study the effect of potassium on the growth, yield and quality of brinjal (*Solanum melongena* L.) cv. Dhanmondi. This study investigated the effects of potassium on the growth, yield, and quality of brinjal. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, and yield of brinjal, while also improving the fruit quality. The study concluded that potassium application is essential for the production of high-quality brinjal.

Kumar and Sharma (2016) carried out an experiment to study the effect of potassium application on growth, yield and fruit quality of brinjal (*Solanum melongena* L.) under semi-arid conditions of north-western India. This study investigated the effect of potassium application on the growth, yield, and fruit quality of brinjal grown under semi-arid conditions. The results showed that potassium application significantly increased the plant height, stem girth, leaf area, and yield of brinjal, while also improving the fruit quality. The study concluded that potassium application is essential for the production of high-quality brinjal under semi-arid conditions.

Mahbub *et al*. (2017) carried out an experiment to study the effect of potassium on growth, yield and yield attributes of brinjal. This study investigated the effects of

different levels of potassium on the growth, yield, and yield attributes of brinjal. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, and yield of brinjal, while also improving the fruit quality. The study concluded that proper application of potassium is essential for obtaining high yields and good fruit quality in brinjal.

Singh, and Singh (2017) investigated the effect of potassium and zinc application on the growth, yield, and fruit quality of brinjal grown in the Bihar plain region. The results showed that potassium and zinc application significantly increased the plant height, stem girth, leaf area, and yield of brinjal, while also improving the fruit quality. The study concluded that the proper application of potassium and zinc is essential for obtaining high yields and good fruit quality in brinjal.

Choudhary and Sharma (2013) reported the effect of different levels of potassium on the growth, yield, and fruit quality of brinjal. The results showed that potassium application significantly increased the plant height, stem diameter, number of branches, number of leaves, and yield of brinjal. The study concluded that potassium application is essential for the production of high-quality brinjal.

Das and Saha (2014) conducted an experiment to investigate the effect of potassium and magnesium on the growth, yield, and quality of brinjal. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, number of fruits per plant, and yield of brinjal. The study also showed that magnesium application had no significant effect on the growth and yield of brinjal. The study concluded that potassium application is essential for the production of high-quality brinjal.

Kamble *et al*. (2015) reported the effect of potassium and phosphorus on the growth, yield, and nutrient uptake of brinjal. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, and yield of brinjal. The study also showed that phosphorus application had no

significant effect on the growth and yield of brinjal. The study concluded that potassium application is essential for the production of high-quality brinjal.

Khandaker *et al*. (2015) investigated the effect of potassium on the growth, yield, and nutrient uptake of brinjal grown in a calcareous soil. The results showed that potassium application significantly increased the plant height, stem diameter, number of leaves, and yield of brinjal. The study also showed that potassium application improved the nutrient uptake of brinjal, particularly nitrogen and phosphorus. The study concluded that potassium application is essential for the production of high-quality brinjal in calcareous soils.

Pandey *et al*. (2015) carried out an experiment to study the effect of potassium and nitrogen on the growth, yield, and quality of brinjal. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, number of fruits per plant, and yield of brinjal. The study also showed that nitrogen application had no significant effect on the growth and yield of brinjal. The study concluded that potassium application is essential for the production of high-quality brinjal.

Radha and Murali (2016) conducted an experiment to study the the effect of potassium and zinc on the growth, yield, and quality of brinjal. The results showed that potassium application significantly increased the plant height, stem diameter, number of leaves, and yield of brinjal. Zinc application also increased the yield of brinjal but had no significant effect on plant growth. The study concluded that potassium application is essential for the production of high-quality brinjal, and zinc can also be applied for improved yield.

Shahzad *et al*. (2017) investigated the interactive effect of potassium and drought stress on the growth, physiology, and nutrient uptake of brinjal. The results showed that potassium application mitigated the negative effects of drought stress on plant growth and physiology, including photosynthesis, water use efficiency,

and nutrient uptake. The study concluded that potassium application can enhance the tolerance of brinjal to drought stress.

Singh, and Singh (2017) conducted an experiment to study the response of brinjal (*Solanum melongena* L.) to different levels of potassium and zinc in an Inceptisol of Eastern Uttar Pradesh, India. The results showed that potassium application significantly increased the plant height, stem diameter, leaf area, and yield of brinjal. Zinc application also increased the yield of brinjal but had no significant effect on plant growth. The study concluded that potassium application is essential for the production of high-quality brinjal, and zinc can also be applied for improved yield.

Subramanian and Sivakumar (2017) carried out a study to investigate the effect of potassium and iron on growth, yield and quality of brinjal (*Solanum melongena* L.). The results showed that potassium application significantly increased the plant height, stem diameter, number of leaves, and yield of brinjal. Iron application also increased the yield of brinjal but had no significant effect on plant growth. The study concluded that potassium application is essential for the production of high-quality brinjal, and iron can also be applied for improved yield.

# CHAPTER III

# MATERIALS AND METHODS

This chapter describes the materials and methods which were used in the field to conduct the experiment during the period from March to July 2022. It comprises a short description of the location of the experimental plot, climatic condition of the area where the plot was situated, materials used for experimental treatments, design of the experiment, method of cultivation, method of data collection, statistical analysis have been presented.

## 3.1 Experimental site

The research work was conducted at the farm of Sher-e-Bangla Agricultural University, Dhaka-1207 to study the influence of crop nutrition on seed yield and quality of brinjal during the period from March to July 2022. Experimental field was located at 90°22/ E longitude and 23°41/ N latitude and altitude of 8.2 m above the sea level. The experimental site is presented in Appendix I.

## 3.2 Climate

Experimental area belongs to subtropical climatic zone which is characterized by heavy rainfall, high temperature and relatively long day period during "Kharif-1" season (April-September) and scarce rainfall, low humidity, low temperature and short day period during "Rabi" season (October-March). This climate is also characterized by distinct season, *viz*. the monsoon extending from May to October, the winter or dry season from November to February and per-monsoon period or hot season from March to April (Edris *et al.*, 1979). The meteorological data in respect of temperature, rainfall, relative humidity, average sunshine and soil temperature for the entire experimental period have been shown in Appendix II.

### 3.3 Characteristics of soil

The soil of the experimental area belongs to the Modhupur Tract in Agroecological Zone (AEZ)-28 (UNDP, 1988). It was medium high land and the soil series was Tejgaon (FAO, 1988). The soil was having a texture of sandy loam with pH and CEC were 5.6 and 2.64 meq/100 g soil, respectively. The characteristics of the soil under the experimental plot were analyzed in the Soil Testing laboratory, SRDI, Khamarbari, Dhaka and details of the recorded soil characteristics were presented in Appendix III.

### 3.4 Planting materials

Three brinjal varieties viz., BARI hybrid begun-4, BARI begun-8 and BARI begun-10 were used in the present experiment. The seeds were collected from the Horticulture Research Center (HRC), Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur.

### 3.5 Treatments of the experiment

**Factor A: Three varieties**

1. $V_1$ = BARI hybrid begun-4
2. $V_2$ = BARI begun-8
3. $V_3$ = BARI begun-10

**Factor B: Four levels of potassium**

1. $K_0$ = Control (no K; 0 kg K $ha^{-1}$)
2. $K_1$ = 95 kg K $ha^{-1}$
3. $K_2$ = 115 kg K $ha^{-1}$
4. $K_3$ = 135 kg K $ha^{-1}$

**There were 12 (3×4) treatment combinations given below:**

$V_1K_0$, $V_1K_1$, $V_1K_2$, $V_1K_3$, $V_2K_0$, $V_2K_1$, $V_2K_2$, $V_2K_3$, $V_3K_0$, $V_3K_1$, $V_3K_2$ and $V_3K_3$

### 3.6 Design and layout of the experiment

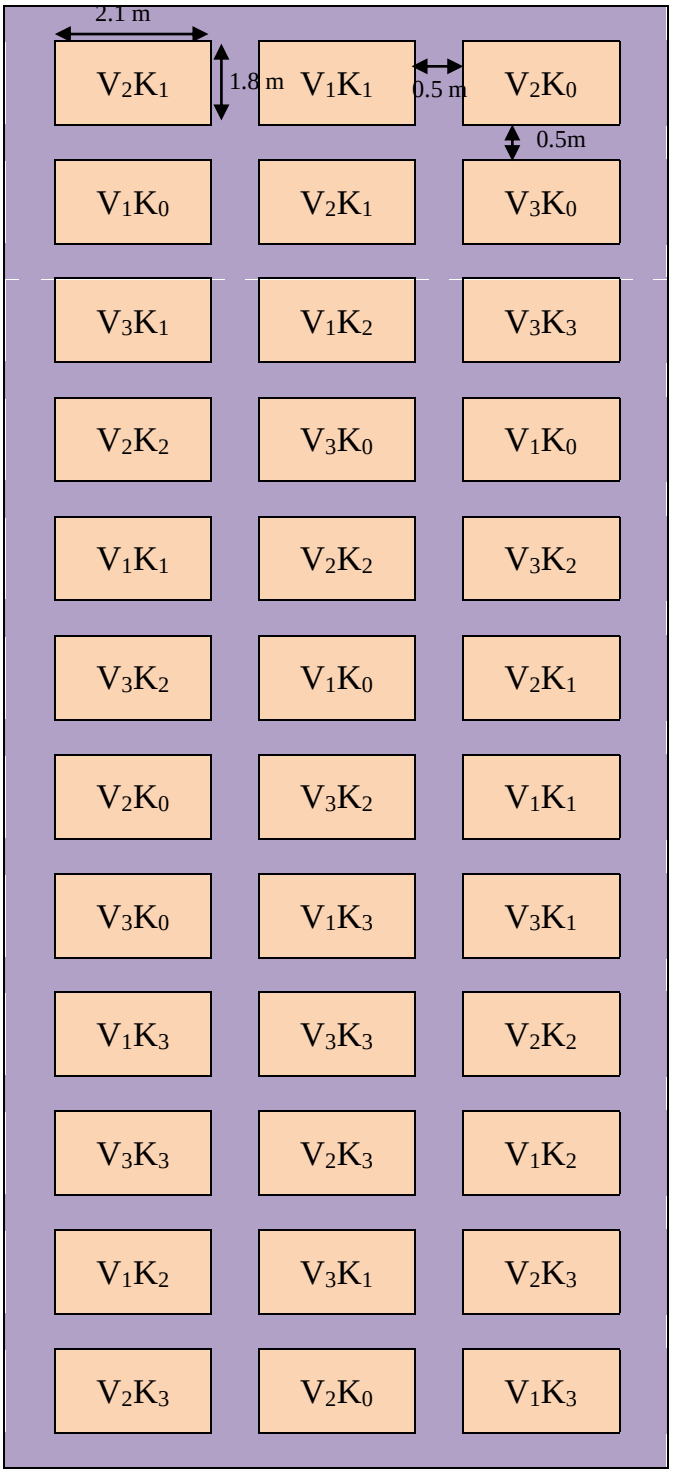
The two factor experiment was laid out in the Randomized Complete Block Design (RCBD) with three replications. There were 12 treatment combinations. In total 36 plots for 3 blocks. Each block consisted of 12 unit plots. The size of each unit plot was (2.1 m × 1.8 m). The distance maintained between two replications and two plots were 0.5 m and 0.5 m, respectively. The layout of the experiment is shown in Figure 1.

