PERFORMANCE OF BRINJAL GENOTYPES (*Solanum melongena* L.) UNDER DIFFERENT GROWTH CONDITIONS

BY

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CERTIFICATE

This is to certify that thesis entitled, **"Performance of Brinjal Genotypes (*Solanum Melongena* L.) Under Different Growth Conditions"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE** in **GENETICS AND PLANT BREEDING,** embodies the result of a piece of *bona fide* research work carried out by **Md. Masud Rana**, Registration No.08-02895 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated: June, 2014
Place: Dhaka, Bangladesh

(Prof. *Dr. Mohammad Saiful Islam*)
Supervisor


DEDICATED
TO
MY BELOVED PARENTS

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LIST OF ABBREVIATED TERMS

ABBREVIATION	FULL NAME
AEZ	Agro-Ecological Zone
BBS	Bangladesh Bureau of Statistics
cm	Centimeter
cv	Coefficient of variation
^{0}C	Degree Celsius
DAS	Date After Seeding
et al.	and others
Etc	Etcetera
FAO	Food and Agriculture Organization
gm	gram
LSD	Least Significance Difference
m^2	Square meter
MP	Muriate of Potash
RCBD	Randomized Complete Block Design
SAU	Sher-e-Bangla Agricultural University
TSP	Triple Super Phosphate
UNDP	United Nations Development Program

PERFORMANCE OF BRINJAL GENOTYPES (*Solanum melongena* L.) UNDER DIFFERENT GROWTH CONDITIONS

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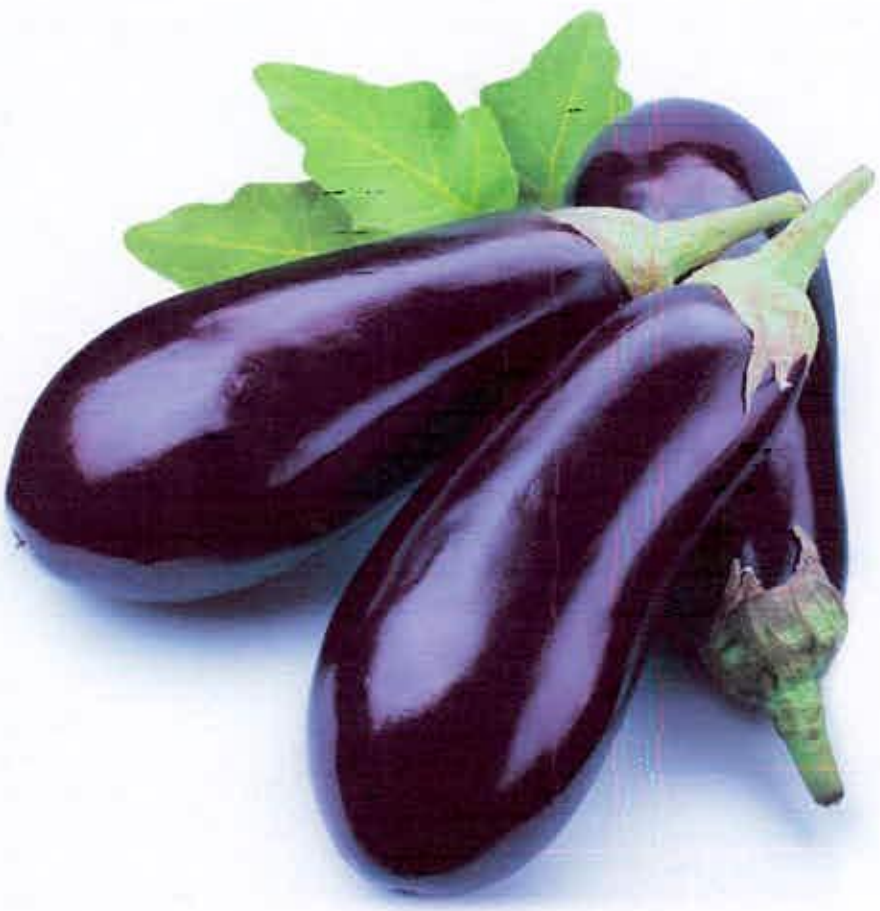
ABSTRACT

The present piece of research work was conducted during the period from September 2013 to February 2014 in rabi season in the experimental area of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka to find out the performance of brinjal genotypes (*Solanum melongena* L.) under different growth conditions. The experiment consisted of two factors: Factor A: Cowdung and chemical fertilizers; T_1: Cowdung, T_2: Cowdung + Urea + TSP + MP, T_3: Urea + TSP + MP and T_4: TSP + MP; Factor B: Different brinjal variety, V_1: BARI Begun-1, V_2: BARI Begun-2, V_3: BARI Begun-3, V_4: BARI Begun-4, V_5: BARI Begun-5, V_6: BARI Begun-6, V_7: BARI Begun-7, V_8: BARI Begun-8, V_9: BARI Begun-9, V_{10}: BARI Begun-10. The two factors experiment was laid out in Split-plot design with three replications. Mean performance and variability studies were done on different yield and yield contributing characters of brinjal variety due to the environmental condition created by application of cowdung and chemical fertilizers treatment. For different treatment, the maximum number of fruits per plant (34.29) was recorded from T_2 and the minimum number (31.57) from T_4. The highest weight of individual fruit (75.61 g) was observed from T_2, again the lowest weight (66.66 g) from T_4. The highest yield per plant of brinjal (2.53 kg) was recorded from T_2 and the lowest yield (2.04 kg) from T_4. For different variety, the maximum number of fruits per plant (52.73) was found from V_1, whereas the minimum number (19.33) from V_6. The highest weight of individual fruit (95.52 g) was obtained from V_6, whereas the lowest weight (54.57 g) from V_1. The highest yield per plant of brinjal (3.16 kg) was observed from V_2 (BARI Begun-2), while the lowest yield per plant (1.48 kg) from V_7. In case of combined effect of treatments and variety, the maximum number of fruits per plant (55.60) was found from T_2V_1, again the minimum number (17.67) from T_3V_6. The highest weight of individual fruit (99.40 g) was attained from T_2V_6, whereas the lowest weight (47.78 g) from T_4V_1. The highest yield per plant of brinjal (3.63 kg) was found from T_2V_4, whereas the lowest yield (1.20 kg) from T_4V_7. The highest genetic advance along with high heritability was recorded for days required for 1st flowering, number of leaves per plant, number of fruits per plant, length of brinjal, diameter of brinjal and yield per plant, indicating the importance of these traits in selection for high yield. BARI Begun-2 was found to be promising in the application of Cowdung + Urea + TSP + MP.

CHAPTER I

INTRODUCTION



CHAPTER I

INTRODUCTION

Brinjal or eggplant (*Solanum melongena* L) locally known as "Begoon", is one of the most commonly grown edible vegetable belong to the Solanaceae family (Kantharajah and Golegaonkar, 2004). It is a major vegetable crop throughout the tropic and subtropics and also a popular vegetable crop in France, Italy, USA, Mediterranean and Balkan areas (Bose and Som, 1986). Brinjal is thought to be originated in Indian sub-continent because it's maximum genetic diversity and closely related species are observed in this region. Brinjal contains 92.7% moisture, 1.4 g protein, 0.3 g fat, 0.3 g minerals, 1.3 g fiber, 4 g carbohydrates, 18 mg calcium, 0.9 mg iron, 3 mg sodium, copper 0.17 mg, potassium 2 mg, 44 mg sulfur, chlorine 52 mg, 16 mg magnesium, 18 mg oxalic acid, 47 mg phosphorus, 0.04 mg Thiamine, 0.11 mg Riboflavin, 0.09 mg Nicotinic acid, 12.0 mg vitamin A etc. (Bose and Som, 1986). It is also a rich source of potassium, magnesium, calcium and iron (Zenia and Halina, 2008).

Brinjal is extensively cultivated in Bangladesh and is generally grown in homestead and as a field crop in both winter and rainy seasons though bulk of its production is obtained during winter season. It is grown all the year round in Bangladesh but due to some environmental limitations only a few varieties are grown during the rainy season (Rashid, 1993). More than 20 varieties of brinjal are grown in different regions of the country. Approximately 8.2 million farmers are involved in eggplant cultivation in Bangladesh (Anon., 2012). The vegetable production in summer is scanty and brinjal plays an important role to meet up the shortage of vegetable in this lean period. Brinjal is the second most important vegetable crop next to potato in Bangladesh in respect of acreage and production (BBS, 2013). It was cultivated in 28,764 ha of land with production of 216,182 metric tons during the rabi season of 2009-2010 and 17,966.4 ha of land with production of 125,080 metric tons during the kharif season of 2011-2012 in Bangladesh (BBS, 2013).

In Bangladesh yield are very low and the low yield of brinjal however is not an indication of low yielding potentially of this crop but the fact of low yield may be attributed to a number of reasons, viz. unavailability of quality seeds of high yielding varieties, land for production based on fertilizer management, judicious application of organic and inorganic manure, pest infestation and improper irrigation facilities as well as production in abiotic stress conditions. The environmental stresses for brinjal cultivation resulting from nutrient, drought, temperature, salinity, air pollution, pesticides and soil pH are major limiting factors in crop production (Hernandez *et al.*, 2001; Alqudah *et al.*, 2011). In Bangladesh, nutrient stresses of soils are increasing day by day. Depletion of soil fertility has been identified as a major constraint for higher crop yield. Use of fertilizer is an essential component of modern farming of today with about 50% of the world crop production (Prodhan, 1992). Among the cultural technologies like application of organic manures with other inorganic fertilizers and selection of right variety is the important one.

Vegetable crop growing with organic manures is now a popular practice in agriculture and people have realized the benefits of organic manures for vegetable production. By applying proper dose of fertilizer is one of the most important ways of quality vegetable production. Nitrogenous, phosphorus and potassic fertilizers have a great effect on this respect. Vizayakumar *et al.* (1995) reported that NPK fertilizers increase the vegetable growth and fruit yield of brinjal. Phosphorus is a constituent of nucleic acids and phospholipids which are important constituents of cell membrane (Sharma, 1995). As a biennial crop, Eggplant will require high quantity of nutrients to sustain its growth. These nutrients can easily be made available through the use of inorganic fertilizers but there are problems associated with its use which include: leaching, soil degradation, underground water pollution, fast release of nutrients. Organic manure application is known to supply plant nutrients and improve the soil structure. It has been reported that application of organic manure showed a

significant increase in yield than inorganic manure in eggplant production (Ullah *et al.*, 2008; Anoop and Chauban, 2009).

There are several varieties of brinjal grown in our country, such as Zhumka, Nayantara, Islampuri, Uttara, Khotkhotia, Singnath, Luffa, Bholanath, Dohajari, ISD-006, China EG-190, Dhundul etc. All the varieties are not high yielding, some high yielding varieties in our country are BARI Begun-2 (Tarapuri), BARI Begun-4 (Kazla), BARI Begun-5 (Nayantara). Various forms, colors and shapes of brinjal are found throughout the Southeast Asia. For the intensive cultivation and increased production of brinjal, improved varieties/lines with desirable characters need to be identified. A large number of varieties/lines having wide variability in different characters are being cultivated in Bangladesh and some of the variations are so localized that their cultivation beyond the particular zone is completely unknown. BARI released a number of varieties of brinajl with high yielding potential. It is necessary to evaluate the performance and characteristics of these varieties of brinjal in present condition especially creating environment through the application of organic and inorganic fertilizers. But the information in this regards of different BARI released brinjal variety to optimize the production within the farmers limited resources is inadequate.

Moreover, a suitable combination of variety and fertilizer dose is necessary for better yield. Limited number of publication is available focusing the organic manures and inorganic fertilizer practices. Extensive research works are necessary to find out appropriate variety and optimum rate of organic and inorganic fertilizers to obtain satisfactory yield of brinjal. Hence, the study has been under taken with a view to:

- To evaluate the yield and yield contributing characters of different brinjal variety under different growth conditions created by manure and fertilizers;
- To estimate the variability of different brinjal variety under different growth conditions created by manure and fertilizers

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Brinjal is one of the popular and most important vegetable crop throughout the tropic and subtropics and also Bangladesh. A large number of varieties/lines of brinjal having wide variability in different characters are being cultivated in Bangladesh and some of the variations are so localized that their cultivation beyond the particular zone is completely unknown. The crop has received much concentration by the researchers on various aspects especially application of manure and fertilizers. Many studies in relation to different aspects such as pest control, seedling age, planting geometry, fertilizers and irrigation management for different variety have been carried out in Bangladesh and as well as many countries of the world. The work so far done in Bangladesh is not adequate and conclusive. Nevertheless, some of the important and informative works and research findings so far been done at home and abroad regarding environment creating by the application of manure and fertilizers have been reviewed in this chapter under the following headings:

2.1 Effect of organic manures

Asiegbu *et al.* (1984) carried out an experiment in Nigeria on onion with farmyard manure and reported that bulb diameter and the percentage of grade I bulbs were increased with increasing FYM application. Hedge (1988) studied the effect of different regimes of irrigation & nitrogen at Bangalore in India and found low fruit weight under the irrigation regimes. They also found that yields were maximum with FYM @ 20 t/ha.