### 3.7 Raising of seedlings

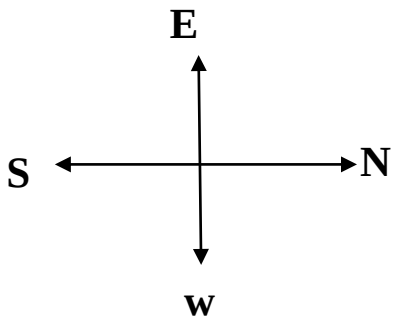
The land selected for nursery bed was well drained and were sandy loam type soil. The area was well prepared and converted into loose friable and dried mass to obtain fine tilth. All weeds and dead roots were removed and the soil was mixed with well rotten cowdung at the rate of 5 kg/bed. Seed bed size was 3m × 1m raised above the ground level. One bed was prepared for raising the seedlings. Five (5) grams of seeds were sown in the seed bed on 3$^{rd}$ March 2022. After sowing, the seeds were covered with light soil. Complete germination of the seeds took place within 5 days after seed sowing. Necessary shading was made by bamboo mat (chatai) from scorching sunshine or rain. No chemical fertilizer was used in the seed bed.

### 3.8 Preparation of the main field

The plot selected for the experiment was opened in the first week of April, 2022 with a power tiller, and was exposed to the sun for a few days, after, which the land was harrowed, ploughed and cross-ploughed several times followed by laddering to obtain a good tilth. Weeds and stubble were removed and finally obtained a desirable tilth of soil for transplanting. The land preparation was completed on 8 April 2022. The individual plots were made by making ridges (20 cm high) around each plot to restrict lateral runoff of irrigation water.




**LEGEND**




**Treatments**

**Factor A: Three varieties**

1. $V_1$ = BARI hybrid begun-4
2. $V_2$ = BARI begun-8
3. $V_3$ = BARI begun-10

**Factor B: Four levels of potassium**

1. $K_0$ = Control (no K; 0 kg K $ha^{-1}$)
2. $K_1$ = 95 kg K $ha^{-1}$
3. $K_2$ = 115 kg K $ha^{-1}$
4. $K_3$ = 135 kg K $ha^{-1}$

Figure 1. Layout of the experimental plot

### 3.9 Fertilizers and manure application

At first the whole experiment plot was fertilized with 10 ton per ha cowdung and mixed with soils thoroughly. The plant nutrients as N, P. K and S were applied through urea, Triple super phosphate (TSP), MoP and gypsum, respectively. Potassium was applied as per treatment. The whole amount of TSP, gypsum and half amount of MoP were applied as basal dose before seedling transplanting in the main field. First top dressing of urea was applied when seedling established in the main field about 10 days after seedling transplanting. Second top dressed of urea and rest amount of MoP were applied about 25 days after first top dressing. Then rest amount of urea was applied as third installment at 40 DAT.

The following fertilizer doses were used in the experiment field

| Plant nutrients | Manure and fertilizer | Doses $ha^{-1}$ |
|---|---|---|
| -- | Cowdung | 10 t |
| N | Urea | 375 kg |
| P | TSP | 150 kg |
| K | MoP | As per treatment |
| S | Gypsum | 100 kg |

Source: BARI, 2019

### 3.10 Transplanting of seedlings

Healthy and uniform sized 32 days old seedlings were taken separately from the seed bed and were transplanted in the experimental field on 8 April, 2022. The plant spacing was maintained as 70 cm × 60 cm. The seed bed was watered before uprooting the seedlings so as to minimize the damage of the roots. This operation was carried out during late hours in the evening. The seedlings were watered after transplanting. Shading was provided by piece of banana leaf sheath for three days to protect the seedlings from the direct sun. A strip of the same crop was established around the experimental field as border crop to do gap filling and to check the border effect.

### 3.11 Intercultural Operation

After establishment of seedlings, various intercultural operations were accomplished for better growth and development of the brinjal.

#### 3.11.1 Gap filling and weeding

When the seedlings were established, the soil around the base of each seedling was pulverized. A few gaps filling were done by healthy plants from the border whenever it was required. Weeds of different types were controlled manually as and when necessary.

#### 3.11.2 Irrigation

Irrigation was done at three times. The first irrigation was given in the field at 25 days after transplanting (DAT) through irrigation channel. The second irrigation was given at the stage of maximum vegetative growth stage (35 DAT). The final irrigation was given at the stage of fruit formation.

#### 3.11.3 Plant protection

The crop was infested with brinjal shoot and fruit borer, cutworm, leaf hopper and others. The insects were controlled successfully by spraying Malathion 57 EC @ 2ml /L water. The insecticide was sprayed fortnightly from a week after transplanting to a week before first harvesting. During foggy weather precautionary measures against fungal diseases of brinjal was taken by spraying Dithane M-45 @ 2 g/L.

### 3.12 Harvesting

Harvesting was started on the 3 July, 2022 and continued to 10 August, 2022. At each harvest the fruits of brinjal were allowed to edible stage. Different yield contributing data have been recorded from the means of five harvested plants which was selected at random of each unit plot of every harvesting stage.

### 3.13 Collection of data

Five representative plants were selected at random from each of unit plot to avoid border effect and tagged in the field. The details of data recording are given below:

#### 3.13.1 Growth and yield contributing parameters and yield parameters

1. Plant height
2. Number of leaves plant$^{-1}$
3. Number of branches plant$^{-1}$
4. Days to 1$^{st}$ flowering
5. Days to 50% flowering
6. Number of fruits plant$^{-1}$
7. Single fruit weight (g)
8. Fruit length (cm)
9. Fruit diameter (cm)
10. Dry matter content of leaves (%)
11. Fruit yield plant$^{-1}$ (g)
12. Fruit yield plot$^{-1}$ (kg)
13. Fruit yield ha$^{-1}$ (t)

#### 3.13.2 Economic analysis

1. Total cost of production
2. Gross return (Tk. ha$^{-1}$)
3. Net return (Tk. ha$^{-1}$)
4. Benefit Cost Ratio (BCR)

### 3.14 Procedure of recording data

#### 3.14.1 Plant height

Plant height was taken at 20, 40 and 60 DAT (days after transplanting). The

height was takent from ground level to the tip of largest leaf of the plants. The plant height was recorded at the time of first harvest. Plant height of five randomly sampled plants were recorded and mean was calculated in centimeter (cm).

### 3.14.2 Number of leaves plant$^{-1}$

The number of leaves of five randomly selected plants was counted from each unit plot at 20, 40 and 60 DAT and means were calculated.

### 3.14.3 Number of branches plant$^{-1}$

The number of branches plant$^{-1}$ was recorded from randomly selected five plants in each plot. It was recorded at 60 DAT.

### 3.14.4 Days to 1$^{st}$ flowering

Days to first flowering was counted from transplanting date to when 1$^{st}$ flower was appeared in the plant.

### 3.14.5 Number of fruits plant$^{-1}$

Number of fruits from five randomly selected plants was counted and their mean values were calculated.

### 3.14.6 Fruit yield plant$^{-1}$ (g)

Fruit weight of five sample plants were weighed and their average was taken in gram (g).

### 3.14.7 Single fruit weight (g)

Single fruit was taken from randomly selected 20 fruits from each unit plot. Average value was taken and expressed in gram (g).

### 3.14.8 Fruit length (cm)

Length of fruit was measured from randomly selected 10 fruits from each replication using meter scale when it was harvested and then mean was recorded and expressed in centimeter (cm).

### 3.14.9 Fruit diameter (cm)

Fruit diameter was measured from randomly selected 10 fruits from each replication using slide calipers when it was harvested and then mean was recorded and expressed in centimeter (cm).

### 3.14.10 Dry matter content of leaves (%)

Collected leaves were at first sun dried and after that it was oven dried at 70°C for 72 hours to attain a constant weight. Then it was transferred to desiccators to cool and after that percent dry matter content was measured with the following formula:

$$\% \text{ Dry weight of leaves} = \frac{\text{Oven dry weight of leaves}}{\text{Fresh weight of leaves}} \times 100$$

### 3.14.11 Fruit yield plot$^{-1}$ (kg)

Total fruit weight was taken from each unit plot from first harvest to last harvest and expressed in kilogram (kg).

### 3.14.12 Economic analysis

To find out the cost effectiveness of different treatments on brinjal production with variety and potassium, the procedure of economic analysis was done in details according to the procedure of (Alam *et al*., 1989).

#### 3.14.12.1 Total cost of production

All the material and non-material input cost, interest on fixed capital of land and miscellaneous cost were considered for calculating the total cost of production.

Total cost of production (input cost, overhead cost), gross return, net return and BCR are presented in Appendix XI.

### 3.14.12.2 Gross return (Tk. ha$^{-1}$)

Gross return was calculated on the basis of mature cabbage head sale. The price of brinjal was assumed to be Tk. 25.00/kg basis of current market value of Kawran Bazar, Dhaka at the time of harvesting.

### 3.14.12.3 Net return

Net return was calculated by deducting the total production cost from gross income for each treatment combination.

### 3.14.12.4 Benefit cost ratio (BCR)

The economic indicator BCR was calculated by the following formula for each treatment combination.

$$\text{Benefit cost ratio (BCR)} = \frac{\text{Gross return per hectare}}{\text{Total cost of production per hectare}}$$

## 3.15 Statistical analysis

The recorded data on different parameters were statistically analyzed using MSTAT computer package programme. The analysis of variance for the characters under study were performed by 'F' variance test. The differences between the pairs of treatment means was compared using least significant difference (LSD) test (Gomez and Gomez, 1984).

# CHAPTER IV

# RESULTS AND DISCUSSION

The experiment was carried out to find out the growth and yield of brinjal as influenced by different levels of potassium. The effect of different variety and potassium (K) and their interaction on growth and yield contributing characters also economic analysis have been presented and discussed in this chapter under the following heads.

## 4.1 Growth parameters

### 4.1.1 Plant height (cm)

Different variety showed significant influence on plant height of brinjal at different days after transplanting (Fig. 2 and Appendix IV). The largest plant (37.27, 63.91 and 83.19 cm at 20, 40 and 60 DAT, respectively) were found from the variety $V_1$ (BARI hybrid begun-4) which was significantly different from other varieties followed by $V_3$ (BARI begun-10) variety. Similarly, the lowest plant height (33.22, 56.33, and 71.18 cm at 20, 40 and 60 DAT, respectively) were recorded from the variety $V_2$ (BARI begun-8). The result obtained from the present study was similar with findings of Sahu *et al.* (2022) and Singh *et al.* (2019); they observe variation on plant height among different brinjal varieties.

There was a significant variation on plant height of brinjal at different DAT due to influenced by different potassium (K) levels (Fig. 3 and Appendix IV). The highest plant height (44.46, 70.64 and 84.66 cm at 20, 40 and 60 DAT, respectively) were achieved from $K_3$ (135 kg K $ha^{-1}$) treatment which significantly differed to other treatments followed by $K_2$ (115 kg K $ha^{-1}$). On the other hand, at 20, 40 and 60 DAT, the lowest plant height (31.82, 50.37 and 65.70 cm, respectively) were obtained from the control treatment $K_0$ (0 kg K $ha^{-1}$). Macronutrient potassium had significant effect on plant growth parameters and

plant height increased significantly with K application (Abou-Khadrah and Abdel-Rahman, 2018). Improvement in growth characters as a result of application of potassium might be due to the enhanced photosynthetic and other metabolic activity which leads to an increase in various plant metabolites responsible for cell division and elongation as opined by Hatwar *et al*. (2003) which leads to produced tallest plant. The result obtained from the present study was similar with findings of El-Fouly *et al*. (2020), Ali and Niazi (2019) and Abou-Khadrah and Abdel-Rahman (2018), who recorded significant variation on plant height of brinjal due to different doses of potassium.

Plant height of brinjal at different growth stages was significantly influenced by application of different variety and potassium combinations (Table 1 and Appendix IV). Results revealed that the highest plant height (41.13, 78.25 and 93.72 cm at 20, 40 and 60 DAT, respectively) were found from the treatment combination $V_1K_3$ which significantly differed to other treatment combinations followed by $V_1K_2$. The lowest plant height (31.45, 46.47 and 61.25 cm at 20, 40 and 60 DAT, respectively) was identified from the treatment combination of $V_2K_0$ which differed significantly to other treatment combinations.

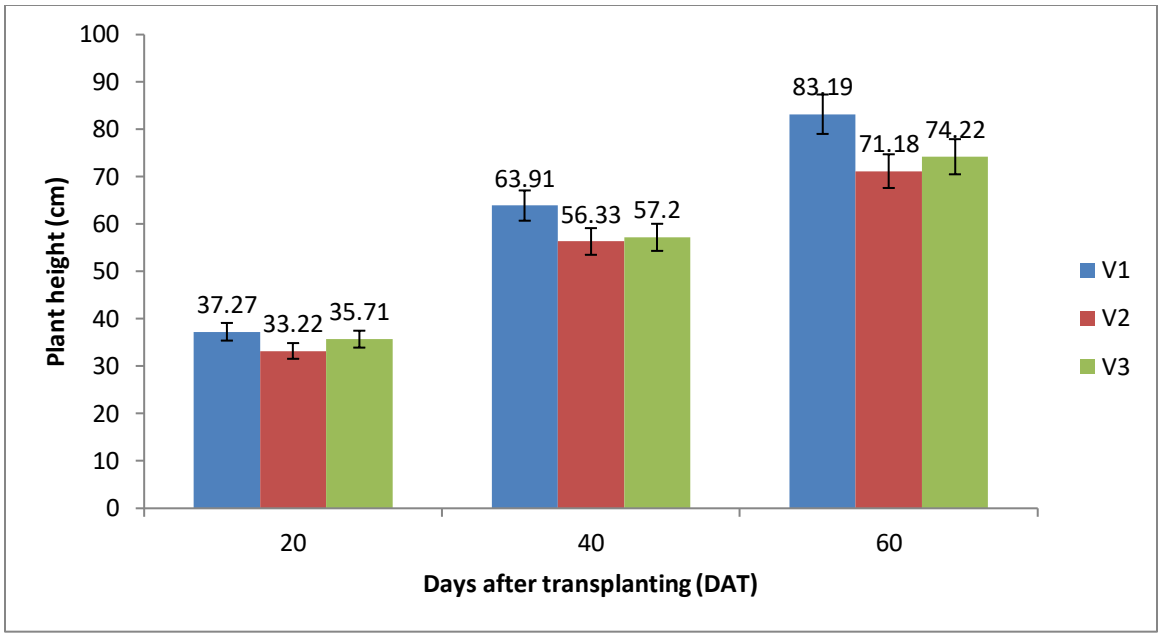



**Figure 2.** Plant height of brinjal as influenced by different varieties

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10

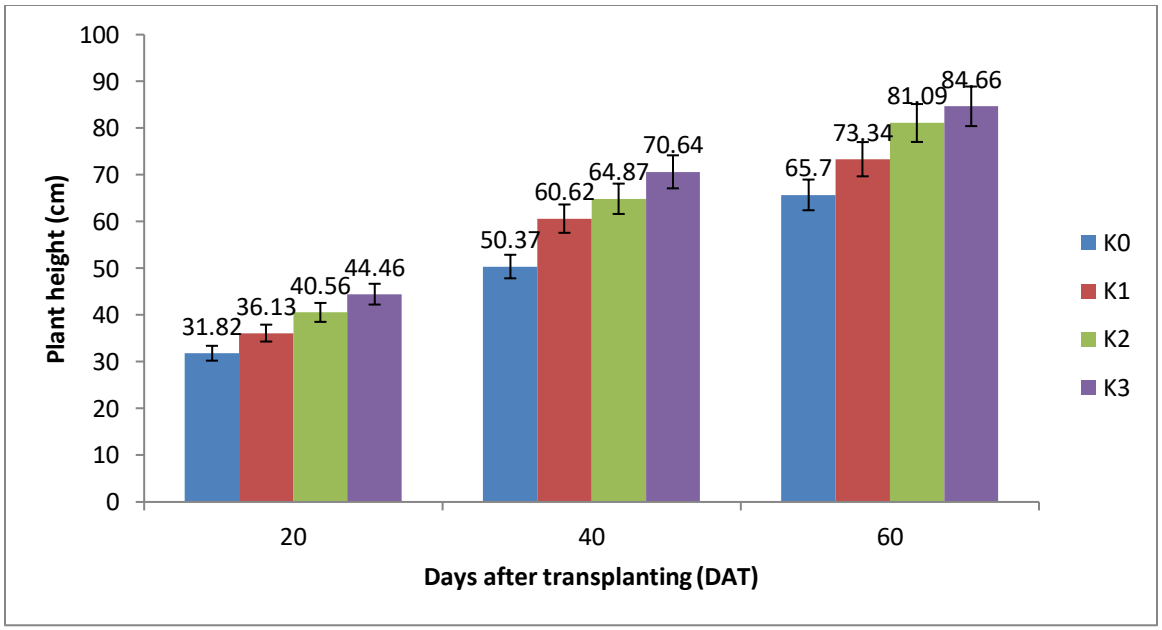



**Figure 3.** Plant height of brinjal as influenced by different potassium levels

$K_0$ = Control (no K; 0 kg K $ha^{-1}$), $K_1$ = 95 kg K $ha^{-1}$, $K_2$ = 115 kg K $ha^{-1}$, $K_3$ = 135 kg K $ha^{-1}$

Table 1. Plant height of brinjal as influenced by different treatment combinations of varieties and potassium levels

| Treatments | Plant height (cm) at | | |
|---|---|---|---|
| | 20 DAT | 40 DAT | 60 DAT |
| $V_1K_0$ | 34.00 d | 56.30 f | 71.20 f |
| $V_1K_1$ | 37.67 cd | 63.46 de | 78.36 de |
| $V_1K_2$ | 39.89 ab | 74.58 b | 89.47 b |
| $V_1K_3$ | 41.13 a | 78.25 a | 93.72 a |
| $V_2K_0$ | 31.45 f | 46.47 h | 61.25 h |
| $V_2K_1$ | 37.43 d | 54.56 f | 69.40 f |
| $V_2K_2$ | 39.27 bc | 60.59 e | 75.45 e |
| $V_2K_3$ | 39.63 ab | 63.77 d | 78.63 d |
| $V_3K_0$ | 32.65 ef | 49.79 g | 64.65 g |
| $V_3K_1$ | 37.13 d | 57.65 f | 72.25 f |
| $V_3K_2$ | 38.17 bcd | 64.76 de | 78.36 de |
| $V_3K_3$ | 38.73 bc | 68.03 c | 81.63 c |
| $LSD_{0.05}$ | 1.716 | 2.990 | 2.981 |
| CV(%) | 7.792 | 8.820 | 11.24 |

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 5% level of significance

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10
$K_0$ = Control (no K; 0 kg K $ha^{-1}$), $K_1$ = 95 kg K $ha^{-1}$, $K_2$ = 115 kg K $ha^{-1}$, $K_3$ = 135 kg K $ha^{-1}$

### 4.1.2 Number of leaves $plant^{-1}$

Significant variation was observed on number of leaves $plant^{-1}$ at different DAT due to influenced by different brinjal varieties except at 40 DAT (Fig. 4 and Appendix V). However, it was found that the highest number of leaves $plant^{-1}$ at 20, 40 and 60 DAT (27.42, 29.88 and 35.18, respectively) was obtained from the variety $V_1$ (BARI hybrid begun-4) followed by the variety $V_2$ (BARI begun-8) where the lowest number of leaves $plant^{-1}$ (24.24, 30.21 and 33.44 at 20, 40 and 60 DAT, respectively) was obtained from the variety $V_3$ (BARI begun-10). Sahu *et al*. (2022) and Singh *et al*. (2019) also observed similar result with the present

finding; they reported significant variation on number of leaves plant$^{-1}$ due to varietal difference.

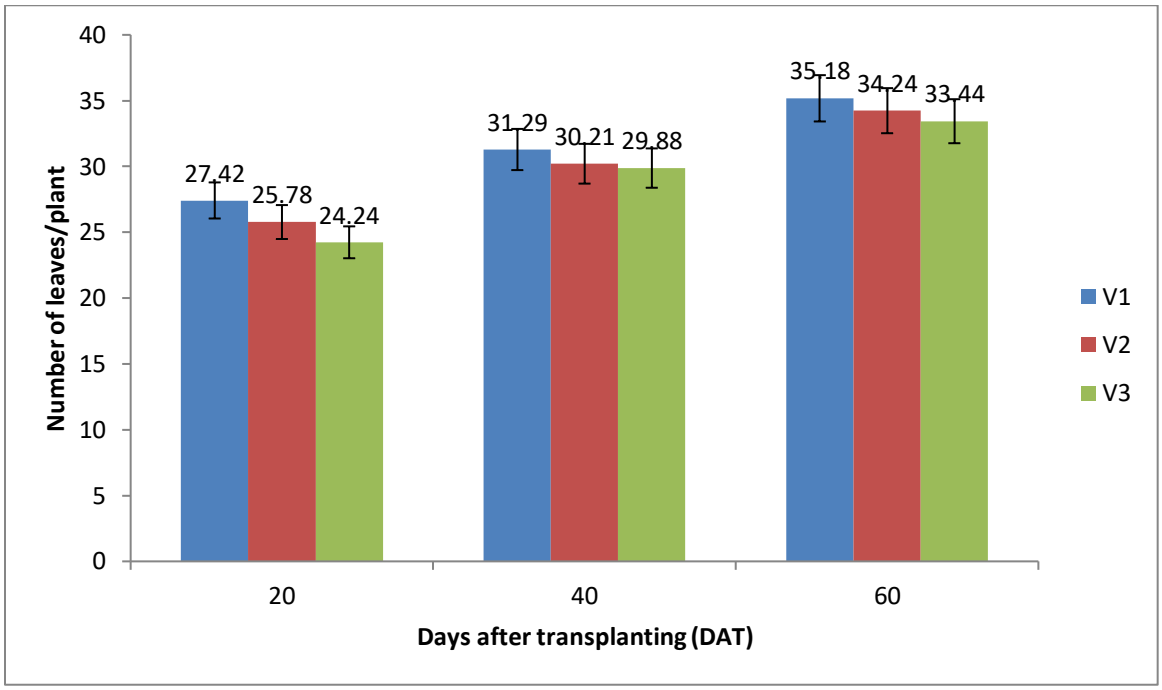



**Figure 4.** Number of leaves plant$^{-1}$ of brinjal as influenced by different varieties

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10

Number of leaves plant$^{-1}$ at different DAT was significantly varied due to different potassium levels (Fig. 5 and Appendix V). Results indicated that the highest number of leaves plant$^{-1}$ at 20, 40 and 60 DAT (26.95, 30.56 and 36.87, respectively) were achieved from the treatment $K_3$ (135 kg K ha$^{-1}$) which was statistically identical to $K_2$ (115 kg K ha$^{-1}$) treatment. The lowest number of leaves plant$^{-1}$ at harvest (20.72, 24.25 and 29.73 at 20, 40 and 60 DAT, respectively) were achieved from the control treatment $K_0$ (0 kg K ha$^{-1}$). El-Fouly *et al*. (2020) and Ali and Niazi (2019) also found similar result on number of leaves plant$^{-1}$ which supported the present finding.