Bevacqua *et al.* (1994) observed that onion seedlings transplanted to compost treated plots established more vigorously than those in the control plots. They also found that compost treatments increased yields (FW) of onions compared to control condition.

Naidu *et al.* (1997) mentioned that the effects NPK fertilizers in combination with organic manures (farmyard manure, poultry manure and vermicompost) and biofertilizers (phosphate solubilizing bacteria and Azospirillum) on the growth and yield of aubergine cv. JB-64 were investigated during the rabi seasons in Jabalpur, Madhya Pradesh, India. NPK at 100:60:50 kg/ha + farmyard manure at 25 t/ha recorded the highest values for most parameters studied. NPK at 75:35:0 kg/ha + farmyard manure at 25 t/ha recorded the highest fruit girth and earliest 50% flowering.

Rahman *et al.* (1998) observed increase vegetative growth and yield of berry of brinjal was by using animal blood meal, mustard oil cake, epil-epil leaves or the combination of these three in the soil as organic manures. The vegetative growth was highest with blood meal and lowest with epil-epil leaves. The dates of flowering and maturity were earlier both with blood meal and the combined application of the 3 manures than the untreated control. The yield of berry was highest with the combined application of the manures. Of the 3 manures, yield was lowest with epil-epil leaves.

Prasanna and Rajan (2001) showed that brinjal [aubergine] cv. Surya plants were supplied with farmyard manure: (FYM, at 20 and 38 t/ha); poultry manure @ 6.67 and 12.92 t/ha; FYM @ 20 t/ha and NPK at 75 : 40 : 25 kg per ha; and fertilizers equivalent to the NPK content in 20 and 38.5 t/ha FYM and 6.67 and 12.92 t/ha poultry manure in an experiment conducted. Fruits from the different treatments were harvested and stored in paper plates under open conditions. After 5 and 7 days of storage, the highest number of unmarketable fruits was from plants treated with inorganic fertilizers, while the lowest were from plants treated with organic fertilizers.

Yadav *et al.* (2002) stated that a field experiment was conducted on sandy loam typic Ustocrept soil, in Hisar, Haryana, India to study the effect of high RSC water along with gypsum and farmyard manure (FYM) oil the soil, growth and yield of brinjal (aubergine) cv. Hisar Pragati. The initial soil pH, ECE, ESP, CEC

and organic carbon was 7.2, 1.5 dS/m. 6.7, 9.3 cmol per kg soil and 0.30%, respectively. It was observed that the pH and the ESP of the soil decreased significantly both with the addition of FYM and gypsum. The yield and growth parameters also creased up to addition of FYM @ 10 t/ha.

Almeida *et al.* (2004) conducted an experiment in Rio de Janeiro, Brazil, to evaluate biological nitrogen fixation (BNF) for green manures pre-cropped and intercropped with aubergine in an organic cropping system. BNF did not affect aubergine yield, but the BNF in legumes was enough to compensate for the exported N in the harvest fruits.

Castro *et al.* (2005) evaluated no tillage systems in aubergine (*Solanum melongena*) based organic cropping systems in Seropedica, Rio de Janeiro State, Brazil. Intercropping with leguminous species did not reduce aubergine yield. In a succeeding experiment, no-tillage (with *Crotalaria juncea* and spontaneous weed mulches) and conventional ploughing were compared. These treatments were combined with increasing levels of poultry manure (0, 100, 200 and 400 kg N/ha). In terms of biomass input, *C. juncea* was superior to spontaneous weeds. The highest yield of aubergine (50.6 t/ha) was obtained with the highest rate of manure (36.9 t/ha for the control plots).

A study was conducted by Suge *et al.* (2011) at Bukura Agricultural college farm aimed at evaluating the effect of combination between two levels of the recommended mineral fertilizers (50% and 100% of research recommended rates) with three types of organic manures on growth, fruit yield and quality of egg plant (*Solanum melongena* L.) var. black beauty. The experimental design was split plot design with three replications, where two levels of mineral fertilizers treatments (50% and 100%) were randomized in main plots while three types of organic manures(FYM, Compost and Tithonia) and control treatments were randomized in the subplots. Results showed significant differences in eggplant growth, fruit yield and quality between the two main treatments (50% RRR and 100% RRR), the three organic manures and their control. The plants in the organic manure treated

plots were characterized with vigorous vegetative growth, which in turn led to increase in total fruit yields as well as improving fruit quality. The farm yard manure was considered the superior source of manure to obtaining the highest value of the parameters under study as compared to compost.

Agbo *et al.* (2012) carried out an experiment to ascertain the optimal rate of organic manure and the frequency of its application on the growth, yield, and some vitamins and mineral composition of the fruits of *S. melongena* L. Four rates of organic manure (0, 10, 20, and 30 t ha^{-1}) were applied at three varying frequencies namely: single, split, and split-split. Data revealed that days to flowering, plant height, number of trusses per plant, and number of leaves per plant increased with increase in rate of organic manure. At maturity, 30 t ha^{-1} of organic manure gave the highest mean value on number of leaves per plant, and plant height which was statistically similar to the values obtained in plants that received 20 t ha^{-1}. Increase in rates of organic manure increased the individual fruit weight of the harvested fruits, which declined as the harvest progressed. Split-split method of organic manure application increased the individual fruit weight over the split, and single dose applications, respectively.

Shilpi *et al.* (2014) conducted an experiment at Horticultural Research Farm to study the effect of different doses of organic manures and inorganic fertilizers on growth, yield and quality of brinjal. The experiment consisted of different doses of FYM (100, 75, 50 and 25 %), Vermicompost (100, 75, 50 and 25 %) and Neem cake (100, 75, 50 and 25 %) along with recommended dose of fertilizer. The result showed that the yield attributing parameters were recorded maximum in terms of fruit length (22.33 cm), fruit diameter (4.88 cm), fruit weight (123.11 g), number of fruits per plant (16.66), fruit yield per plant (2.05 kg), fruit yield per plot (32.80 kg) and fruit yield per hectare (75.93 tonnes) under 25% RDF+ 75% Neem cake while, all the yield and yield attributing parameters found minimum under control.

2.2 Effect of inorganic fertilizer

Lawande *et al.* (1987) in their experiment with cauliflower noted maximum effect by adding 240 kg N and 80 kg P_2O_5/ha but the response to added K_2O at 0-80 kg/ha was not significant. Doss *et al.* (1981) conducted an experiment to determine the effect of nitrogen rates on the growth and yield of tomato and found that there was no consistent effect from nitrogen rate on marketable yield. Average yields from the lower nitrogen rate were greater than the higher nitrogen rate in the two driest years and were similar or higher from the higher nitrogen rate in year of more average rainfall. Razia and Islam (1981) conducted an experiment at Bangladesh Agricultural Research Institute (BARI), Joydebpur on brinjal and found that different nitrogen levels had significant increasing yield on brinjal cv. Singnath. The highest nitrogen level of 150 kg per ha produced the highest yield of 11973 kg/ha. Nitrogen was applied at the rate of 0, 30, 60, 90, 120 and 150 kg N/ha from urea.

Khurana *et al.* (1987) reported that N application at the rate of 60 kg/ha gave the highest yield and was the most economic treatment. The average curd weight was also highest in this treatment.

Kaniszewski *et al.* (1987) studied the effects of nitrogen fertilization at rates from 37.5 to 300 kg N/ha and irrigation was studied under field conditions on a tomato variety. They reported that fertilization tip to the rate of 225 kg N/ha resulted in a significant increase of total and marketable yield with irrigation whereas the yield increase was found up to the rate of 150 kg N/ha without irrigation.

Reddy *et al.* (1988) carried out a series of experiments on varietal performance, spacing and fertilization on brinjal. The fertilizer levels exhibited significant influence on the fruit yield of brinjal variety Pusakranti. The highest response was found at the combination of 187:150:75 kg NPK/ha. The other combinations were 62:50:25 and 125:100:50.

Nasreen and Islam (1990) also investigated the fertilizer effect on tomato yield and found that the yield response was linear with the levels of nitrogen and nitrogen application had certain optimum range beyond which the yield of tomato would not increase. Another experiment was conducted by Nandekar and Swarkar (1990) and they reported that plant height, number of leaves per plant, fruit length, diameter and weight were significantly increased by the application of 120 kg N + 75 kg P_2O_5 + 45 kg K_2O per ha in brinjal compared with 60 kg N + 25 kg P_2O_5 + 15 kg K_2O per ha and 90 kg N + 50 kg P_2O_5 + 30 kg K_2O.

Subramanian *et al.* (1993) stated that plant height and quality were increased with increasing rate of N application. They obtained the highest yield with 150 kg N/ha. The levels used were 0, 5, 100 and 150 kg/ha. Singh and Maurya (1992) reported that growth and yield of brinjal were increased with increasing rate of NPK fertilizer. They obtained the best yield from 120 kg N/ha. The levels of nitrogen were 0, 60, and 120 kg N/ha. They also recorded better growth of plant and early flowering with the application of 60 kg K_2O/ha. The yield was increased significantly by NPK fertilizer application.

Farooque and Mondal (1987) observed that increased level of nitrogen application resulted in a significant increase in cabbage yield. The highest yield (48.6 t/ha) was obtained with (the application of 336 kg N/ha). Sharma (1995) reported that in tomato (cv. Pusa Ruby) the plant height, fruit number, seed yield per plant and seed yield per ha were increased with increasing rates of N. The highest yield of seeds was observed due to 120 kg N/ha.

Khattak *et al.* (2001) studied the effect of different levels of nitrogen on the growth and yield of different cultivars of eggplant under the agro-climatic conditions of Peshawar. Effect of different nitrogen levels (0, 50, 75, 100, 125, 150 kg/ha) on aubergines (Solanum melongena) cultivars Black Bahar, Long Purple, Neelam Long and Special Black were studied at Agriculture Research Institute Tamab, Peshawar, Pakistan. Different levels of nitrogen significantly increased number of branches, leaves and fruits per plant, stem thickness, plant

height and yield at 125 kg nitrogen per ha, while minimum values for these parameters were observed in different treatments. Total fruit yield per plant and total yield (t/ha) were significantly influenced by both N and planting pattern treatments. The highest total fruit yield per plant was recorded from the treatment of 125 kg/ha.

Among the factors that affect crop production, fertilizer is one of the most crucial factors, which ultimately increase the total yield of any crop. Now-a-days, fertilizer holds the key to the success of the crop production system of Bangladesh. Nitrogenous fertilizer is one of the most used fertilizers, which has an important physiological activity on plant body. Formation of chlorophylls tissue is one of the most important functions of nitrogen, which help in photosynthesis of plant. Thus application of more nitrogenous fertilizer caused more vegetative growth and development of plant. As a major nutrient phosphorus has a great influence on vegetative growth as well as on yield. Some researchers worked in this aspect and they found a noticeable influence of phosphatase fertilizer on it. The requirement of nutrients for different vegetables varies, for example, leafy vegetables require more nitrogen than others and phosphorus requirement of fruit producing vegetable is higher. Potassium is an element, which helps to translocate carbohydrate and it has a very mobile nature in plant body, which helps in cell division resulting in more growth and development of a plant (FRG, 2005).

A field experiment was conducted by Ullah *et al.* (2008) at the Horticultural Farm of Bangladesh Agricultural University (BAU), Mymensingh during the period from December to evaluate the effect of manures and fertilizers on the yield of brinjal. There were five treatments consisting of organic, inorganic and combined sources of nutrients, of which the combined treatment (60 % organic +40% inorganic) showed the best performances. The maximum branching (20.1) with the highest number fruits/plant (15.2), fruit length (14.1 cm) and fruit diameter (4.3 cm) were found combined application of manures and fertilizers. The highest yield (45.5 t ha^{-1}) was also obtained from the combined application of organic and

inorganic sources of nutrients. Application of mustard oil cake or poultry manure alone gave better performance compared to only chemical fertilizers. The organic matter content and availability of N, P, K and S in soil were increased by organic matter application. On the other hand soil pH was increased with chemical application than organic.