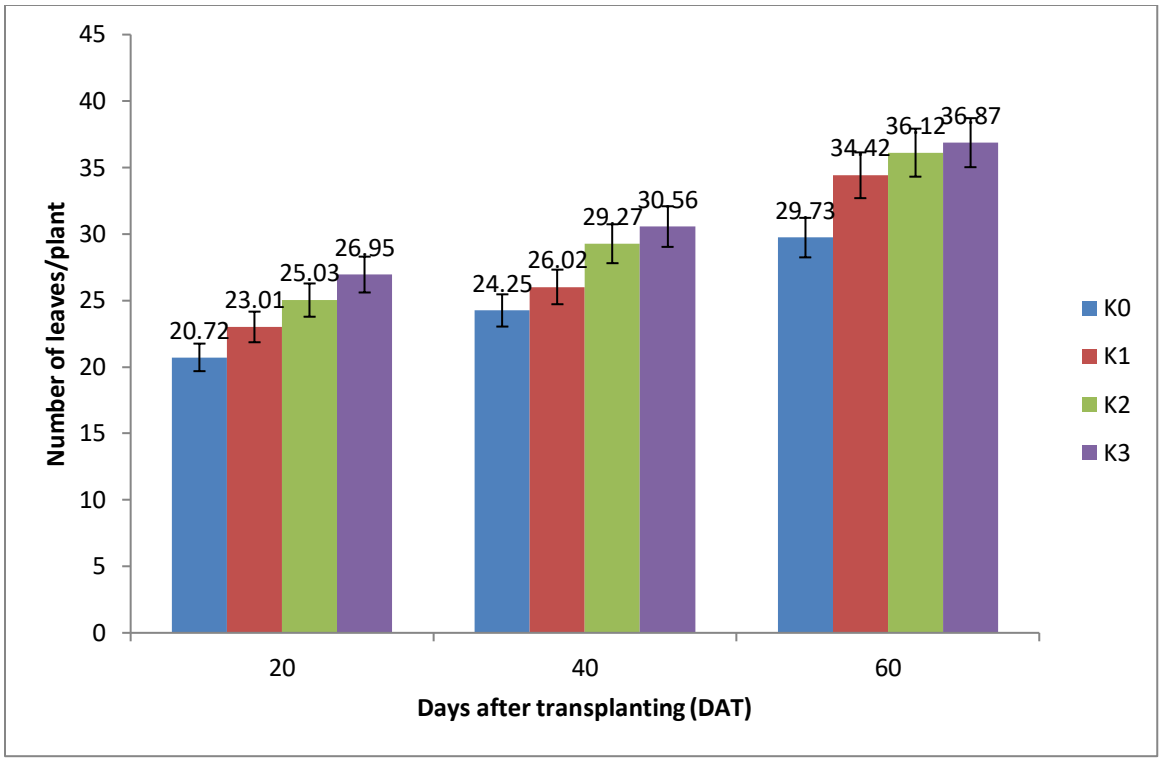



**Figure 5.** Number of leaves plant$^{-1}$ of brinjal as influenced by different potassium levels

$K_0$ = Control (no K; 0 kg K ha$^{-1}$), $K_1$ = 95 kg K ha$^{-1}$, $K_2$ = 115 kg K ha$^{-1}$, $K_3$ = 135 kg K ha$^{-1}$

Remarkable variation was observed on number of leaves plant$^{-1}$ at different DAT as influenced by different variety and potassium combinations except at 40 DAT (Table 2 and Appendix V). However, the highest number of leaves plant$^{-1}$ at 20, 40 and 60 DAT (26.80, 28.88 and 38.12, respectively) were found from the treatment combination of $V_1K_3$ which was statistically similar to $V_1K_2$ and $V_2K_3$ treatment combinations at 60 DAT. The lowest number of leaves plant$^{-1}$ (21.01, 26.02 and 28.52at 20, 40 and 60 DAT, respectively) were found from the treatment combination of $V_3K_0$ which was statistically similar to $V_2K_0$ treatment combination at 60 DAT.

Table 2. Number of leaves plant$^{-1}$ of brinjal as influenced by different treatment combinations of varieties and potassium levels

| Treatments | Number of leaves plant$^{-1}$ at | | |
|---|---|---|---|
| | 20 DAT | 40 DAT | 60 DAT |
| $V_1K_0$ | 24.07 c | 27.07 | 31.04 e |
| $V_1K_1$ | 26.17 b | 28.98 | 34.67 cd |
| $V_1K_2$ | 27.11 a | 29.11 | 36.88 ab |
| $V_1K_3$ | 26.80 a | 28.88 | 38.12 a |
| $V_2K_0$ | 21.35 fg | 27.12 | 29.62 ef |
| $V_2K_1$ | 21.67 f | 27.80 | 34.40 d |
| $V_2K_2$ | 22.59 de | 28.43 | 36.24 bc |
| $V_2K_3$ | 22.31 e | 28.16 | 36.70 ab |
| $V_3K_0$ | 21.01 g | 26.02 | 28.52 f |
| $V_3K_1$ | 22.50 e | 27.44 | 34.20 d |
| $V_3K_2$ | 23.11 d | 27.79 | 35.24 bcd |
| $V_3K_3$ | 22.85 de | 28.73 | 35.80 bcd |
| $LSD_{0.05}$ | 0.616 | $3.629^{NS}$ | 0.6002 |
| CV(%) | 6.32 | 5.89 | 8.36 |

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 5% level of significance

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10
$K_0$ = Control (no K; 0 kg K ha$^{-1}$), $K_1$ = 95 kg K ha$^{-1}$, $K_2$ = 115 kg K ha$^{-1}$, $K_3$ = 135 kg K ha$^{-1}$

## 4.2 Yield contributing parameters

### 4.2.1 Number of branches plant$^{-1}$

Significant influence was noted on number of branches plant$^{-1}$ affected by different brinjal varieties (Table 3 and Appendix VI). The highest number of branches plant$^{-1}$ at 60 DAT (10.10) was obtained from the variety $V_1$ (BARI hybrid begun-4) which was significantly different from other varieties whereas the lowest number of branches plant$^{-1}$ at 60 DAT (8.92) was obtained from the variety $V_3$ (BARI begun-10) which was statistically identical to the variety $V_2$ (BARI begun-

8). Supported result on number of branches plant$^{-1}$ was also observed by Sahu *et al*. (2022), Singh *et al*. (2019) and Saini and Singh (2017).

Number of branches plant$^{-1}$ varied significantly due to different treatments of potassium (K) (Table 3 and Appendix VI). It was observed that the highest number of branches plant$^{-1}$ at harvest (11.22) was achieved from the $K_2$ (115 kg K ha$^{-1}$) treatment which was statistically identical to $K_3$ (135 kg K ha$^{-1}$) treatment. The lowest number of branches plant$^{-1}$ at harvest (7.13) was achieved from the control treatment $K_0$ (0 kg K ha$^{-1}$) which significantly differed to other treatments. The result obtained from the present study was similar with findings of El-Fouly *et al*. (2020) and Choudhary and Sharma (2013).

Significant variation was remarked on number of branches plant$^{-1}$ as influenced by different treatment combinations of variety and potassium (Table 3 and Appendix VI). At harvest the highest number of branches per plant (12.28) was found from the $V_1K_2$ treatment combination which was statistically similar to $V_1K_3$ whereas the lowest number of branches per plant (6.82) was found from the $V_3K_0$ treatment combination that was statistically similar to the treatment combinations of $V_2K_0$ and $V_1K_0$.

### 4.2.2 Days to 1$^{st}$ flowering

Days to 1$^{st}$ flowering was significantly influenced by different varieties of egg plant (Table 3 and Appendix VI). It was found that the lowest days required for 1$^{st}$ flowering (63.75 days) was obtained from the variety $V_1$ (BARI hybrid begun-4) which was significantly different from other varieties whereas the highest days to 1$^{st}$ flowering (66.43 days) was obtained from the variety $V_3$ (BARI begun-10) which was statistically identical to variety $V_2$ (BARI begun-8). Similar result was also found from the findings of Alama *et al*. (2021) and Sahu *et al*. (2022) who reported variation on days to first flowering varied significantly due to varietal difference.

Days to 1st flowering of brinjal was significantly affected by different potassium (K) levels (Table 3 and Appendix VI). The lowest days to 1st flowering (64.89 days) was achieved from the $K_2$ (115 kg K $ha^{-1}$) treatment which was statistically identical to $K_3$ (135 kg K $ha^{-1}$) treatment. The highest days to 1st flowering (67.99 days) was observed from the control treatment $K_0$ (0 kg K $ha^{-1}$) treatment which significantly differed to other treatments followed by $K_1$ (95 kg K $ha^{-1}$). Abou-Khadrah and Abdel-Rahman (2018) reported that early flowering with potassium application which supported the present study.

Variation on days to 1st flowering was significantly influenced by different variety and potassium (K) levels (Table 3 and Appendix VI). The lowest days to 1st flowering (62.44 days) was found from the $V_1K_2$ treatment combination which was statistically identical to $V_1K_3$. The highest days to 1st flowering (68.12 days) was found from the $V_3K_0$ treatment combination which was statistically identical to $V_2K_0$ treatment combination.

### 4.2.3 Number of fruits $plant^{-1}$

The recorded data on number of fruits $plant^{-1}$ was significant due to different brinjal varieties (Table 3 and Appendix VI). Results showed that the highest number of fruits $plant^{-1}$ (31.88) was obtained from variety $V_1$ (BARI hybrid begun-4) followed by $V_3$ (BARI begun-10). The lowest number of fruits $plant^{-1}$ (21.93) was obtained from the variety$V_2$ (BARI begun-8). Similar findings were also observed by Sahu *et al*. (2022) and Alama *et al*. (2021) also reported significant variation among different brinjal varieties on fruit number per plant which supported the present finding.

Considerable influence was observed on number of fruits $plant^{-1}$ obtained from different potassium (K) treatments (Table 3 and Appendix VI). The highest number of fruits $plant^{-1}$ (29.93) was achieved from the $K_2$ (115 kg K $ha^{-1}$) treatment which was statistically identical to $K_3$ (135 kg K $ha^{-1}$) whereas the

lowest number of fruits plant$^{-1}$ (19.03) was recorded from the control treatment $K_0$ (0 kg K ha$^{-1}$). The result obtained from the present study was similar with findings of Ali and Niazi (2019) who reported that potassium application significantly increased the number of fruits per plant.

Remarkable variation was identified on number of fruits plant$^{-1}$ due to the different treatmetn combinations of variety and potassium (K) levels (Table 3 and Appendix VI). The highest number of fruits plant$^{-1}$ (37.30) was found from the treatment combination of $V_1K_2$ which was significantly different from other treatment combinations followed by $V_1K_3$. The lowest number of fruits plant$^{-1}$ (16.40) was found from the treatment combination of $V_2K_0$ which was statistically identical to $V_3K_0$ treatment combination.

### 4.2.4 Single fruit weight (g)

Single fruit weight was significantly affected different brinjal varieties (Table 3 and Appendix VI). The highest single fruit weight (58.18 g) was obtained from the $V_1$ (BARI hybrid begun-4) variety followed by $V_2$ (BARI begun-8). The lowest single fruit weight (45.45 g) was obtained from the variety $V_3$ (BARI begun-10) which was significantly different from other varieties. The result obtained from the present study was similar with findings of Sahu *et al*. (2022).