An experiment was conducted by Anoop and Chauhan (2009) to study the seed germination and growth behavior of brinjal (*Solanum melongena* L.) with inorganic fertilizers (NPK) and organic manure (Cowdung) under environmental conditions. Seeds of *Solanum melongena* L. cv. BR 112, were sown in poly bags (1 seed/poly) at the depth of 2.5 cm. with different treatments i.e. S_1 (Control-Only Soil), S_2 (Soil + NPK), S_3 (Soil + Cow dung). 50 replicates of each treatment were used for the study. Total numbers of germinated plants were counted from each poly bag of all treatments, at the interval period of 5 days after sowing, and reported as emergence count/poly bag. For growth study plant height, number of leaves, length and width of leaves and root length were measured from all the treatments. Result revealed that cow dung showed maximum germination% i.e. 49 plantlets from 50 seeds then control and NPK i.e. 29 plantlets and 35 plantlets respectively. Growth of plantlets also showed maximum plant height (59.2 cm), number of leaves (5.8), length of leaves (7.82 cm), width of leaves (5.73 cm) and root length (19.63 cm) in S_3 treatment then control (34.6 cm. plant height, 3.7 number of leaves, 3.53 length of leaves, 2.72 width of leaves, 7.05 root length) and NPK (46.4 cm. plant height, 3.4 number of leaves, 4.15 length of leaves, 3.18 width of leaves, 17.76 root length).

A study was conducted by Suge *et al.* (2011) at Bukura Agricultural college farm aimed at evaluating the effect of combination between two levels of the recommended mineral fertilizers (50% and 100% of research recommended rates) with three types of organic manures on growth, fruit yield and quality of egg plant (*Solanum melongena* L.) var. black beauty. The experimental design was split plot design with three replications, where two levels of mineral fertilizers treatments (50% and 100%) were randomized in main plots while three types of organic

manures(FYM, Compost and Tithonia) and control treatments were randomized in the subplots. Results showed that increasing NPK from 50% to 100% of the research recommended rates encouraged the vegetative growth of eggplants as expressed as plant height and fresh weight besides increasing the total yield it enhanced the fruit quality. Soil fertilized with 100% recommended NPK combined with organic manures produced the superior growth of plants and the highest amount of total fruit yields.

A field experiments was conducted by Bozorgi (2012) in Astaneh Ashrafiyeh Township (north of Iran), to investigate the application of nitrogen fertilizer and nano iron chelate fertilizer on Eggplant (*Solanum melongena* L.). Factors of experiment was consist of nano iron chelate fertilizer foliar spraying in three levels (I_1: control (without foliar spraying of nano iron chelate fertilizer), I_2: 1 g/L and I_3: 2 g/L foliar spraying) and nitrogen fertilizer management with four levels (N_1: control (without nitrogen fertilizer application), N_2: 30 kg/ha, N_3: 60 kg/ha and N_4: 90 kg/ha pure nitrogen from source of urea (46% pure nitrogen)). In maturity time, fruit yield, number of fruits per plant, plant height, number of branches per plant, fruit length and fruit width were measured. Application of nitrogen and iron fertilizer showed significant effects on all studied traits.

A pot experiment was conducted by Hasan *et al.* (2013) in the net house of the Department of Agricultural Chemistry, Bangladesh Agricultural University, Mymensingh to evaluate the influence of phosphorus (P) and sulphur (S) on major nutrient contents and their uptake by brinjal (cv. BARI brinjal-8). The experiment was laid out using four levels of P (0, 30, 60 and 90 kg P ha^{-1}) and three levels of S (0, 15 and 30 kg S ha^{-1}) along with the basal doses of urea, muriate of potash, boric acid, zinc oxide, cowdung and poultry manure. The study revealed that major nutrient contents and their uptake were significantly influenced by P and S interactions. They had positive significant effects on major nutrient contents and their uptake. Application of P increased N, P, K, Ca, Mg and S contents and their uptake upto 60 kg ha^{-1} and over the dose the values were reduced or near to control treatment.

An experiment was conducted by Shilpi *et al.* (2014) at Horticultural Research Farm to study the effect of different doses of organic manures and inorganic fertilizers on growth, yield and quality of brinjal and to ascertain the best treatment for growth, yield and quality of brinjal. The experiment consisted of different doses of FYM (100, 75, 50 and 25 %), Vermicompost (100, 75, 50 and 25 %) and Neem cake (100, 75, 50 and 25 %) along with recommended dose of fertilizer. The result showed that maximum plant height (47.33 cm), number of branches (9.22), number of leaves (103.8 per plant) was recorded under 25% RDF+ 75% Neemcake and the maximum number of flowers (16.77) was noted under 75% RDF+ 25% vermicompost while, all the growth parameters were found minimum under control. The yield attributing parameters were recorded maximum in terms of fruit length (32.333 cm), fruit diameter (8.88 cm), fruit weight (123.111g), number of fruits per plant (16.66), fruit yield per plant (2.05 kg), fruit yield per plot (32.80 kg) and fruit yield per hectare (75.93 tonnes) under 25% RDF+ 75% Neem cake while, all the yield and yield attributing parameters were found minimum under control.

Latha *et al.* (2014) reported that the application of microbial and chemical fertilizers solely or combined application had a great influence at all the growth stages of the crop. Significant differences in all parameters like, total biomass differs irrespective of the treatments differed significantly. Among all the treatments, the maximum biomass was observed in T_{10} (containing urea, super phosphate, Murate of potash, Azospirillum, Phosphobacteria and potassium mobilizer (each 5g/pot). The fresh weight was 89.67 g/plant and dry weight 6.15 g/plant during harvest time. Maximum total chlorophyll content was recorded in T_{10} (1.749 mg/g). The maximum protein content was recorded in T_{10} which was 18.2 mg/g at flowering stage. Total phenol content was recorded in T_{10} which was (19.6 mg/g^{-1}). The level of total free amino acids ranged 25.0 mg/g was found increased at 80 days. The total carbohydrates were increased in T_{10} plant was 92 mg/g at flowering stage in leaf samples.

2.3 Effect of genotypes/varieties

Gopimony *et al.* (1984) studied the analysis of data on total fruit yield/plant and 11 related traits from 27 *Solanum melongena* verities/lines revealed that the phenotypic coefficient of variation ranged being highest for yield and single fruit weight, heritability and genetic advance being highest for single fruit weight and over all mean. The association of high heritability and genetic advance shown by yield, single fruit weight and fruit diameter was taken as an indication of additive gene effects.

Vedivel and Bapu (1990) studied nineteen genotypes of eggplant including 7 from foreign sources, which were grown for observation on growth and yield related traits. Plant height, fruit weight and fruit/plant exhibited high genotypic variance. High heritability coupled with high genetic gain from fruit yield/plant, fruit/plant and length indicated the predominance of additive gene effects.

It was revealed by Ushakumiry *et al.* (1991) through the evaluation of fifty four diverse genotypes of brinjal for 10 yield components that phenotypic co-efficient of variation was higher than genotype co-efficient of variation for all the characters since they showed high heritability values. They concluded that there was enough scope for improvement of quantitative characters in brinjal by selection.

Mandal and Dana (1992) studied 20 genotypes of brinjal for the yield contributing characters and indicated that fruits/plant; secondary branches/plant and plant height were important traits for the selection of superior genotypes.

Randhawa *et al.* (1993) studied 22 genotypes of brinjal on 24 quantitative characters for deriving information on yield co-relation and observed that fruits/plant and number of branches/plant had the highest direct effect on yield.

Information on genetic variation, heritability and genetic advance was derived from data on 10 yield components in 16 tomato lines grown during the winter season at Bhubaneswar reported by Sahu *et al.* (1994). There were significant

differences among the lines for all the characters studied. Yield per plant, number of fruits per plant, number of flower trusses per plant and fruit weight had high genotypic coefficient of variation with values for heritability and genetic advance.

Yadav *et al.* (1996) studied genetic divergence using Mahalanobis's D^2 statistic in 40 diverse type of brinjal. The genotypes differed significantly for 10 yield contributing characters and they observed that there was no close correspondence between geographical distribution and genetic divergence.

Genetic divergence among 20 cultivars of brinjal (*Solanum melogena*) was estimated by Mishra *et al.* (1998) for eleven yield traits. High genetic advance coupled with high heritability was observed for all the characters studied for brinjal which suggested that these traits were under the control of additive gene action and could be improved through simple selection procedures.

Kumar *et al.* (2000) evaluate the performance of eleven advance lines along with three standard control cultivars of brinjal under spring summer season. HLB-25 genotypes recorded the highest fruit yield (980.38 g/plant) followed by HLB-18 (863.76 g/plant), HLB-106 (858.28 g/plant) and HLB-24 (824.23 g/plant).

Damnjanovic *et al.* (2002) conducted an experiment to determine the mode of inheritance, the combining ability and the components of genetic variance for fruit weight and fruit number per plant in five divergence genotypes and reported that high values of heritability for yield components indicated a more important role of additive genes. It can be concluded that selection of genotypes with high average values for fruit weight and fruit number per plant could be a way for the improvement of aubergine breeding.

Golani *et al.* (2007) conducted an experiment with twenty three genotypes of brinjal and found that the genotypic coefficient of variation, heritability and genetic advance as percentage of mean were high for fruit length, fruit girth and 10-fruit weight, indicating additive gene action, which contributed to maximum divergence and played a major role in the improvement of brinjal yield.

Ram *et al.* (2007) carry out an investigation to study and selection parameters was undertaken using fifteen aubergine line (KS 219, KS 247, KS 253, KS 262, KS 228, KS 233, KS 250, KS 263, KS 235, KS 227, ACC 5114, ACC 8204, ACC 8207 and ACC 2623) and four testers (T 3, AB 1, KS 224 and DBR 8). The estimates of phenotypic coefficient of variation were higher than the genotypic coefficient of variation for all the characters studied. High magnitude of variability was observed in the mean among the parents for number of branches per plant, number of fruits per plant, length of fruit, width of fruit and yield per plant. The high genotypic and phenotypic coefficients of variation were observed for yield per plant, plant spread and number of fruits per plant in parents, suggesting the improvement by selection. High heritability coupled with high genetic advance indicating additive gene action was exhibited by characters, plant height, days to marketable maturity, plant spread, days to flowering, yield per plant, fruit weight and number of branches per plant. These characters can be improved by simple selection to get higher yield.

An investigation was carried out by Sherly and Shanthi (2009) with 24 genotypes of brinjal for variability, heritability and genetic advance. The study indicated that high estimate of phenotypic coefficient of variation and genotypic coefficient of variation was observed for fruit length, number of fruits per plant, fruit weight and fruit yield per plant. High heritability coupled with high genetic advance was registered for all the characters except total number of fruits per plant and this character can be effectively improved through selection.

CHAPTER III

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METHODS

The experiment was conducted to find out the performance of brinjal genotypes (*Solanum melongena* L.) under different growth conditions. The details of the materials and methods i.e. location of experimental site, soil and climate condition of the experimental plot, materials used, design of the experiment, data collection procedure and procedure of data analysis that used or followed in this experiment has been presented below under the following headings:

3.1 Description of the experimental site

3.1.1 Experimental period

The experiment was conducted during the period from September 2013 to February 2014 in rabi season.

3.1.2 Site description

The present piece of research work was conducted in the experimental area of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka. The location of the site is $23^0 74'$N latitude and $90^0 35'$E longitude with an elevation of 8.2 meter from sea level.

3.1.3 Climatic condition

The geographical location of the experimental site was under the subtropical climate and its climatic conditions is characterized by three distinct seasons, namely winter season from the month of November to February and the pre-monsoon period or hot season from the month of March to April and monsoon period from the month of May to October (Edris *et al.*, 1979). Details of the meteorological data of air temperature, relative humidity, rainfall and sunshine hour during the period of the experiment was collected from the Weather Station of Bangladesh, Sher-e-Bangla Nagar, Dhaka and details has been presented in Appendix I.

3.1.4 Soil characteristics of the experimental plot

The soil belonged to "The Modhupur Tract", AEZ-28 (FAO, 1988). Top soil was silty clay in texture, olive-gray with common fine to medium distinct dark yellowish brown mottles. Soil pH was 5.6 and had organic carbon 0.45%. The experimental area was flat having available irrigation and drainage system and above flood level. The selected plot was medium high land. The details have been presented in Appendix II.

3.2 Experimental details

3.2.1 Treatment of the experiment

The experiment consisted of two factors:

Factor A: Cowdung and chemical fertilizers

i T_1: Cowdung

ii. T_2: Cowdung + Urea + TSP + MP

iii. T_3: Urea + TSP + MP

iv. T_4: TSP + MP

Factor B: Different brinjal variety

i. V_1: BARI Begun-1

ii. V_2: BARI Begun-2

iii. V_3: BARI Begun-3

iv. V_4: BARI Begun-4

v. V_5: BARI Begun-5

vi. V_6: BARI Begun-6

vii. V_7: BARI Begun-7

viii. V_8: BARI Begun-8

ix. V_9: BARI Begun-9

x. V_{10}: BARI Begun-10

There were 40 (4 × 10) treatments combination such as T_1V_1, T_1V_2, T_1V_3, T_1V_4, T_1V_5, T_1V_6, T_1V_7, T_1V_8, T_1V_9, T_1V_{10}, T_2V_1, T_2V_2, T_2V_3, T_2V_4, T_2V_5, T_2V_6, T_2V_7, T_2V_8, T_2V_9, T_2V_{10}, T_3V_1, T_3V_2, T_3V_3, T_3V_4, T_3V_5, T_3V_6, T_3V_7, T_3V_8, T_3V_9, T_3V_{10}, T_4V_1, T_4V_2, T_4V_3, T_4V_4, T_4V_5, T_4V_6, T_4V_7, T_4V_8, T_4V_9 and T_4V_{10}.

3.2.2 Design and layout of the experiment

The two factors experiment was laid out in Split-plot design with three replications where cowdung and chemical fertilizers was assigned in main plot and brinjal variety in sub-plot. The experiment area was divided into three equal blocks. Each block contains 40 plots where 40 treatments combination were allotted at random. There were 120 unit plot altogether in the experiment. The size of the each plot was 3.5 m × 1.8 m. The distance maintained between two blocks and two plots were 1.0 m and 0.5 m respectively.

3.3 Growing of crops

3.3.1 Raising of seedlings

Brinjal seedlings were raised in seedbeds of 3.0 m × 1.0 m size. The soil was well prepared and converted into loose friable and dried for seedbed. All weeds and stubbles were removed and well rotten cowdung was mixed with the soil. In each seed bed seeds were sown on 14th August 2013. After sowing, seeds were covered with light soil. Heptachlor 40 WP was applied @ 4 kg ha^{-1}, around each seedbed as precautionary measure against ants and worm. The emergence of the seedlings took place with 5 to 6 days after sowing. For healthy and uniform seedlings seedbeds were watering when necessary and removed weeds when emerged.

3.3.2 Land preparation

The plot selected for conducting the experiment was opened in the 1st week of September 2013 with a power tiller, and left exposed to the sun for a week. After one week the land was harrowed, ploughed and cross-ploughed several times followed by laddering to obtain until good tilth. Weeds and stubbles were removed, and finally obtained a desirable tilth of soil was obtained for transplanting brinjal seedlings. The experimental plot was partitioned into unit

blocks and blocks into unit plots in accordance with the design of the experiment. Cowdung and chemical fertilizers as indicated below in 3.3.3 were mixed with the soil of each unit plot.

3.3.3 Application of manure and fertilizers

The sources of N, P_2O_5, K_2O and S as urea, TSP, MP and Zypsum were applied, respectively. The entire amounts of TSP, Zypsum and 300 kg urea were applied during the final land preparation. The rest amount of urea was applied in three equal installments at 15 days after transplanting (DAT), during fruiting stage and middle point of brinjal harvest with the amount was as per the mentioned below. MP was applied in 50% at 15 DAT and during fruiting stage with the amount was as per the mentioned below. Well-rotten cowdung 10 t/ha also applied during final land preparation. The following amount of manures and fertilizers were used which shown in Table 1 as recommended by BARI (2011).

Table 1. Fertilizers and manure applied for the experimental field

Manures and Fertilizers	Dose/ha	Application			
		Final land preparation	1st installment	2nd installment	3rd installment
Cowdung	10 tons	10 ton	--	--	--
Urea	375 kg	300 kg	25 kg	25 kg	25 kg
TSP	150 kg	150 kg	--	--	--
MP	250 kg	125 kg	50 kg	75 kg	--
Zypsum	100 kg	100 kg	--	--	--

3.3.4 Transplanting of seedlings

Healthy and uniform brinjal seedlings were uprooted separately from the seed bed and were transplanted in the experimental plots in the afternoon of 15 September, 2013 with maintaining 70 cm distance from row to row and 60 cm from plant to plant. This allowed an accommodation of 15 plants in each plot. The seedbed was watered before uprooting the seedlings from the seedbed so as to minimize damage to the roots. Seedlings were also planted around the border area of the experimental plots for gap filling.

3.3.5 After care

After transplanting of seedlings, various intercultural operations such as irrigation, fertilizing weeding and top dressing etc. were accomplished for better growth and development of the brinjal seedlings.

Irrigation and drainage

Over-head irrigation was provided with a watering can to the plots when needed and applied equally for all the plots. Excess water was effectively drained out at the time of heavy rain.

Sticking

When the plants were well established, staking was given to each plant by bamboo sticks to keep them erect.

Weeding

Weeding was done to keep the plots clean and easy aeration of soil which ultimately ensured better growth and development of brinjal plants. The newly emerged weeds were uprooted carefully.

Top dressing

Urea and MP was used as top-dressed as mentioned in 3.3.3. The fertilizers with the mentioned amount were applied on both sides of plant rows and mixed well with the soil. Eathing up operation was done immediately after top-dressing with fertilizer.

Plant protection

Malathion 57 EC was applied @ 2 ml L^{-1} against the insect pests of brinjal like Jassids, thrips and others insets and pests. To control Fruit and Shoot Borer (FSB) tracer was applied as per suggestion of the company. The insecticide application was made fortnightly for a week after transplanting to a week before first harvesting. Furadan 10 G was also applied during final land preparation as soil insecticide.

3.4 Data collection

The following data were recorded at different stages:

3.4.1 Days required for 1st flowering

Days required for transplanting to initiation of flowering was counted from the date of transplanting to the initiation of flowering and was recorded. Data were recorded as the average of 5 plants selected from the inner rows of each plot.

3.4.2 Days required for 1st harvest

Days required for transplanting to starting of harvesting was counted from the date of transplanting to the starting of 1st harvest of brinjal and was recorded. Data were recorded as the average of 5 plants selected from the inner rows of each plot.

3.4.3 Number of leaves per plant

The total number of leaves per plant was counted from plant of each unit plot. Data were recorded during 1st flowering. Data were recorded as the average of 5 plants selected at random from the inner rows of each plot.

3.4.4 Length of leaf (cm)

The length of leaf was measured with a meter scale from one side in to another side in longitudinally of leaf blade of 5 fresh leaves from each plot and there average was taken and expressed in cm.

3.4.5 Breadth of leaf (cm)

The breadth of leaf was measured with a meter scale from one side in to another side of leaf blade of 5 fresh leaves from each plot and there average was taken and expressed in cm.

3.4.6 Plant height (cm)

Plant height was measured from the ground level to the tip of the longest stem and mean value was calculated. Plant height was recorded during 1st flowering as the average of 5 plants to observe the growth rate of plants.

3.4.7 Number of branches per plant

The total number of branches per plant was counted from plant of each unit plot. Data were recorded during 1st flowering. Data were recorded as the average of 5 plants selected at random from the inner rows of each plot.

3.4.8 Root length (cm)

The length of root was measured with a meter scale from one side in to another side of longest root of 5 fresh plants after final harvest from each plot and there average was taken and expressed in cm.

3.4.9 Fresh weight of plant (gm)

The fresh weight per plant was recorded from the average of five (5) selected plants in grams (gm) with a beam balance after final harvest.

3.4.10 Dry matter content of plant

At first whole part of selected plant were collected, cut into pieces and was dried under sunshine for a 3 days and then dried in an oven at 70^0C for 72 hours. The sample was then transferred into desiccators and allowed to cool down at room temperature. The final weight of the sample was taken. The dry matter contents of plant were computed by simple calculation from the weight recorded by the following formula:

$$\text{Dry matter content of plant (\%)} = \frac{\text{Dry weight of plant}}{\text{Fresh weight of plant}} \times 100$$

3.4.11 Number of fruits per plant

The number of brinjal fruits per plant was counted from plant of each unit plot and the number of brinjal per plant was recorded. Data were recorded as the average of 5 plants selected at random from the inner rows of each plot.

3.4.12 Weight of individual fruit (gm)

The weight of individual brinjal fruit was recorded in gram (gm) by a beam balance from all fruits of selected five plants and converted individually.

3.4.13 Length of brinjal (cm)

The length of brinjal fruit was measured with a meter scale from the neck of the fruit to the bottom of 5 selected marketable fruits from each plot and there average was taken and expressed in cm.

3.4.14 Diameter of brinjal (cm)

Diameter of brinjal fruit was measured at the middle portion of 5 selected marketable fruit from each plot with a slide calipers and there average was taken and expressed in cm.

3.4.15 Yield per plant (kg)

Yield of brinjal per plant was recorded as the whole brinjal fruit per plant harvested in different time and was expressed in kilogram. Data were recorded as the average of 5 plants selected at random from the inner rows of each plot.

3.5 Statistical Analysis

The data obtained for different characters under the present trial were statistically analyzed to observe the genotype and environmental interaction of brinjal in relation to yield contributing characters and yield and subsequently variability. The mean values of all the characters were calculated and analysis of variance was performed. The significance of the difference among the treatment means was estimated by the Duncan Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

3.6 Estimation of variability

Genotypic and phenotypic coefficient of variation and heritability were estimated by using the following formulae:

3.6.1 Estimation of components of variance from individual environment

Genotypic and phenotypic variances were estimated with the help of the following formula suggested by Johnson *et al.* (1955). The genotypic variance (σ^2_g) was estimated by subtracting error mean square (σ^2_e) from the genotypic mean square

and dividing it by the number of replication (r). This is estimated by using the following formula -

$$\text{Genotypic variance } (\sigma^2_g) = \frac{MS_V - MS_E}{r}$$

Where,

MS_V = genotype mean square

MS_E = error mean square

r = number of replication

The phenotypic variance (σ^2_p), was derived by adding genotypic variances with the error variance, as given by the following formula –

$$\text{Phenotypic variance } (\sigma^2_{ph}) = \sigma^2_g + \sigma^2_e$$

Where,

σ^2_{ph} = phenotypic variance

σ^2_g = genotypic variance

σ^2_e = error variance

3.6.2 Estimation of genotypic co-efficient of variation (GCV) and phenotypic co-efficient of variation (PCV)

Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were calculated following formula as suggested by Burton (1952):

$$\%\text{ Genotypic coefficient of variance} = \frac{\sigma_g}{\bar{x}} \times 100$$

Where,

σ_g = genotypic standard deviation

$\bar{x}$ = population mean

$$\%\text{ Phenotypic coefficient of variance} = \frac{\sigma_{ph}}{\bar{x}} \times 100$$

Where,

σ_{ph} = phenotypic standard deviation

$\bar{x}$ = population mean

3.6.3 Estimation of heritability

Heritability in broad sense was estimated following the formula as suggested by Johnson *et al.* (1955):

$$\text{Heritability (\%)} = \frac{\sigma^2_g}{\sigma^2_{ph}} \times 100$$

Where,

σ^2_g = genotypic variance

σ^2_{ph} = phenotypic variance

3.6.4 Estimation of genetic advance

The following formula was used to estimate the expected genetic advance for different characters under selection as suggested by Allard (1960):

$$GA = \frac{\sigma^2_g}{\sigma^2_p} \times K.\ \sigma_p$$

Where,

GA = Genetic advance

σ^2_g = genotypic variance

σ^2_{ph} = phenotypic variance

σ_{ph} = phenotypic standard deviation

K = Selection differential which is equal to 2.64 at 5% selection intensity

3.6.5 Estimation of genetic advance in percentage of mean

Genetic advance in percentage of mean was calculated by the following formula given by Comstock and Robinson (1952):

$$\text{Genetic Advance in percentage of mean} = \frac{\text{Genetic advance}}{\bar{x}} \times 100$$

CHAPTER IV

RESULTS AND DISCUSSION

CHAPTER IV

RESULTS AND DISCUSSION

The study was conducted to find out the performance of brinjal genotypes (*Solanum melongena* L.) under different growth conditions. Mean performance and variability studies were done on different yield and yield contributing characters of brinjal variety due to the environmental condition created by application of cowdung and chemical fertilizers treatment. The experimental results obtained have been presented under the following heads:

4.1 Mean performance of different yield and yield contributing characters of brinjal

4.1.1 Days required for 1st flowering

Statistically significant variation was recorded in terms of days required for 1st flowering of brinjal due to application of different treatment (Table 2). The maximum days required for 1st flowering (53.73) was observed from T_4 (application of TSP + MP) which was statistically similar (53.01) with T_1 (application of cowdung), while the minimum days required for flowering (51.54) was found from T_2 (application of cowdung + Urea + TSP + MP) treatment which was statistically identical (52.15) with T_3 (application of Urea + TSP + MP) treatment. Naidu *et al.* (1997) reported that NPK at 75:35:0 kg/ha + farmyard manure at 25 t/ha recorded the earliest 50% flowering. Agbo *et al.* (2012) reported that days to flowering increased with increase in rate of organic manure.