Variation on single fruit weight was significantly influenced by different potassium (K) treatments (Table 3 and Appendix VI). The highest single fruit weight (55.46 g) was achieved from the $K_2$ (115 kg K ha$^{-1}$) treatment which was statistically identical to $K_1$ (95 kg K ha$^{-1}$) and $K_3$ (135 kg K ha$^{-1}$) treatments where the lowest single fruit weight (42.22 g) was identified from the control treatment $K_0$ (0 kg K ha$^{-1}$). Ashraf *et al*. (2019) reported that potassium had significant contribution on individual fruit weight which supported the present findings.

Single fruit weight of brinjal was significantly affected by combined effect of variety and potassium (K) (Table 3 and Appendix VI). Results revealed that the

highest single fruit weight (66.05 g) was found from the $V_1K_2$ treatment combination which was significantly different from other treatment combinations followed by $V_1K_1$ and $V_1K_3$. The lowest single fruit weight (39.98 g) was found from the treatment combination $V_3K_0$ which was significantly different from other treatment combinations.

### 4.2.5 Fruit length (cm)

Significant variation was observed on fruit length influenced by different brinjal varieties (Table 3 and Appendix VI). The highest fruit length (26.12 cm) was obtained from the variety $V_1$ (BARI hybrid begun-4) followed by $V_3$ (BARI begun-10) whereas the lowest fruit length (13.90 cm) was obtained from the variety $V_1$ (BARI hybrid begun-4). Sahu *et al*. (2022) and Alama *et al*. (2021) also found similar result with the present study.

Fruit length was significantly varied due to different potassium (K) treatments (Table 3 and Appendix VI). Results indicated that the highest fruit length (23.60 cm) was achieved from the $K_2$ (115 kg K $ha^{-1}$) treatment which was statistically identical to $K_3$ (135 kg K $ha^{-1}$) treatment where the lowest fruit length (18.28 cm) was achieved from the control treatment $K_0$ (0 kg K $ha^{-1}$). Abou-Khadrah and Abdel-Rahman (2018) also found similar result with the present finding.

Remarkable variation was observed on fruit length were influenced by different treatment combinations of variety and potassium (K) (Table 3 and Appendix VI). Results showed that the highest fruit length (28.28 cm) was found from the $V_2K_2$ treatment combination which was statistically similar to $V_2K_3$ treatment combination. The lowest fruit length (11.43 cm) was found from the $V_1K_0$ treatment combination which was significantly different from other treatment combination.

### 4.2.6 Fruit diameter (cm)

Significant variation was observed on fruit diameter influenced by different brinjal varieties (Table 3 and Appendix VI). The highest fruit diameter (8.12 cm) was obtained from the variety $V_1$ (BARI hybrid begun-4) whereas the lowest fruit diameter (4.07 cm) was obtained from the variety $V_1$ (BARI hybrid begun-4) which was statistically identical to $V_3$ (BARI begun-10). Alama *et al*. (2021) also found similar result with the present study.

Fruit diameter was significantly varied due to different potassium (K) treatments (Table 3 and Appendix VI). Results revealed that the highest fruit diameter (6.35 cm) was achieved from the $K_2$ (115 kg K $ha^{-1}$) treatment which was statistically identical to $K_3$ (135 kg K $ha^{-1}$) treatment where the lowest fruit diameter (4.21 cm) was recorded from the control treatment $K_0$ (0 kg K $ha^{-1}$). Supported result was also observed by Abou-Khadrah and Abdel-Rahman (2018).

Remarkable variation was observed on fruit diameter influenced by different treatment combinations of variety and potassium (K) (Table 3 and Appendix VI). Results reviewed that the highest fruit diameter (9.17 cm) was found from the $V_1K_2$ treatment combination which was statistically identical to $V_1K_3$ treatment combination. The lowest fruit diameter (3.06 cm) was found from the $V_2K_0$ treatment combination which was statistically similar to $V_3K_0$.

Table 3. Yield contributing parameters of eggplant varieties as influenced by different potassium levels

| Treatments | Yield contributing parameters | | | | | |
|---|---|---|---|---|---|---|
| | Number of branches plant$^{-1}$ at 60 DAT | Days to 1$^{st}$ flowering | Number of fruits plant$^{-1}$ | Single fruit weight (g) | Fruit length (cm) | Fruit diameter (cm) |
| Effect of variety | | | | | | |
| $V_1$ | 10.10 a | 63.75 b | 31.88 a | 58.18 a | 13.90 c | 8.12 a |
| $V_2$ | 9.02 b | 65.57 a | 21.93 c | 52.31 b | 26.12 a | 4.07 b |
| $V_3$ | 8.92 b | 66.43 a | 23.90 b | 45.45 c | 24.06 b | 4.42 b |
| $LSD_{0.05}$ | 0.968 | 1.039 | 1.880 | 1.598 | 1.334 | 0.596 |
| Effect of potassium (K) | | | | | | |
| $K_0$ | 7.13 c | 67.99 a | 19.03 c | 42.22 b | 18.18 c | 4.21 c |
| $K_1$ | 8.67 b | 66.33 b | 26.11 b | 55.35 a | 21.11 b | 5.52 b |
| $K_2$ | 11.22 a | 64.89 c | 29.93 a | 55.46 a | 23.60 a | 6.35 a |
| $K_3$ | 10.57 a | 65.21 c | 28.53 a | 54.88 a | 22.67 a | 6.07 a |
| $LSD_{0.05}$ | 1.423 | 1.005 | 1.871 | 1.585 | 1.432 | 0.610 |
| Combined effect of variety and potassium | | | | | | |
| $V_1K_0$ | 7.76 ef | 65.45 c | 23.40 fg | 42.63 g | 11.43 h | 6.12 c |
| $V_1K_1$ | 9.18 cd | 63.78 d | 31.63 c | 61.56 b | 13.38 g | 8.22 b |
| $V_1K_2$ | 12.28 a | 62.44 e | 37.30 a | 66.05 a | 15.56 f | 9.17 a |
| $V_1K_3$ | 11.27 ab | 62.79 e | 35.20 b | 62.48 b | 14.78 f | 8.99 a |
| $V_2K_0$ | 6.85 f | 67.45 a | 16.40 h | 44.05 g | 22.56 d | 3.06 g |
| $V_2K_1$ | 8.48 de | 65.78 bc | 22.40 g | 53.68 d | 25.75 c | 3.72 f |
| $V_2K_2$ | 10.68 b | 64.12 d | 24.70 ef | 56.79 c | 28.28 a | 4.64 de |
| $V_2K_3$ | 10.29 bc | 64.45 d | 24.20 fg | 54.70 d | 27.44 ab | 4.36 e |
| $V_3K_0$ | 6.82 f | 68.12 a | 17.30 h | 39.98 h | 20.35 c | 3.39 fg |
| $V_3K_1$ | 8.38 de | 66.45 b | 24.30 f | 46.32 f | 23.69 d | 4.56 e |
| $V_3K_2$ | 10.56 bc | 64.13 d | 27.80 d | 48.04 e | 26.43 bc | 5.16 d |
| $V_3K_3$ | 10.16 bc | 64.46 d | 26.20 de | 47.45 ef | 25.27c | 4.90 de |
| $LSD_{0.05}$ | 1.379 | 0.950 | 1.88 | 1.571 | 1.328 | 0.600 |
| CV(%) | 7.25 | 8.92 | 7.47 | 9.45 | 8.16 | 7.35 |

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 5% level of significance

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10

$K_0$ = Control (no K; 0 kg K ha$^{-1}$), $K_1$ = 95 kg K ha$^{-1}$, $K_2$ = 115 kg K ha$^{-1}$, $K_3$ = 135 kg K ha$^{-1}$

## 4.3 Yield parameters

### 4.3.1 Dry matter content of leaves (%)

Significant influence was noted on dry matter percentage of leaf affected by different brinjal varieties (Table 4 and Appendix VII). The highest matter percentage of leaf (11.60%) was obtained from the variety $V_1$ (BARI hybrid begun-4) followed by $V_2$ (BARI begun-8) where the lowest matter percentage of leaf (10.30%) was obtained from the variety $V_3$ (BARI begun-10). Sahu *et al*. (2022) also observed significant variation on fruit yield plant$^{-1}$ among different varieties of brinjal which supported the present findings.

Percent dry matter content of leaf significantly influenced due to the effect of different potassium (K) treatments (Table 4 and Appendix VII). The highest dry matter percentage of leaf (12.00%) was achieved from the treatment of $K_2$ (115 kg K ha$^{-1}$) followed by $K_3$ (135 kg K ha$^{-1}$). The lowest dry matter percentage of leaf (10.14%) was achieved from the control treatment $K_0$ (0 kg K ha$^{-1}$). Ali and Niazi (2019) also found higher fruit yield plant$^{-1}$ with higher doses of potassium which supported the present findings.

Significant variation was remarked for dry matter percentage of leaf as influenced by different combinations of variety and potassium (K) treatments (Table 4 and Appendix VII). It was found that the highest dry matter percentage of leaf (12.77%) was observed from the $V_1K_2$ that was statistically similar to treatment combinations of $V_2K_2$ and $V_2K_3$ whereas the lowest dry matter percentage of leaf (10.05% g) was found from the $V_3K_0$ treatment combination which was statistically to $V_2K_0$, $V_2K_1$, $V_3K_1$ and $V_3K_3$.

Table 4. Yield parameters of eggplant varieties as influenced by different potassium levels

| Treatments | Yield parameters | | | |
|---|---|---|---|---|
| | Dry matter content of leaves (%) | Fruit yield plant$^{-1}$ (g) | Fruit yield plot$^{-1}$ (kg) | Fruit yield ha$^{-1}$ (t) |
| Effect of variety | | | | |
| $V_1$ | 11.60 a | 1895.00 a | 17.06 a | 45.13 a |
| $V_2$ | 10.50 b | 1163.00 b | 10.47 b | 27.69 b |
| $V_3$ | 10.30 b | 1099.00 c | 9.89 b | 26.17 b |
| $LSD_{0.05}$ | 0.271 | 47.87 | 1.789 | 3.008 |
| CV(%) | 9.82 | 12.37 | 11.84 | 11.78 |
| Effect of potassium (K) | | | | |
| $K_0$ | 10.14 d | 803.90 d | 7.24 b | 19.14 d |
| $K_1$ | 10.94 c | 1472.00 c | 13.25 a | 35.06 c |
| $K_2$ | 12.00 a | 1678.00 a | 15.11 a | 39.96 a |
| $K_3$ | 11.23 b | 1589.00 b | 14.30 a | 37.83 b |
| $LSD_{0.05}$ | 0.037 | 22.05 | 2.159 | 1.617 |
| CV(%) | 9.80 | 12.37 | 11.84 | 11.78 |
| Combined effect of variety and potassium | | | | |
| $V_1K_0$ | 10.23 d | 997.50 i | 8.980 f | 23.75 g |
| $V_1K_1$ | 11.02 b | 2089.00 c | 18.80 b | 49.74 b |
| $V_1K_2$ | 12.77 a | 2296.00 a | 20.67 a | 54.67 a |
| $V_1K_3$ | 11.68 b | 2199.00 b | 19.79 ab | 52.36 ab |
| $V_2K_0$ | 10.16 c | 722.40 j | 6.50 g | 17.20 h |
| $V_2K_1$ | 10.98 c | 1202.00 g | 10.82 de | 28.63 ef |
| $V_2K_2$ | 11.92 a | 1403.00 d | 12.63 c | 33.40 c |
| $V_2K_3$ | 11.52 ab | 1324.00 e | 11.91 cde | 31.52 cde |
| $V_3K_0$ | 10.05 c | 691.74 k | 6.23 g | 16.47 h |
| $V_3K_1$ | 10.82 c | 1126.00 h | 10.13 ef | 26.80 f |
| $V_3K_2$ | 11.30 b | 1336.00 e | 12.02 cd | 31.80 cd |
| $V_3K_3$ | 10.49 c | 1243.00 f | 11.19 cde | 29.60 def |
| $LSD_{0.05}$ | 0.903 | 19.20 | 1.789 | 3.008 |
| CV(%) | 9.80 | 12.37 | 11.84 | 11.78 |

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 5% level of significance

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10

$K_0$ = Control (no K; 0 kg K ha$^{-1}$), $K_1$ = 95 kg K ha$^{-1}$, $K_2$ = 115 kg K ha$^{-1}$, $K_3$ = 135 kg K ha$^{-1}$

### 4.3.2 Fruit yield plant$^{-1}$ (g)

Significant influence was noted on fruit yield plant$^{-1}$ affected by different brinjal varieties (Table 4 and Appendix VII). The highest fruit yield plant$^{-1}$ (1895.00 g) was obtained from the variety $V_1$ (BARI hybrid begun-4) followed by $V_2$ (BARI begun-8) where the lowest fruit yield plant$^{-1}$ (1099.00 g) was obtained from the variety $V_3$ (BARI begun-10). Alama *et al*. (2021) and Sahu *et al*. (2022) also observed significant variation on fruit yield plant$^{-1}$ among different varieties of brinjal which supported the present findings.

Fruit yield plant$^{-1}$ varied significantly due to the effect of different potassium (K) treatments (Table 4 and Appendix VII). The highest fruit yield plant$^{-1}$ (1678.00 g) was achieved from the treatment of $K_2$ (115 kg K ha$^{-1}$) followed by $K_3$ (135 kg K ha$^{-1}$). The lowest fruit yield plant$^{-1}$ (803.90 g) was achieved from the control treatment $K_0$ (0 kg K ha$^{-1}$). Abou-Khadrah and Abdel-Rahman (2018) and Ali and Niazi (2019) also found higher fruit yield plant$^{-1}$ with higher doses of potassium which supported the present findings.

Significant variation was remarked as influenced by different combinations of variety and potassium (K) treatments (Table 4 and Appendix VII). It was found that the highest fruit yield plant$^{-1}$ (2296.00 g) was observed from the $V_1K_2$ treatment combination followed by $V_1K_3$ and the lowest fruit yield plant$^{-1}$ (691.74 g) was found from the $V_3K_0$ treatment combination which was significantly different from other treatment combinations.

### 4.3.3 Fruit yield plot$^{-1}$ (kg)

The recorded data on fruit yield plot$^{-1}$ was significant due to different brinjal varieties (Table 4 and Appendix VII). The highest fruit yield plot$^{-1}$ (17.06 kg) was obtained from the variety $V_1$ (BARI hybrid begun-4) which was significantly different from other varieties. The lowest fruit yield plot$^{-1}$ (9.89 kg) was obtained from the variety $V_3$ (BARI begun-10).

Considerable influence was observed on fruit yield plot$^{-1}$ persuaded by different potassium (K) treatments (Table 4 and Appendix VII). The highest fruit yield plot$^{-1}$ (15.11 kg) was achieved from the treatment $K_2$ (115 kg K ha$^{-1}$) which was statistically identical to $K_1$ (95 kg K ha$^{-1}$) and $K_3$ (135 kg K ha$^{-1}$) where the lowest fruit yield plot$^{-1}$ (7.24 kg) was achieved from control treatment $K_0$ (0 kg K ha$^{-1}$).

Remarkable variation was identified on fruit yield plot$^{-1}$ due to the different brinjal varieties combined with different potassium (K) treatments (Table 4 and Appendix VII). The highest fruit yield plot$^{-1}$ (20.67 kg) was found from the $V_1K_2$ treatment combination which was statistically similar to $V_1K_3$. The lowest fruit yield plot$^{-1}$ (6.23 kg) was found from the $V_3K_0$ which was statistically identical to the treatment combination of $V_2K_0$.

### 4.3.4 Fruit yield ha$^{-1}$ (t)

Fruit yield ha$^{-1}$ was significantly varied due to different brinjal varieties (Table 4 and Appendix VII). Results revealed that the highest fruit yield ha$^{-1}$ (45.13 t) was obtained from the variety $V_1$ (BARI hybrid begun-4) where the lowest fruit yield ha$^{-1}$ (26.17 t) was obtained from the variety $V_3$ (BARI begun-10) which was statistically identical to $V_2$ (BARI begun-8). The result obtained from the present study was similar with findings of Sahu *et al*. (2022), Singh *et al*. (2019), Tawab *et al*. (2015) and Saini and Singh (2017); they reported significant variation on fruit yield due to varietal difference.

Significant variation was observed on fruit yield ha$^{-1}$ influenced by different potassium (K) treatments (Table 4 and Appendix VII). It was observed that the highest fruit yield ha$^{-1}$ (39.96 t) was achieved from the treatment $K_2$ (115 kg K ha$^{-1}$) followed by $K_3$ (135 kg K ha$^{-1}$) whereas control treatment $K_0$ (0 kg K ha$^{-1}$) showed the lowest fruit yield ha$^{-1}$ (19.14 t). The result obtained from the present study was conformity with findings of El-Fouly *et al*. (2020), Ali and Niazi

(2019), Abou-Khadrah and Abdel-Rahman (2018) and Ashraf *et al*. (2019) who reported significant of potassium at different doses of potassium to brinjal yield.

Remarkable variation was observed on fruit yield $ha^{-1}$ influenced by different brinjal varieties and potassium (K) combinations (Table 4 and Appendix VII). Results indicated that the highest fruit yield $ha^{-1}$ (54.67 t) was found from the treatment combination $V_1K_2$ which was statistically similar to the treatment combination of $V_1K_3$. The lowest fruit yield $ha^{-1}$ (16.47 t) was found from the $V_3K_0$ treatment combination which was statistically identical to the treatment combination of $V_2K_0$. Yield contributing parameters like number of fruits $plant^{-1}$, single fruit weight and fruit yield $plant^{-1}$ were also highest from the treatment combination of $V_1K_2$, which resulted the highest fruit yield $ha^{-1}$ from this treatment combination.

### 4.4 Economic analysis

Economic analysis is included total cost of production, gross return (Tk. $ha^{-1}$), net return (Tk. $ha^{-1}$) and finally benefit cost ration (BCR) (Table 5 and Appendix VIII). Price of brinjal was considered at Kawran Bazar market, Dhaka rate @ Tk. 25 $kg^{-1}$. The economic analysis is presented under the following headlines:

#### 4.4.1 Total cost of production

Different combination of brinjal varieties and potassium (K) showed variation in terms of cost of production $ha^{-1}$ (Table 5 and Appendix VIII). The highest cost of production $ha^{-1}$ (Tk. 320681.00) was recorded from the treatment combination of $V_1K_3$, $V_2K_3$ and $V_3K_3$ followed by $V_1K_2$, $V_2K_2$ and $V_3K_2$ whereas the lowest cost of production $ha^{-1}$ (Tk. 316750.00) was recorded from the treatment combination of $V_1K_0$, $V_2K_0$ and $V_3K_0$.

### 4.4.2 Gross return

Different combination of brinjal varieties and potassium (K) showed distinct differences in gross return $ha^{-1}$ (Table 5 and Appendix VIII). Gross return was calculated on the basis of sale of brinjal. The highest gross return $ha^{-1}$ (Tk. 1093400.00) was obtained from the treatment combination of $V_1K_2$ (BARI hybrid begun-4 + 115 kg K $ha^{-1}$) followed by $V_1K_3$ (Tk. 1047200.00 $ha^{-1}$) which also showed promising results on gross return. The lowest gross return (Tk. 329400.00) obtained from the treatment combination of $V_3K_0$ (BARI begun-10 + 0 kg K $ha^{-1}$) which is very nearest to the treatment combination of $V_2K_0$. The result obtained from the present study was similar with the findings of Sahu *et al.* (2022) who achieved the highest gross income (303100.00 Rs/ha) in Kashi Taru variety with recommended fertilizer doses.

Table 5. Economic analysis of regarding treatment combinations of brinjal varieties and potassium levels

| Treatments | Total cost of production | Yield $ha^{-1}$ | Gross return (Tk. $ha^{-1}$) | Net return (Tk. $ha^{-1}$) | BCR |
|---|---|---|---|---|---|
| $V_1K_0$ | 316750 | 23.75 | 475000 | 158250 | 1.50 |
| $V_1K_1$ | 319546 | 49.74 | 994800 | 675254 | 3.11 |
| $V_1K_2$ | 320070 | 54.67 | 1093400 | 773330 | 3.42 |
| $V_1K_3$ | 320681 | 52.36 | 1047200 | 726519 | 3.27 |
| $V_2K_0$ | 316750 | 17.20 | 344000 | 27250 | 1.09 |
| $V_2K_1$ | 319546 | 28.63 | 572600 | 253054 | 1.79 |
| $V_2K_2$ | 320070 | 33.40 | 668000 | 347930 | 2.09 |
| $V_2K_3$ | 320681 | 31.52 | 630400 | 309719 | 1.97 |
| $V_3K_0$ | 316750 | 16.47 | 329400 | 12650 | 1.04 |
| $V_3K_1$ | 319546 | 26.80 | 536000 | 216454 | 1.68 |
| $V_3K_2$ | 320070 | 31.80 | 636000 | 315930 | 1.99 |
| $V_3K_3$ | 320681 | 29.60 | 592000 | 271319 | 1.85 |

Selling cost of brinjal = 20.00 Tk/kg

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10

$K_0$ = Control (no K; 0 kg K $ha^{-1}$), $K_1$ = 95 kg K $ha^{-1}$, $K_2$ = 115 kg K $ha^{-1}$, $K_3$ = 135 kg K $ha^{-1}$

### 4.4.3 Net return

Different combination of brinjal varieties and potassium (K) showed remarkable variations in net returns (Table 5 and Appendix VIII). The highest net return (Tk. 773330.00) was obtained from the treatment combination of $V_1K_2$ (BARI hybrid begun-4 + 115 kg K $ha^{-1}$) followed by the treatment combination of $V_1K_3$ and $V_1K_1$ which showed second and third highest net return, respectively (Tk. 726519.00 and 675254.00, respectively) compared to other treatment combinations. The lowest net return (Tk. 12650.00) obtained from the treatment combination of $V_3K_0$ (BARI begun-10 + 0 kg K $ha^{-1}$) which was nearest to the treatment combination of $V_2K_0$ (Tk. 27250.00). Supported result was also observed by Sahu *et al*. (2022) who reported the highest net income (240972 Rs/ha) in Kashi Taru variety with recommended fertilizer doses.