Days required for 1st flowering of brinjal showed statistically significant variation due to different variety (Table 2). The maximum days required for 1st flowering (57.52) was recorded from V_7 (BARI Begun-7), which was statistically identical (56.81) with V_{10} (BARI Begun-10), whereas the minimum days required for 1st flowering (48.32) was attained from V_2 (BARI Begun-2). Kumar *et al.* (2000) reported that HLB-25 genotypes recorded the minimum days to flowering eleven advance lines along with three standard control cultivars of brinjal.

Table 2. Main effect of treatment and variety on days required for 1st flowering & harvest, length and breadth of leaf of brinjal

Treatment and variety	Days required for 1st flowering	Days required for 1st harvest	Length of leaf (cm)	Breadth of leaf (cm)
Treatment				
T_1	53.01 ab	62.85 ab	14.22 ab	4.27 bc
T_2	51.54 c	62.07 b	14.75 a	4.55 a
T_3	52.15 bc	62.42 b	14.28 ab	4.43 ab
T_4	53.73 a	63.88 a	13.33 b	4.23 c
$LSD_{(0.05)}$	1.244	1.098	0.987	0.184
Level of significance	0.05	0.05	0.05	0.05
Variety				
V_1	50.73 cd	62.82 c	14.63 ab	4.16 c
V_2	48.32 \d	58.68 e	15.44 a	4.64 a
V_3	54.25 b	63.52 bc	13.69 bc	4.26 bc
V_4	49.66 cd	59.45 de	15.26 a	4.51 ab
V_5	52.33 bc	61.70 cd	12.75 c	4.53 ab
V_6	50.92 cd	61.87 cd	13.48 bc	4.55 ab
V_7	57.52 a	66.87 a	12.56 c	4.02 c
V_8	51.62 bc	63.45 bc	14.58 ab	4.23 bc
V_9	53.93 b	63.92 bc	14.79 ab	4.30 bc
V_{10}	56.81 a	65.80 ab	14.25 ab	4.50 ab
$LSD_{(0.05)}$	2.467	2.374	1.353	0.297
Level of significance	0.01	0.01	0.01	0.01
CV(%)	5.76	4.65	12.17	8.33

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability

T_1: Cowdung
T_2: Cowdung + Urea + TSP + MP
T_3: Urea + TSP + MP
T_4: TSP + MP

V_1: BARI Begun-1
V_2: BARI Begun-2
V_3: BARI Begun-3
V_4: BARI Begun-4
V_5: BARI Begun-5
V_6: BARI Begun-6
V_7: BARI Begun-7
V_8: BARI Begun-8
V_9: BARI Begun-9
V_{10}: BARI Begun-10

Combined effect of different treatment and variety showed significant differences on days required for 1st flowering of brinjal (Table 3). The maximum days required for 1st flowering (60.60) was recorded from T_4V_8 (appliation of TSP + MP and BARI Begun-8) treatment combination and the minimum days required for 1st flowering (44.33) was observed from T_3V_2 (application of Urea + TSP + MP and BARI Begun-2) treatment combination.

4.1.2 Days required for 1st harvest

Days required for 1st harvest of brinjal varied significantly for application of different treatment (Table 2). The maximum days required for 1st harvest (63.88) was recorded from T_4 (application of TSP + MP) which was statistically similar (62.85) with T_1 (application of cowdung). On th other hand, the minimum days required for harvest (62.07) was observed from T_2 (application of cowdung + Urea + TSP + MP) treatment which was statistically identical (62.42) with T_3 (application of Urea + TSP + MP) treatment.

Statistically significant variation was recorded for different variety on days required for 1st harvest of brinjal (Table 2). The maximum days required for 1st flowering (66.87) was found from V_7 (BARI Begun-7), which was statistically identical (65.80) with V_{10} (BARI Begun-10), again the minimum days required for 1st harvest (58.68) was recorded from V_2 (BARI Begun-2). Kumar *et al.* (2000) reported that HLB-25 genotypes recorded the minimum days to harvest eleven advance lines along with three standard control cultivars of brinjal.

Combined effect of different treatment and variety showed significant differences on days required for 1st harvest of brinjal (Table 3). The maximum days required for 1st harvest (69.07) was found from T_3V_7 (appliation of TSP + MP and BARI Begun-7) treatment combination, while the minimum days required for 1st harvest (55.00) was found from T_3V_2 (application of Urea + TSP + MP and BARI Begun-2) treatment combination.

Table 3. Combined effect of treatment and variety on days required for 1st flowering & harvest, length and breadth of leaf of brinjal

Treatment and variety	Days required for 1st flowering	Days required for 1st harvest	Length of leaf (cm)	Breadth of leaf (cm)
T_1V_1	48.20 g-k	56.00 l-n	10.18 m	4.53 b-i
T_1V_2	55.60 a-e	61.93 f-k	18.68 ab	3.76 jk
T_1V_3	54.07 b-g	64.60 a-j	13.75 d-l	3.93 h-k
T_1V_4	44.87 jk	55.67 mn	10.18 m	5.33 a
T_1V_5	55.53 a-e	67.20 a-g	16.17 b-e	4.09 g-k
T_1V_6	55.00 a-f	67.93 a-e	15.30 c-h	4.16 f-k
T_1V_7	57.10 a-d	65.53 a-h	11.22 k-m	3.89 h-k
T_1V_8	49.67 e-k	60.53 h-n	15.63 b-g	4.49 b-j
T_1V_9	50.67 e-j	60.47 h-n	13.69 d-l	4.46 b-j
T_1V_{10}	59.40 ab	68.67 a	17.44 a-c	4.09 g-k
T_2V_1	49.00 f-k	59.13 i-n	15.08 c-i	4.48 b-j
T_2V_2	46.53 i-k	58.53 k-n	15.61 b-g	5.08 ab
T_2V_3	55.13 a-k	63.47 a-k	15.45 c-h	4.38 b-k
T_2V_4	52.87 c-g	62.27 e-k	20.08 a	3.94 h-k
T_2V_5	51.80 d-i	58.87 j-n	11.70 j-m	4.94 a-d
T_2V_6	48.53 g-k	59.87 h-n	12.56 f-m	4.91 a-e
T_2V_7	57.70 a-d	68.07 a-d	15.06 c-i	3.97 h-k
T_2V_8	45.73 jk	62.00 f-k	13.01 e-m	4.31 c-k
T_2V_9	55.00 a-f	63.73 a-k	15.96 b-e	4.44 b-j
T_2V_{10}	53.13 c-g	64.80 a-i	12.95 e-m	5.01 a-c
T_3V_1	53.07 c-g	67.80 a-e	16.99 b-d	3.69 k
T_3V_2	44.33 k	55.00 n	13.90 d-l	4.86 a-f
T_3V_3	55.67 a-e	63.47 a-k	13.69 d-l	4.29 c-k
T_3V_4	50.43 e-j	58.27 k-n	15.86 b-f	4.53 b-i
T_3V_5	51.93 d-i	61.20 h-m	12.39 g-m	4.73 a-g
T_3V_6	51.73 d-i	61.73 f-k	14.82 c-j	4.56 b-h
T_3V_7	58.47 a-c	69.07 a	13.70 d-l	4.05 g-k
T_3V_8	50.47 e-j	62.80 b-k	14.59 c-j	4.33 c-k
T_3V_9	50.20 e-k	62.60 c-k	14.74 c-j	4.36 b-k
T_3V_{10}	55.20 a-e	62.27 e-k	12.13 h-m	4.89 a-e
T_4V_1	52.67 c-h	68.33 a-c	16.27 b-e	3.96 h-k
T_4V_2	46.80 h-k	59.27 i-n	13.56 e-l	4.85 a-f
T_4V_3	52.13d-i	62.53 d-k	11.90 i-m	4.43 b-k
T_4V_4	50.47 e-j	61.60 g-l	14.93 c-j	4.26 d-k
T_4V_5	50.07 e-k	59.53 i-n	10.76 lm	4.36 b-k
T_4V_6	48.40 g-k	57.93 k-n	11.25 k-m	4.56 b-h
T_4V_7	56.80 a-d	64.80 a-i	10.27 m	4.18 e-k
T_4V_8	60.60 a	68.47 ab	15.11c-i	3.79 i-k
T_4V_9	59.87 ab	68.87 a	14.77 c-j	3.92 h-k
T_4V_{10}	59.50 ab	67.47 a-f	14.48 c-k	3.99 h-k
$LSD_{(0.05)}$	4.934	4.749	2.706	0.594
Level of significance	0.01	0.01	0.01	0.01
CV(%)	5.76	4.65	12.17	8.33

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability

T_1: Cowdung
T_2: Cowdung + Urea + TSP + MP
T_3: Urea + TSP + MP
T_4: TSP + MP

V_1: BARI Begun-1
V_2: BARI Begun-2
V_3: BARI Begun-3
V_4: BARI Begun-4
V_5: BARI Begun-5
V_6: BARI Begun-6
V_7: BARI Begun-7
V_8: BARI Begun-8
V_9: BARI Begun-9
V_{10}: BARI Begun-10

4.1.3 Number of leaves per plant

Application of different treatment varied significantly in terms of number of leaves per plant of brinjal (Figure 1). The maximum number of leaves per plant (154.63) was found from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (149.67 and 147.60) with T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung), whereas the minimum number (135.20) was recorded from T_4 (application of TSP + MP) treatment. Vizayakumar *et al.* (1995) reported that NPK fertilizers increase the vegetable growth of brinjal. Shilpi *et al.* (2014) reported that maximum number of leaves (103.8 per plant) was recorded under 25% RDF+ 75% Neemcake and the minimum under control.

Number of leaves per plant showed statistically significant variation for different variety of brinjal (Figure 2). The maximum number of leaves per plant (165.50) was observed from V_2 (BARI Begun-2), which was statistically identical (162.75 and 158.75) with V_4 (BARI Begun-4) and V_1 (BARI Begun-1), while the minimum number (140.17) was found from V_7 (BARI Begun-7).

Statistically significant variation was recorded for the combined effect of different treatment and variety in terms of number of leaves per plant (Figure 3). The maximum number of leaves per plant (245.00) was obtained from T_1V_2 (appliation of cowdung and BARI Begun-2) treatment combination, whereas the minimum number (104.33) was observed from T_4V_6 (application of TSP + MP and BARI Begun-6) treatment combination.

4.1.4 Length of leaf

Length of leaf of brinjal varied significantly for application of different treatment (Table 2). The longest leaf (14.75 cm) was recorded from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (14.28 cm and 14.22 cm) with T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung), again the shortest leaf (13.33 cm) from T_4 (application of TSP + MP) treatment. Naidu *et al.* (1997) reported that NPK at 100:60:50 kg/ha + farmyard manure at 25 t/ha recorded the highest values for length of leaf.