### 4.4.4 Benefit cost ratio (BCR)

Different combination of brinjal varieties and potassium (K) showed higher variation on benefit cost ration (BCR) for brinjal production (Table 5 and Appendix VIII). Results showed that the highest BCR (3.42) was found from the treatment combination of $V_1K_2$ (BARI hybrid begun-4 + 115 kg K $ha^{-1}$) followed by $V_1K_3$ and $V_1K_1$ (3.24 and 3.11, respectively). The lowest BCR 1.04) was obtained from the treatment combination of $V_3K_0$ (BARI begun-10 + 0 kg K $ha^{-1}$) which was very close to the treatment combination of $V_2K_0$ (1.09). From economic point of view, it was evident from the above results that the treatment combination of $V_1K_2$ (BARI hybrid begun-4 + 115 kg K $ha^{-1}$) and also $V_1K_3$ (BARI hybrid begun-4 + 135 kg K $ha^{-1}$)) and $V_1K_1$ (BARI hybrid begun-4 + 95 kg K $ha^{-1}$) were more profitable than rest of the treatment combinations. Similar result was also observed by Sahu *et al.* (2022) who recorded the highest benefit cost ratio (3.87) in Kashi Taru variety with recommended fertilizer doses.

# CHAPTER V

## SUMMARY AND CONCLUSION

A research was conducted to investigate the growth and yield of brinjal as influenced by different levels of potassium at horticulture farm of Sher-e-Bangla Agricultural University, Dhaka during the period from March to July 2022. Two factor experiment included 3 brinjal varieties *viz*. $V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10 and 4 potassium treatments *viz*. $K_0$ = Control (no K; 0 kg K $ha^{-1}$), $K_1$ = 95 kg K $ha^{-1}$, $K_2$ = 115 kg K $ha^{-1}$, $K_3$ = 135 kg K $ha^{-1}$ were outlined in Randomized Complete Block Design (RCBD) with three replications.

Results revealed that different brinjal varieties showed significant variations for maximum studied parameters. At 20, 40 and 60 DAT, the highest plant height (37.27, 63.91 and 83.19 cm, respectively) and number of leaves $plant^{-1}$ (27.42, 31.29 and 35.18, respectively) were obtained from the variety $V_1$ (BARI hybrid begun-4) whereas the lowest plant height (33.22, 56.33 and 71.18 cm, respectively) was recorded from the variety $V_2$ (BARI begun-8) but the lowest number of leaves $plant^{-1}$ (24.24, 29.88 and 33.44, respectively) was obtained from the variety $V_3$ (BARI begun-10). The highest number of branches $plant^{-1}$ at harvest (10.10) was obtained from the variety $V_1$ (BARI hybrid begun-4) whereas the lowest number of branches $plant^{-1}$ at harvest (8.92) was obtained from the variety $V_3$ (BARI begun-10). Similarly, the minimum days to $1^{st}$ flowering (63.75 days) was obtained from $V_1$ (BARI hybrid begun-4) variety whereas the maximum days to $1^{st}$ flowering (66.43 days) was obtained from $V_3$ (BARI begun-10). Again, the highest number of fruits $plant^{-1}$ (31.88), single fruit weight (58.18 g), fruit diameter (8.12 cm), dry matter content of leaves (11.60%), fruit yield $plant^{-1}$ (1895.00 g), fruit yield $plot^{-1}$ (17.06 kg) and fruit yield $ha^{-1}$ (45.13 t) were obtained from the variety $V_1$ (BARI hybrid begun-4) while the highest fruit length (26.12

cm) was recorded from $V_2$ (BARI begun-8) variety. The lowest number of fruits plant$^{-1}$ (21.93) and fruit diameter (4.07 cm) was found from the variety $V_2$ (BARI begun-8) while the variety $V_3$ (BARI begun-10) showed the lowest single fruit weight (45.45 g), dry matter content of leaves (10.30), fruit yield plant$^{-1}$ (1099.00 g), fruit yield plot$^{-1}$ (9.89 kg) and fruit yield ha$^{-1}$ (26.17 t) but the lowest fruit length (13.90 cm) was recorded from the variety $V_1$ (BARI hybrid begun-4).

In case of potassium (K) treatments, all the parameters of the study were influenced significantly. Results indicated that at 20, 40 and 60 DAT, the highest plant height (44.46, 70.64 and 84.66 cm, respectively) and number of leaves plant$^{-1}$ (26.95, 30.56 and 36.87, respectively) were recorded from the treatment $K_3$ (135 kg K ha$^{-1}$) while the maximum number of branches plant$^{-1}$ (11.22) was recorded from $K_2$ (115 kg K ha$^{-1}$) treatment whereas at 20, 40 and 60 DAT, the control treatment $K_0$ (0 kg K ha$^{-1}$) showed the lowest plant height (31.82, 50.37 and 65.70 cm, respectively), number of leaves plant$^{-1}$ (20.72, 24.25 and 29.73, respectively) and number of branches plant$^{-1}$ (7.13) at the time of harvest. Results also revealed that the minimum days to 1$^{st}$ flowering (64.89 days) was recorded from $K_2$ (115 kg K ha$^{-1}$) treatment whereas the maximum days to 1$^{st}$ flowering (67.99 days) was recorded from the control treatment $K_0$ (0 kg K ha$^{-1}$). Again, the highest number of fruits plant$^{-1}$ (29.93), single fruit weight (55.46 g), fruit length (22.47 cm), fruit diameter (6.35 cm), dry matter content of leaves (12.00%), fruit yield plant$^{-1}$ (1678.00 g), fruit yield plot$^{-1}$ (15.11 kg) and fruit yield ha$^{-1}$ (39.96 t) were attained from the treatment $K_2$ (115 kg K ha$^{-1}$). The lowest number of fruits plant$^{-1}$ (19.03), single fruit weight (42.22 g), fruit length (18.18 cm), fruit diameter (4.21 cm), dry matter content of leaves (10.14%), fruit yield plant$^{-1}$ (803.90 g), fruit yield plot$^{-1}$ (7.24 kg) and fruit yield ha$^{-1}$ (19.14 t) were recorded from the control treatment $K_0$ (0 kg K ha$^{-1}$).

In terms of combined effect of variety and potassium (K), different treatment combinations showed significant variation for different parameters of brinjal.

Results showed that at 20, 40 and 60 DAT, the highest plant height (41.13, 78.25 and 93.92 cm, respectively) and number of leaves plant$^{-1}$ (26.80, 28.88 and 38.12, respectively) were found from the treatment combination of $V_1K_3$ but the highest number of branches plant$^{-1}$ at harvest (12.28) was recorded from $V_1K_2$ whereas at 20, 40 and 60 DAT, the lowest plant height (31.45, 46.47 and 61.25 cm, respectively) was found from the treatment combination of $V_2K_0$ while lowest number of leaves plant$^{-1}$ (21.04, 26.02 and 18.25, respectively) and number of branches plant$^{-1}$ at harvest (6.82) were found from the treatment combination of $V_3K_0$. Again, the minimum days to 1$^{st}$ flowering (62.44 days) was found from the treatment combination of $V_1K_2$ whereas the maximum minimum days to 1$^{st}$ flowering (68.12 days) was recorded from $V_3K_0$. Similarly, the highest number of fruits plant$^{-1}$ (37.30), single fruit weight (66.05 g), fruit diameter (9.17 cm), dry matter content of leaves (12.77%), fruit yield plant$^{-1}$ (12296.00 g), fruit yield plot$^{-1}$ (20.67 kg) and fruit yield ha$^{-1}$ (54.67 t) were attained from the treatment combination of $V_1K_2$ while the highest fruit length (28.28 cm) was recorded from $V_2K_2$. The lowest number of fruits plant$^{-1}$ (16.40) and fruit diameter (3.06 cm) were recorded from the treatment combinations of $V_2K_0$ while the lowest single fruit weight (39.98 g) and fruit length (11.43 cm) were recorded from the treatment combinations of $V_3K_0$ and $V_1K_0$, respectively. Likewise, the lowest dry matter content of leaves (10.05%), fruit yield plant$^{-1}$ (691.74 g), fruit yield plot$^{-1}$ (6.23 kg) and fruit yield ha$^{-1}$ (16.47 t) were recorded from the treatment combination of $V_3K_0$.

Consideration of economic analysis, the highest gross return (Tk. 1093400.00), net return (Tk. 773330.00) and BCR (3.42) were found from the treatment combination of $V_1K_2$ whereas the lowest gross return (Tk. 329400.00), net return (Tk. 12650.00) and BCR (1.04) was obtained from the treatment combination of $V_3K_0$.

Based on the experimental results, it may be concluded that-

- Application of K combination on different brinjal varieties had significant effect on growth and yield and the treatment combination of $V_1K_2$ seemed to be more suitable for getting higher fruit yield in brinjal.
- Considering economic return, the treatment combination $V_1K_2$ also showed best performance.

**Recommendation**

Considering the above observations of the present study, the following recommendations could be made.

1. The experiment was conducted only one growing season, further study may be needed for ensuring the suitable brinjal variety and potassium (K) level in relation to growth, fruit yield and economic benefits of brinjal in different agro-ecological zones (AEZ) of Bangladesh for regional adaptability.
2. More another doses of potassium (K) may be needed to include for future study as sole or different combination.

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## APPENDICES

Appendix I. Agro-Ecological Zone of Bangladesh showing the experimental location

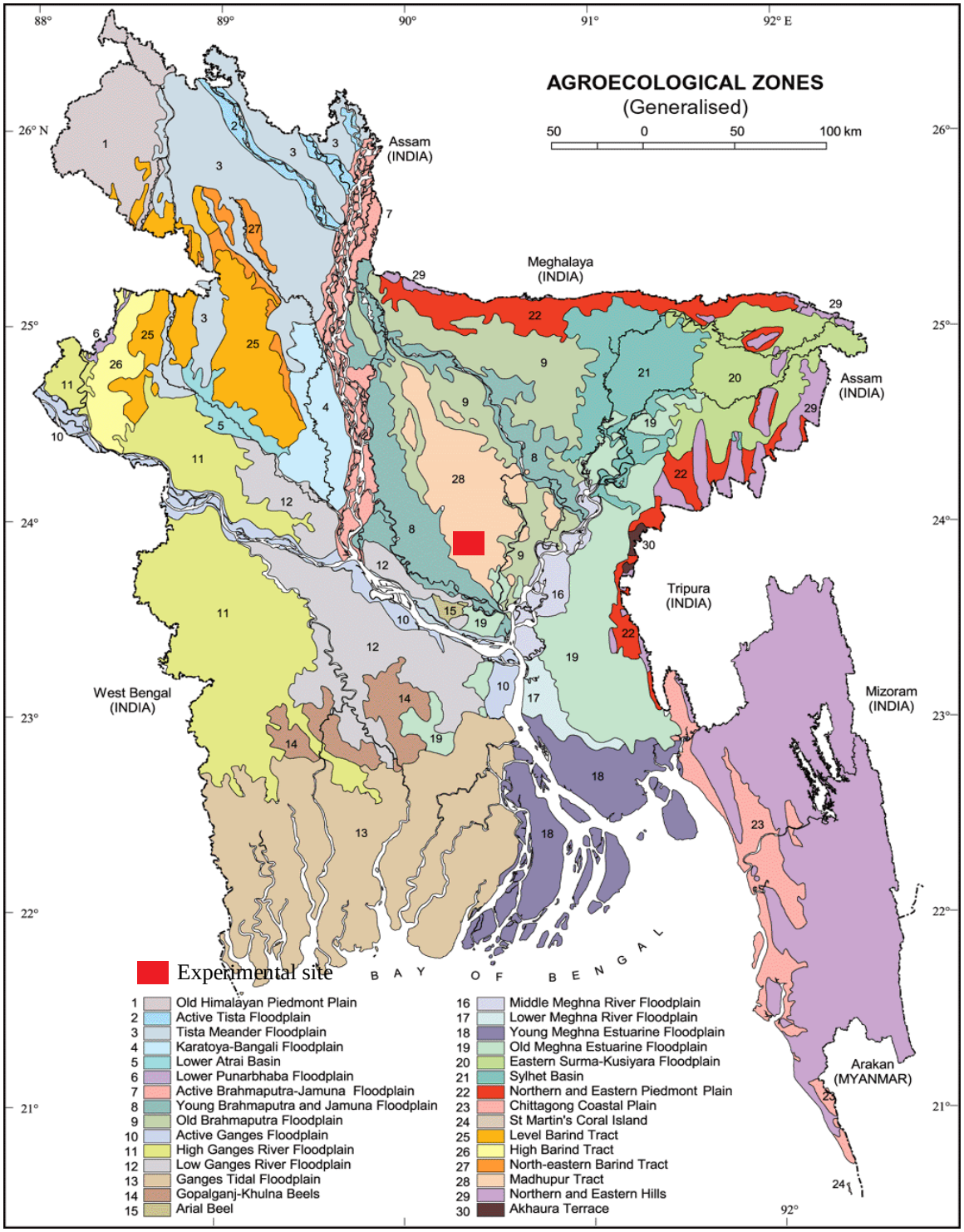


Figure 6. Experimental site

Appendix II. Monthly records of air temperature, relative humidity and rainfall during the period from April to August 2022.