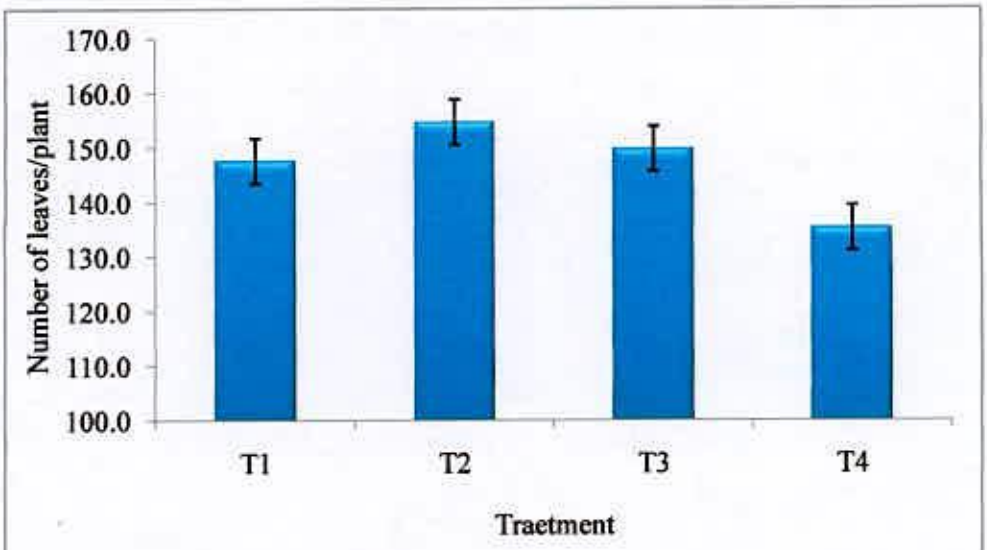


Fig. 1. Effect of different treatment on number of leaves per plant of brinjal. Vertical bars represent LSD value (T_1: Cowdung, T_2: Cowdung + Urea + TSP + MP, T_3: Urea + TSP +MP and T_4: TSP + MP)

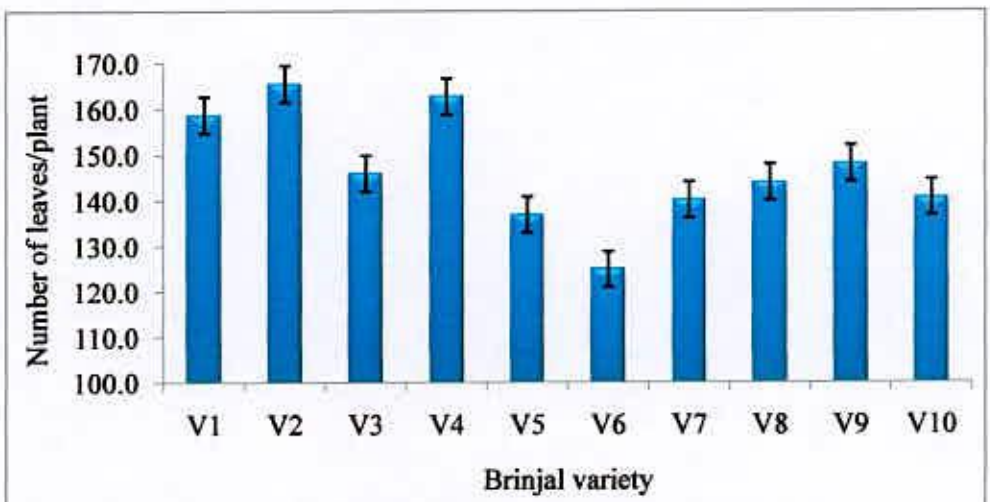


Fig .2. Effect of different variety on number of leaves per plant of brinjal. Vertical bars represent LSD value (V_1: BARI Begun-1,V_2: BARI Begun-2, V_3: BARI Begun-3, V_4: BARI Begun-4, V_5: BARI Begun-5, V_6: BARI Begun-6, V_7: BARI Begun-7, V_8: BARI Begun-8, V_9: BARI Begun-9, V_{10}: BARI Begun-10)

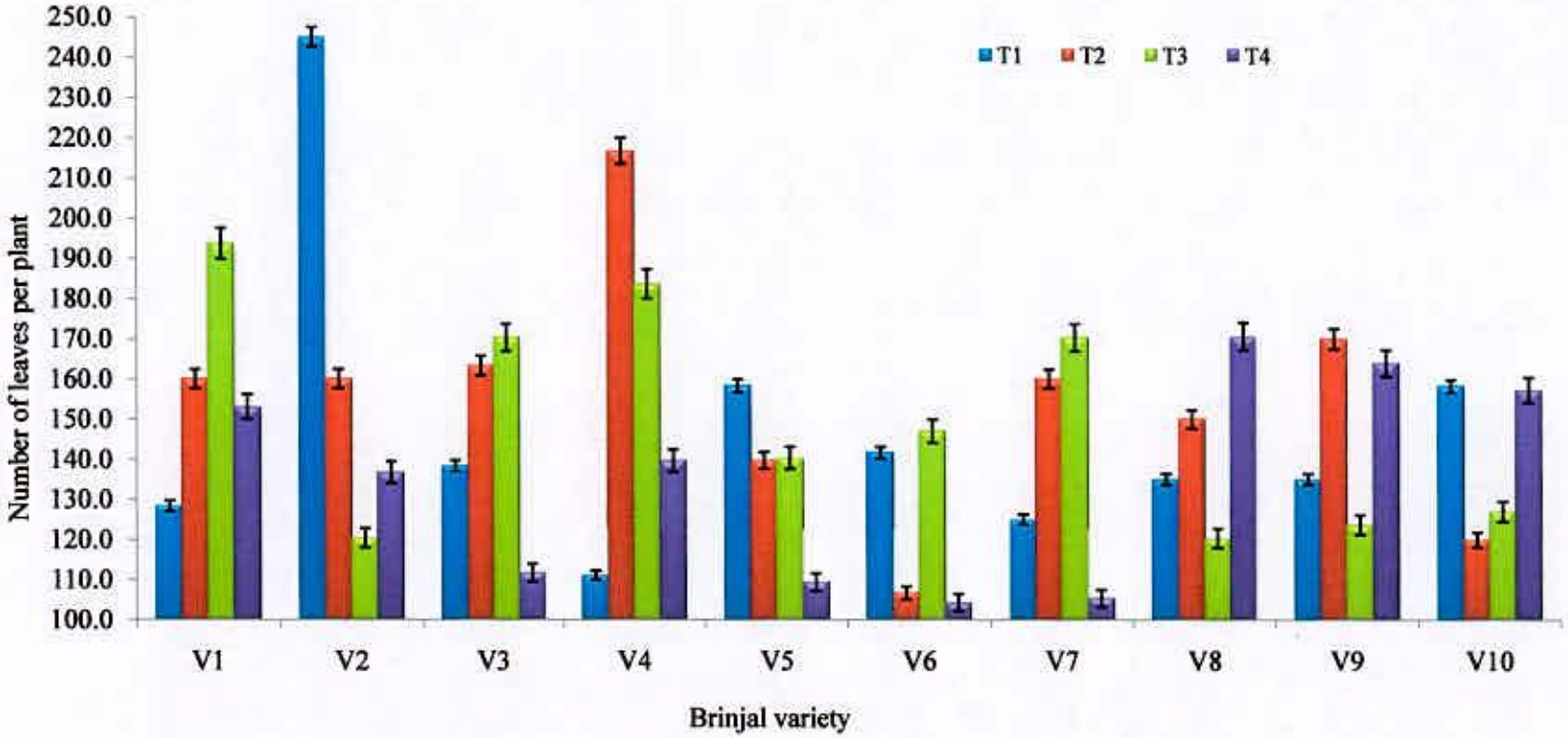


Fig. 3. Combined effect of treatment and different variety on number of leaves per plant of brinjal. Vertical bars represent LSD value. (T_1: Cowdung, T_2: Cowdung + Urea + TSP + MP, T_3: Urea + TSP +MP and T_4: TSP + MP; and V_1: BARI Begun-1, Begun-1,V_2: BARI Begun-2, V_3: BARI Begun-3, V_4: BARI Begun-4, V_5: BARI Begun-5, V_6: BARI Begun-6, V_7: BARI Begun-7, V_8: BARI Begun-8, V_9: BARI Begun-9, V_{10}: BARI Begun-10)

Statistically significant variation was recorded for different variety on length of leaf of brinjal (Table 2). The longest leaf (15.44 cm) was found from V_2 (BARI Begun-2), which was statistically identical (15.26 cm) with V_4 (BARI Begun-4), whereas the shortest leaf (12.56 cm) was recorded from V_7 (BARI Begun-7).

Combined effect of different treatment and variety showed significant differences on length of leaf (Table 3). The longest leaf (20.08 cm) was found from T_2V_4 (appliation of cowdung + Urea + TSP + MP and BARI Begun-4) treatment combination and the shortest leaf (10.18 cm) was found from T_1V_1 (application of cowdung and BARI Begun-1) treatment combination.

4.1.5 Breadth of leaf

Statistically significant variation was observed for application of different treatment in terms of breadth of leaf of brinjal (Table 2). The highest breadth of leaf (4.55 cm) was recorded from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (4.43 cm) with T_3 (application of Urea + TSP + MP), while the lowest breadth of leaf (4.23 cm) was recorded from T_4 (application of TSP + MP) treatment.

Breadth of leaf of brinjal varied significantly for different variety (Table 2). The highest breadth of leaf (4.64 cm) was attained from V_2 (BARI Begun-2), which was statistically identical (4.55 cm, 5.53 cm, 4.51 cm and 4.50 cm) with V_6 (BARI Begun-6), V_5 (BARI Begun-5), V_4 (BARI Begun-4) and V_{10} (BARI Begun-10), while the lowest breadth of leaf (4.02 cm) was observed from V_7 (BARI Begun-7).

Different treatment and variety showed significant differences due to their combined effect in terms of breadth of leaf (Table 3). The highest breadth of leaf (5.33 cm) was found from T_1V_4 (appliation of cowdung and BARI Begun-4) treatment combination, while the lowest breadth of leaf (3.69 cm) was found from T_3V_1 (application of Urea + TSP + MP and BARI Begun-1) treatment combination.

4.1.6 Plant height

Plant height of brinjal varied significantly for application of different treatment (Figure 4). The tallest plant (88.46 cm) was observed from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (87.95 cm and 87.44 cm) with T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung), wheras the shortest plant (81.21 cm) was attained from T_4 (application of TSP + MP) treatment. Shilpi *et al.* (2014) reported that maximum plant height (47.33 cm) was recorded under 25% RDF+ 75% Neemcake and minimum under control.

Statistically significant variation was recorded for different variety on plant height of brinjal (Figure 5). The tallest plant (93.04 cm) was recorded from V_2 (BARI Begun-2), which was statistically identical (91.65 cm, 89.96 cm, 88.68 cm, 88.50 cm and 87.36 cm) with V_4 (BARI Begun-4), V_9 (BARI Begun-9), V_8 (BARI Begun-8), V_1 (BARI Begun-1) and V_{10} (BARI Begun-10), while the shortest plant (77.75 cm) was found from V_7 (BARI Begun-7).

Combined effect of different treatment and variety showed significant differences on plant height of brinjal (Figure 6). The tallest plant (115.77 cm) was observed from T_2V_4 (appliation of cowdung + Urea + TSP + MP and BARI Begun-4) treatment combination and the shortest plant (64.15 cm) was recorded from T_4V_7 (application of TSP + MP and BARI Begun-7) treatment combination.

4.1.7 Number of branches per plant

Number of branches per plant of brinjal varied significantly for application of different treatment (Table 4). The maximum number of branches per plant (14.03) was recorded from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (13.93 and 13.85) with T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung), while the minimum number (13.33) was found from T_4 (application of TSP + MP) treatment. Shilpi *et al.* (2014) reported that maximum number of branches (9.22) was recorded under 25% RDF+ 75% Neemcake and found minimum under control.

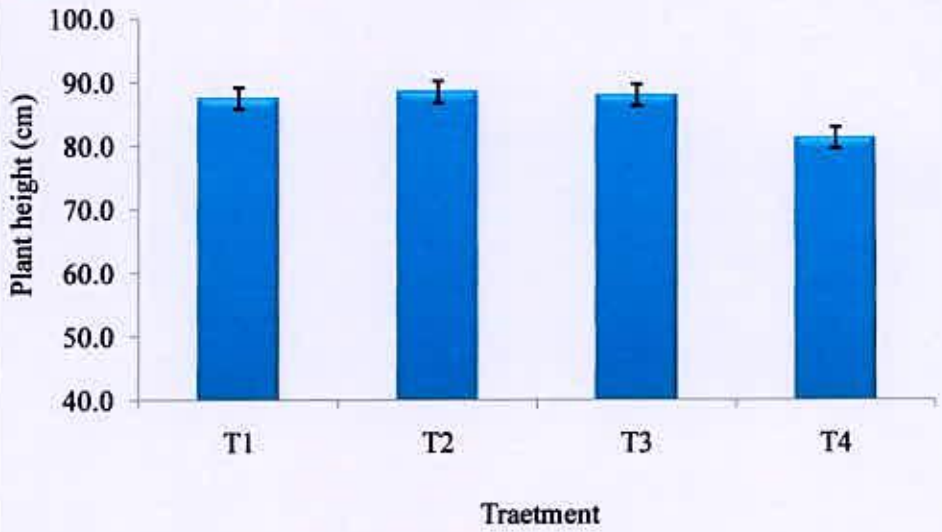


Fig. 4. Effect of different treatment on plant height of brinjal. Vertical bars represent LSD value. (T_1: Cowdung, T_2: Cowdung + Urea + TSP + MP, T_3: Urea + TSP +MP and T_4: TSP + MP)