| Year | Month | Air temperature (°C) | | | Relative humidity (%) | Rainfall (mm) |
|---|---|---|---|---|---|---|
| | | *Max* | *Min* | *Mean* | | |
| 2022 | April | 34.70 | 24.60 | 29.65 | 65.40 | 165.0 |
| 2022 | May | 32.64 | 23.85 | 28.25 | 68.30 | 182.2 |
| 2022 | June | 27.40 | 23.44 | 25.42 | 71.28 | 190 |
| 2022 | July | 30.52 | 24.80 | 27.66 | 78.00 | 536 |
| 2022 | August | 31.00 | 25.60 | 28.30 | 80.00 | 348 |

Source: Bangladesh Meteorological Department (Climate division), Agargaon, Dhaka-1212.

Appendix III. Characteristics of experimental soil analyzed at Soil Resources Development Institute (SRDI), Farmgate, Dhaka.

A. Morphological characteristics of the experimental field

| **Morphological features** | **Characteristics** |
|---|---|
| Location | Agronomy Farm, SAU, Dhaka |
| *AEZ* | Modhupur Tract (28) |
| General Soil Type | Shallow red brown terrace soil |
| Land type | High land |
| Soil series | Tejgaon |
| Topography | Fairly leveled |
| Flood level | Above flood level |
| Drainage | Well drained |
| Cropping pattern | Not Applicable |

Source: Soil Resource Development Institute (SRDI)

B. Physical and chemical properties of the initial soil

| **Characteristics** | **Value** |
|---|---|
| Partical size analysis % Sand | 27 |
| %Silt | 43 |
| % Clay | 30 |
| Textural class | Silty Clay Loam |
| pH | 5.6 |
| Organic carbon (%) | 0.45 |
| Organic matter (%) | 0.78 |
| Total N (%) | 0.03 |
| Available P (ppm) | 20 |
| Exchangeable K ( me/100 g soil) | 0.1 |
| Available S (ppm) | 45 |

Source: Soil Resource Development Institute (SRDI)

Appendix IV. Analysis of variance of the data on plant height of brinjal at different days after transplanting

| Sources of variation | Degrees of freedom | Mean square of plant height at | | |
|---|---|---|---|---|
| | | 20 DAT | 40 DAT | 60 DAT |
| Replication | 2 | 4.352 | 12.156 | 12.146 |
| Factor A (variety) | 2 | 26.201** | 144.691** | 63.232** |
| Factor B (potassium) | 3 | 10.825** | 253.272** | 201.685* |
| Interaction (A×B) | 6 | 0.7892** | 20.006** | 17.0401* |
| Error | 22 | 0.8165 | 0.6792 | 0.175 |

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix V. Analysis of variance of the data number of leaves plant$^{-1}$ of brinjal at different days after transplanting

| Sources of variation | Degrees of freedom | Mean square of number of leaves plant$^{-1}$ at | | |
|---|---|---|---|---|
| | | 20 DAT | 40 DAT | 60 DAT |
| Replication | 2 | 7.0321 | 10.615 | 13.333 |
| Factor A (variety) | 2 | 18.124** | 27.127** | 65.563* |
| Factor B (potassium) | 3 | 20.275** | 178.485** | 170.357* |
| Interaction (A×B) | 6 | 0.7573** | 10.8018** | 16.668** |
| Error | 22 | 0.135 | 0.7352 | 0.9104 |

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix VI. Analysis of variance of the data on yield contributing parameters of brinjal varieties as influenced by different potassium levels

| Sources of variation | Degrees of freedom | Mean square of yield contributing parameters | | | | | |
|---|---|---|---|---|---|---|---|
| | | No. of branches plant$^{-1}$ | Days to 1$^{st}$ flowering | Number of fruits plant$^{-1}$ | Single fruit weight (g) | Fruit length (cm) | Fruit diameter (cm) |
| Replication | 2 | 0.719 | 1.307 | 1.314 | 2.058 | 2.092 | 0.882 |
| Factor A (variety) | 3 | 5.535* | 12.875* | 13.577* | 24.732* | 9.990 | 9.444 |
| Factor B (potassium) | 2 | 1.313* | 7.211* | 10.214* | 48.511* | 7.724 | 4.616 |
| Interaction (A×B) | 6 | 0.827** | 2.367** | 5.732** | 15.367* | 5.525 | 0.828 |
| Error | 22 | 0.815 | 0.104 | 0.411 | 0.287 | 0.5772 | 0.633 |

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix VII. Analysis of variance of the data on yield parameters of brinjal varieties as influenced by different potassium levels

| Sources of variation | Degrees of freedom | Mean square of yield parameters | | | |
|---|---|---|---|---|---|
| | | Dry matter content of leaves | Fruit yield plant$^{-1}$ (g) | Fruit yield plot$^{-1}$ (kg) | Fruit yield ha$^{-1}$ (t) |
| Replication | 2 | 3.244 | 14.836 | 1.017 | 4.146 |
| Factor A (variety) | 3 | 18.92* | 752.434* | 14.239* | 196.237* |
| Factor B (potassium) | 2 | 5.376* | 537.183* | 7.841* | 20.652* |
| Interaction (A×B) | 6 | 2.187** | 184.352* | 4.318* | 10.724* |
| Error | 22 | 0.314 | 42.87 | 0.372 | 1.052 |

NS = Non-significant * = Significant at 5% level ** = Significant at 1% level

Appendix VIII: Cost of production of brinjal per hectare

A. Input cost (Tk. $ha^{-1}$)

| Treatments | Cultivation with abor | Brinjal seed cost | Insecticide cost (Tk./ha) | Irrigation | Cowdung | Fertilizer | | | | Seed bed preparation and seed sowing cost | Transplanting cost | Subtotal (A) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Urea | TSP | MP | Gypsum | | | |
| $V_1K_0$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 4050 | 0 | 1300 | 5000 | 50000 | 244350 |
| $V_1K_1$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 2560 | 1300 | 5000 | 50000 | 302860 |
| $V_1K_2$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 3040 | 1300 | 5000 | 50000 | 303340 |
| $V_1K_3$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 3600 | 1300 | 5000 | 50000 | 303900 |
| $V_2K_0$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 0 | 1300 | 5000 | 50000 | 300300 |
| $V_2K_1$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 2560 | 1300 | 5000 | 50000 | 302860 |
| $V_2K_2$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 3040 | 1300 | 5000 | 50000 | 303340 |
| $V_2K_3$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 3600 | 1300 | 5000 | 50000 | 303900 |
| $V_3K_0$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 0 | 1300 | 5000 | 50000 | 300300 |
| $V_3K_1$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 2560 | 1300 | 5000 | 50000 | 302860 |
| $V_3K_2$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 3040 | 1300 | 5000 | 50000 | 303340 |
| $V_3K_3$ | 60000 | 3000 | 40000 | 55000 | 20000 | 6000 | 60000 | 3600 | 1300 | 5000 | 50000 | 303900 |

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10

$K_0$ = Control (no K; 0 kg K $ha^{-1}$), $K_1$ = 95 kg K $ha^{-1}$, $K_2$ = 115 kg K $ha^{-1}$, $K_3$ = 135 kg K $ha^{-1}$

B. Overhead cost (Tk. $ha^{-1}$), Cost of production (Tk. $ha^{-1}$), Gross return (Tk. $ha^{-1}$), Net return (Tk. $ha^{-1}$) and BCR

| Treatments | Overhead cost | | | Subtotal (B) | Subtotal (A) | Total cost of production (A+B) | Yield $ha^{-1}$ | Gross return (Tk. $ha^{-1}$) | Net return (Tk. $ha^{-1}$) | BCR |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cost of leased land for 6 months (8% of value of land 12,00,000/-) | Miscellaneous cost (Tk. 5% of the input cost) | Interest on running capital for 6 months (8% of cost $year^{-1}$) | | | | | | | |
| $V_1K_0$ | 48000 | 12217.5 | 12183 | 72400 | 244350 | 316750 | 23.75 | 593750 | 277000 | 1.87 |
| $V_1K_1$ | 48000 | 15143 | 14640 | 77783 | 302860 | 380643 | 49.74 | 1243500 | 862857 | 3.27 |
| $V_1K_2$ | 48000 | 15167 | 14660 | 77827 | 303340 | 381167 | 54.67 | 1366750 | 985583 | 3.59 |
| $V_1K_3$ | 48000 | 15195 | 14684 | 77879 | 303900 | 381779 | 52.36 | 1309000 | 927221 | 3.43 |
| $V_2K_0$ | 48000 | 15015 | 14533 | 77548 | 300300 | 377848 | 17.20 | 430000 | 52152 | 1.14 |
| $V_2K_1$ | 48000 | 15143 | 14640 | 77783 | 302860 | 380643 | 28.63 | 715750 | 335107 | 1.88 |
| $V_2K_2$ | 48000 | 15167 | 14660 | 77827 | 303340 | 381167 | 33.40 | 835000 | 453833 | 2.19 |
| $V_2K_3$ | 48000 | 15195 | 14684 | 77879 | 303900 | 381779 | 31.52 | 788000 | 406221 | 2.06 |
| $V_3K_0$ | 48000 | 15015 | 14533 | 77548 | 300300 | 377848 | 15.47 | 386750 | 8902 | 1.02 |
| $V_3K_1$ | 48000 | 15143 | 14640 | 77783 | 302860 | 380643 | 26.80 | 670000 | 289357 | 1.76 |
| $V_3K_2$ | 48000 | 15167 | 14660 | 77827 | 303340 | 381167 | 31.80 | 795000 | 413833 | 2.09 |
| $V_3K_3$ | 48000 | 15195 | 14684 | 77879 | 303900 | 381779 | 29.60 | 740000 | 358221 | 1.94 |

Selling cost of brinjal = 25.00 Tk/kg

$V_1$ = BARI hybrid begun-4, $V_2$ = BARI begun-8, $V_3$ = BARI begun-10
$K_0$ = Control (no K; 0 kg K $ha^{-1}$), $K_1$ = 95 kg K $ha^{-1}$, $K_2$ = 115 kg K $ha^{-1}$, $K_3$ = 135 kg K $ha^{-1}$

Plate 1. Seed sowing of brinjal in seed bed

Plate 2. Brinjal seedlings in seed bed

Plate 3. Flowering of brinjal

Plate 4. Harvested brinjal fruit