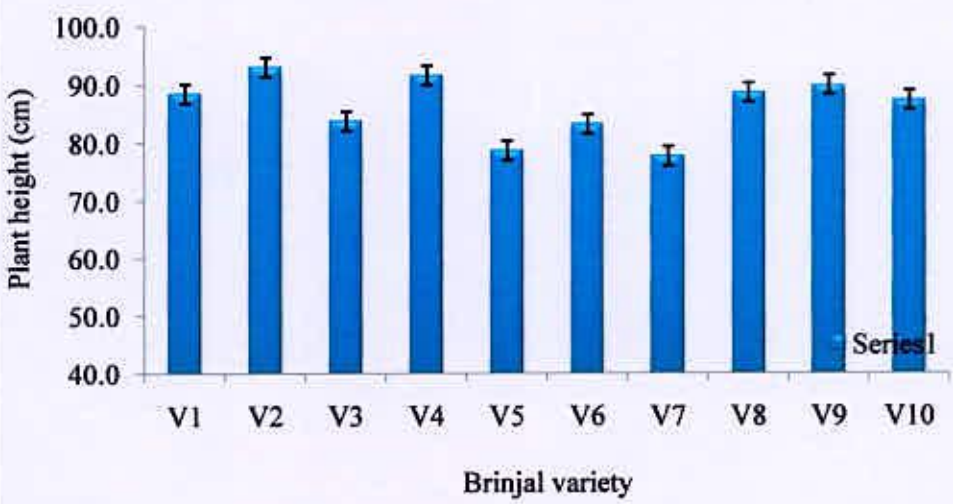


Fig.5. Effect of different variety on plant height of brinjal. Vertical bars represent LSD value. (V_1: BARI Begun-1, V_2: BARI Begun-2, V_3: BARI Begun-3, V_4: BARI Begun-4, V_5: BARI Begun-5, V_6: BARI Begun-6, V_7: BARI Begun-7, V_8: BARI Begun-8, V_9: BARI Begun-9, V_{10}: BARI Begun-10)

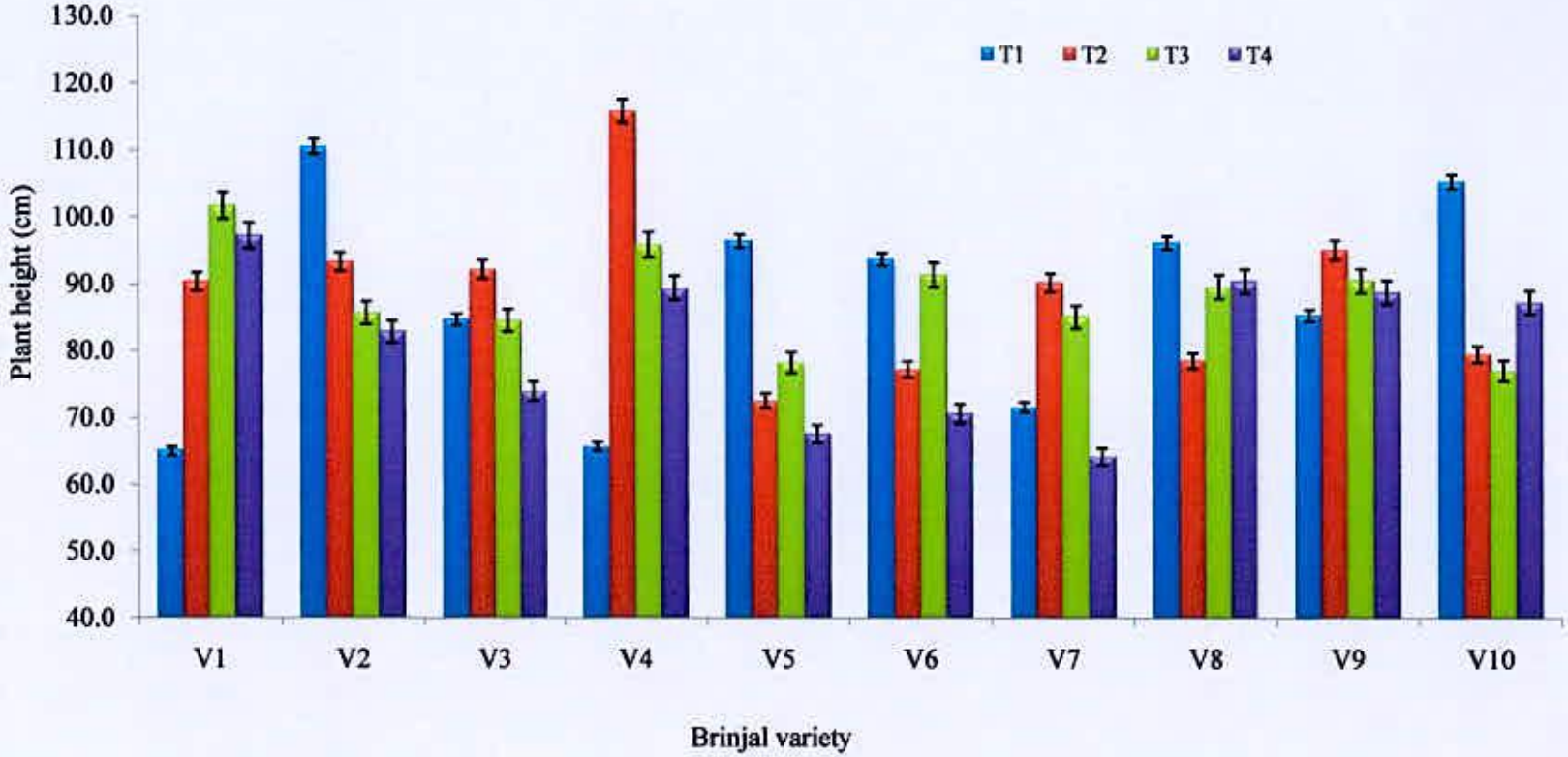


Fig.6. Combined effect of treatment and different variety on plant height of brinjal. Vertical bars represent LSD value. (T_1: Cowdung, T_2: Cowdung + Urea + TSP + MP, T_3: Urea + TSP +MP and T_4: TSP + MP; and V_1: BARI Begun-1, V_2: BARI Begun-2, V_3: BARI Begun-3, V_4: BARI Begun-4, V_5: BARI Begun-5, V_6: BARI Begun-6, V_7: BARI Begun-7, V_8: BARI Begun-8, V_9: BARI Begun-9, V_{10}: BARI Begun-10)

Table 4. Main effect of treatment and variety on number of branches per plant, root length, fresh weight of plant and dry matter content of pant of brinjal

Treatment and variety	Number of branches per plant	Root length (cm)	Fresh weight of plant (g)	Dry matter content of plant (%)
Treatment				
T_1	13.85 a	13.15 a	222.26 a	8.02 a
T_2	14.03 a	13.31 a	229.79 a	8.21 a
T_3	13.93 a	13.20 a	223.58 a	8.10 a
T_4	13.33 b	12.71 b	205.67 b	7.69 b
$LSD_{(0.05)}$	0.381	0.359	11.24	0.306
Level of significance	0.05	0.05	0.01	0.05
Variety				
V_1	14.25 a	13.75 a	228.86 ab	8.35 ab
V_2	14.33 a	13.50 ab	236.38 a	8.44 ab
V_3	13.68 a-d	13.17 bc	212.27 c-e	7.86 cd
V_4	14.18 a	13.76 a	234.89 ab	8.48 a
V_5	13.25 b-d	12.88 cd	203.24 e	7.61 d
V_6	13.05 d	12.49 d	207.62 de	7.59 d
V_7	13.12 cd	13.14 bc	207.18 de	7.76 cd
V_8	14.23 a	12.81 cd	227.46 a-c	8.07 bc
V_9	13.93 ab	12.90 cd	219.63 b-d	7.94 cd
V_{10}	13.82 a-c	12.52 d	225.72 a-c	7.96 cd
$LSD_{(0.05)}$	0.673	0.504	14.04	0.363
Level of significance	0.01	0.01	0.01	0.01
CV(%)	6.00	4.73	7.83	5.58

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability

T_1: Cowdung
T_2: Cowdung + Urea + TSP + MP
T_3: Urea + TSP + MP
T_4: TSP + MP

V_1: BARI Begun-1
V_2: BARI Begun-2
V_3: BARI Begun-3
V_4: BARI Begun-4
V_5: BARI Begun-5
V_6: BARI Begun-6
V_7: BARI Begun-7
V_8: BARI Begun-8
V_9: BARI Begun-9
V_{10}: BARI Begun-10

Table 5. Combined effect of treatment and variety on number of branches per plant, root length, fresh weight of plant and dry matter content of pant of brinjal

Treatment and variety	Number of branches per plant	Root length (cm)	Fresh weight of plant (g)	Dry matter content of plant (%)
T_1V_1	13.33 c-l	13.30 d-l	200.27 g-m	7.62 f-k
T_1V_2	15.60 ab	15.05 ab	286.19 a	9.81 a
T_1V_3	14.00 b-h	13.44 d-l	214.23 d-k	7.94 d-j
T_1V_4	12.00 kl	12.50 k-p	194.59 j-m	7.29 h-l
T_1V_5	14.60 b-e	13.96 b-g	233.40 b-h	8.46 b-f
T_1V_6	13.93 c-i	13.66 c-k	219.79 c-k	8.11 c-h
T_1V_7	12.60 g-l	12.94 f-n	196.22 i-m	7.44 g-l
T_1V_8	14.13 b-h	12.24 l-q	223.17 b-k	7.79 e-j
T_1V_9	13.33 c-l	11.15 q	201.67 f-m	7.06 j-l
T_1V_{10}	15.00 a-c	13.28 e-l	253.05 bc	8.67 b-e
T_2V_1	14.07 b-h	13.76 c-j	230.53 b-i	8.35 b-f
T_2V_2	14.27 b-g	13.79 c-i	229.52 b-i	8.34 b-f
T_2V_3	14.33 b-f	13.90 b-h	234.83 b-g	8.47 b-f
T_2V_4	16.13 a	15.27 a	286.61 a	9.88 a
T_2V_5	13.00 e-l	13.11 e-m	203.91 e-m	7.64 f-k
T_2V_6	11.87 l	11.91 m-q	193.46 j-m	7.11 j-l
T_2V_7	14.07 b-h	13.76 c-j	230.53 b-i	8.35 b-f
T_2V_8	14.60 b-e	12.23 l-q	235.67 b-f	8.04 d-h
T_2V_9	14.27 b-g	13.85 c-h	237.17 b-e	8.51 b-f
T_2V_{10}	13.67 c-j	11.53 o-q	215.67 d-k	7.45 g-l
T_3V_1	14.87 a-d	14.85 a-c	255.02 b	9.18 ab
T_3V_2	14.27 b-g	12.69 h-o	216.99 d-k	7.83 d-j
T_3V_3	13.60 c-k	13.95 b-g	224.89 b-j	8.33 b-f
T_3V_4	14.47 b-f	14.51 a-d	248.63 b-d	8.96 bc
T_3V_5	12.87 f-l	12.54 j-p	199.92 h-m	7.45 g-l
T_3V_6	14.07 b-h	12.56 j-p	227.03 b-j	8.00 d-i
T_3V_7	13.60 c-k	14.03 b-f	224.94 b-j	8.36 b-f
T_3V_8	14.27 b-g	12.57 j-p	215.35 d-k	7.77 f-j
T_3V_9	14.40 b-f	12.60 i-p	213.69 e-k	7.74 f-k
T_3V_{10}	12.93 e-l	11.72 n-q	209.33 e-l	7.42 g-l
T_4V_1	14.73 a-d	13.09 e-m	229.62 b-i	8.27 c-g
T_4V_2	13.20 d-l	12.49 k-p	212.84 e-k	7.77 f-j
T_4V_3	12.80 f-l	11.38 pq	175.14 m	6.69 l
T_4V_4	14.13 b-h	12.75 g-o	209.72 e-l	7.78 e-j
T_4V_5	12.53 h-l	11.92 m-q	175.74 m	6.88 kl
T_4V_6	12.33 i-l	11.84 n-q	190.21 k-m	7.14 i-l
T_4V_7	12.20 j-l	11.83 n-q	177.03 lm	6.88 kl
T_4V_8	13.93 c-i	14.20 a-e	235.65 b-f	8.69 b-d
T_4V_9	13.73 c-j	14.00 b-f	225.99 b-j	8.45 b-f
T_4V_{10}	13.67 c-j	13.57 d-k	224.82 b-j	8.31 b-g
$LSD_{(0.05)}$	1.346	1.007	28.08	0.726
Level of significance	0.01	0.01	0.01	0.01
CV(%)	6.00	4.73	7.83	5.58

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability

T_1: Cowdung
T_2: Cowdung + Urea + TSP + MP
T_3: Urea + TSP + MP
T_4: TSP + MP

V_1: BARI Begun-1
V_2: BARI Begun-2
V_3: BARI Begun-3
V_4: BARI Begun-4
V_5: BARI Begun-5
V_6: BARI Begun-6
V_7: BARI Begun-7
V_8: BARI Begun-8
V_9: BARI Begun-9
V_{10}: BARI Begun-10

Statistically significant variation was recorded for different variety on of number branches per plant of brinjal (Table 4). The maximum number branches per plant (14.33) was found from V_2 (BARI Begun-2), which was statistically identical (14.25, 14.23, 14.18, 13.93, 13.82 and 13.68) with V_1 (BARI Begun-1), V_8 (BARI Begun-8), V_4 (BARI Begun-4), V_9 (BARI Begun-9), V_{10} (BARI Begun-10) and V_3 (BARI Begun-3), while the minimum number (13.05) was recorded from V_6 (BARI Begun-6).

Combined effect of different treatment and variety showed significant differences on number branches per plant of brinjal (Table 5). The maximum number branches per plant (16.13) was found from T_2V_4 (appliation of cowdung + Urea + TSP + MP and BARI Begun-4) treatment combination, while the minimum number (11.87) was found from T_2V_6 (application of cowdung + Urea + TSP + MP and BARI Begun-7) treatment combination.

4.1.8 Root length

Root length of brinjal varied significantly for application of different treatment (Table 4). The tallest root (13.31 cm) was found from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (13.20 cm and 13.15 cm) with T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung), again the shortest root (12.71 cm) was observed from T_4 (application of TSP + MP) treatment.

Statistically significant variation was recorded for different variety on root length of brinjal (Table 4). The tallest root (13.76 cm) was attained from V_2 (BARI Begun-2), which was statistically identical (13.75 cm and 13.50 cm) with V_1 (BARI Begun-1) and V_2 (BARI Begun-2), whereas the shortest root (12.49 cm) was found from V_6 (BARI Begun-6).

Combined effect of different treatment and variety showed significant differences on root length of brinjal (Table 5). The tallest root (15.27 cm) was recorded from T_2V_4 (appliation of cowdung Urea + TSP + MP and BARI Begun-4) treatment

combination, again the shortest root (11.15 cm) was observed from T_1V_9 (application of cowdung and BARI Begun-9) treatment combination.

4.1.9 Fresh weight of plant

Fresh weight of plant of brinjal varied significantly for application of different treatment (Table 4). The highest fresh weight of plant (229.79 g) was found from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (223.58 g and 222.26 g) with T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung), while the lowest weight (205.67 g) was attained from T_4 (application of TSP + MP) treatment.

Different variety showed statistically significant variation in terms of fresh weight of plant of brinjal (Table 4). The highest fresh weight of plant (236.38 g) was recorded from V_2 (BARI Begun-2), which was statistically identical (234.89 g, 228.86 g, 227.46 g and 225.72 g) with V_4 (BARI Begun-4), V_1 (BARI Begun-1), V_8 (BARI Begun-8) and V_{10} (BARI Begun-10), whereas the lowest weight (203.24 g) was found from V_5 (BARI Begun-5).

Statistically significant variation was recorded due to the combined effect of different treatment and variety on fresh weight of plant of brinjal (Table 5). The highest fresh weight of plant (286.61 g) was attained from T_2V_4 (appliation of cowdung + Urea + TSP + MP and BARI Begun-4) treatment combination and the lowest weight (175.14 g) was observed from T_4V_3 (application of TSP + MP and BARI Begun-3) treatment combination.

4.1.10 Dry matter content of plant

Dry matter content of plant of brinjal varied significantly for application of different treatment (Table 4). The highest dry matter content of plant (8.21%) was recorded from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (8.10% and 8.02%) with T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung), while the lowest (7.69%) was observed from T_4 (application of TSP + MP) treatment.

Statistically significant variation was recorded for different variety on of dry matter content of plant of brinjal (Table 4). The highest dry matter content of plant (8.48%) was attained from V_4 (BARI Begun-4), which was statistically similar (8.44% and 8.35%) with V_2 (BARI Begun-2) and V_1 (BARI Begun-1), while the lowest (7.59%) was found from V_6 (BARI Begun-6).

Combined effect of different treatment and variety showed significant differences on dry matter content of plant of brinjal (Table 5). The highest dry matter content of plant (9.88%) was found from T_2V_4 (appliation of cowdung + Urea + TSP + MP and BARI Begun-4) treatment combination, while the lowest (6.69%) was found from T_4V_3 (application of TSP + MP and BARI Begun-3) treatment combination.

4.1.11 Number of fruits per plant

Statistically significant variation was recorded in terms of number of fruits per plant of brinjal due to the application of different treatment (Table 6). The maximum number of fruits per plant (34.29) was recorded from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (33.81 and 33.73) with T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung). On the other hand, the minimum number (31.57) was found from T_4 (application of TSP + MP) treatment. Suge *et al.* (2011) reported that the plants in the organic manure treated plots were characterized with vigorous vegetative growth, which in turn led to increase in total fruit yields. Shilpi *et al.* (2014) reported that yield attributing parameters were recorded maximum in terms of number of fruits per plant (16.66) under 25% RDF+ 75% Neem cake while, all the yield and yield attributing parameters found minimum under control.

Number of fruits per plant of brinjal showed statistically significant variation for different variety (Table 6). The maximum number of fruits per plant (52.73) was found from V_1 (BARI Begun-1), which was closely followed (43.15 and 41.40) by V_2 (BARI Begun-2) and V_4 (BARI Begun-4), whereas the minimum number (19.33) was recorded from V_6 (BARI Begun-6).

Table 6. Main effect of treatment and variety on number of fruits per plant, weight of individual fruit, length and yield per plant of brinjal

Treatment and variety	Number of fruits per plant	Weight of individual fruit (g)	Length of brinjal (cm)	Yield per plant (kg)
Treatment				
T_1	33.73 a	71.68 b	17.36 b	2.37 c
T_2	34.29 a	75.61 a	18.96 a	2.53 a
T_3	33.81 a	73.20 b	17.76 b	2.42 b
T_4	31.57 b	66.66 c	16.18 c	2.04 d
$LSD_{(0.05)}$	1.001	2.092	1.127	0.049
Level of significance	0.01	0.01	0.01	0.01
Variety				
V_1	52.73 a	54.57 f	21.24 a	2.88 b
V_2	43.15 b	73.26 bc	13.76 c	3.16 a
V_3	36.77 c	71.31 cd	19.73 b	2.62 c
V_4	41.40 b	74.63 b	21.79 a	3.11 a
V_5	30.70 d	69.91 de	13.91 c	2.15 d
V_6	19.33 f	95.52 a	10.84 d	1.85 e
V_7	20.70 f	71.27 cd	21.35 a	1.48 g
V_8	32.77 d	69.47 de	21.11 a	2.28 d
V_9	23.62 e	69.98 de	10.97 d	1.66 f
V_{10}	32.32 d	67.93 e	20.95 a	2.19 d
$LSD_{(0.05)}$	2.183	2.804	1.107	0.150
Level of significance	0.01	0.01	0.01	0.01
CV(%)	8.05	4.80	7.74	7.92

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability

T_1: Cowdung
T_2: Cowdung + Urea + TSP + MP
T_3: Urea + TSP + MP
T_4: TSP + MP

V_1: BARI Begun-1
V_2: BARI Begun-2
V_3: BARI Begun-3
V_4: BARI Begun-4
V_5: BARI Begun-5
V_6: BARI Begun-6
V_7: BARI Begun-7
V_8: BARI Begun-8
V_9: BARI Begun-9
V_{10}: BARI Begun-10

Plate 1. Photograph showing field of Brinjal

Plate 2. Photograph showing flower of Brinjal

Different treatment and variety showed significant differences due to their combined effect in terms of number fruits per plant of brinjal (Table 7). The maximum number of fruits per plant (55.60) was found from T_2V_1 (appliation of cowdung + Urea + TSP + MP and BARI Begun-1) treatment combination, again the minimum number (17.67) was found from T_3V_6 (application of Urea + TSP + MP and BARI Begun-6) treatment combination.

4.1.12 Weight of individual fruit

Weight of individual fruit of brinjal varied significantly for application of different treatment (Table 6). The highest weight of individual fruit (75.61 g) was observed from T_2 (application of cowdung + Urea + TSP + MP) which was closely followed (73.20 g and 71.68 g) by T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung), again the lowest weight (66.66 g) was recorded from T_4 (application of TSP + MP) treatment. Shilpi *et al.* (2014) reported that yield attributing parameters were recorded maximum in terms of fruit weight (123.11 g) under 25% RDF+ 75% Neem cake while, all the yield and yield attributing parameters found minimum under control.

Statistically significant variation was recorded for different variety on weight of individual fruit (Table 6). The highest weight of individual fruit (95.52 g) was obtained from V_6 (BARI Begun-6), which was closely followed (74.63 g and 73.26 g) by V_4 (BARI Begun-4) and V_2 (BARI Begun-2), whereas the lowest weight (54.57 g) was found from V_1 (BARI Begun-1).

Combined effect of different treatment and variety showed significant differences on weight of individual fruit of brinjal (Table 7). The highest weight of individual fruit (99.40 g) was attained from T_2V_6 (appliation of cowdung + Urea + TSP + MP and BARI Begun-6) treatment combination, whereas the lowest weight (47.78 g) was observed from T_4V_1 (application of TSP + MP and BARI Begun-1) treatment combination.

Table 7. Combined effect of treatment and variety on number of fruits per plant, weight of individual fruit, length of fruit and yield per plant of brinjal

Treatment and variety	Number of fruits per plant	Weight of individual fruit (g)	Length of brinjal (cm)	Yield per plant (kg)
T_1V_1	50.33 bc	52.27 qr	18.21 i-l	2.63 c-e
T_1V_2	41.00 e	81.82 cd	18.02 j-l	3.35 ab
T_1V_3	42.27 de	73.03 e-k	19.48 g-k	3.05 b
T_1V_4	46.13 cd	67.94 j-n	17.69 kl	3.13 b
T_1V_5	29.33 g	75.89 d-i	16.22 lm	2.23 f-h
T_1V_6	20.40 h-k	96.25 ab	10.65 q	1.96 g-i
T_1V_7	21.80 h-k	70.30 h-m	19.84 f-k	1.53 kl
T_1V_8	32.40 fg	66.51 k-o	20.29 e-k	2.17 f-h
T_1V_9	22.47 h-k	60.60 op	10.17 q	1.36 lm
T_1V_{10}	31.13 fg	72.17 f-l	23.00 b-d	2.22 f-h
T_2V_1	55.60 a	56.76 pq	21.96 b-g	3.15 b
T_2V_2	45.60 de	76.92 d-h	13.87 m-o	3.51 a
T_2V_3	35.27 f	77.56 def	22.35 b-f	2.73 c
T_2V_4	42.67 de	84.97 c	27.06 a	3.63 a
T_2V_5	32.40 fg	73.24 e-k	14.54 mn	2.37 d-f
T_2V_6	21.07 h-k	99.40 a	10.32 q	2.09 f-h
T_2V_7	20.73 h-k	76.76 d-h	23.96 b	1.59 j-l
T_2V_8	32.00 fg	68.49 j-m	22.42 b-f	2.19 f-h
T_2V_9	24.87 h	77.29 d-f	12.56 n-q	1.92 h-j
T_2V_{10}	32.73 fg	64.67 m-o	20.61 d-j	2.12 f-h
T_3V_1	54.07 ab	61.48 n-p	23.64 bc	3.32 ab
T_3V_2	44.20 de	69.73 i-m	11.51 o-q	3.07 b
T_3V_3	35.67 f	76.61 d-h	20.90 d-h	2.73 c
T_3V_4	44.07 de	79.65 cde	23.06 b-d	3.51 a
T_3V_5	30.67 fg	68.92 j-m	13.63 n-p	2.12 f-h
T_3V_6	17.67 k	95.70 ab	12.09 n-q	1.70 i-l
T_3V_7	20.67 h-k	77.05 d-g	22.90 b-e	1.59 j-l
T_3V_8	34.00 fg	69.07 j-m	20.03 f-k	2.34 ef
T_3V_9	24.20 hi	69.26 j-m	10.31 q	1.68 i-l
T_3V_{10}	32.87 fg	64.50 m-o	19.48 g-k	2.12 f-h
T_4V_1	50.93 b	47.78 r	21.15 c-h	2.43 c-f
T_4V_2	41.80 de	64.55 m-o	11.62 o-q	2.70 cd
T_4V_3	33.87 fg	58.03 pq	16.19 lm	1.98 g-i
T_4V_4	32.73 fg	65.97 l-o	19.34 g-k	2.16 f-h
T_4V_5	30.40 fg	61.59 n-p	11.25 pq	1.87 h-k
T_4V_6	18.20 jk	90.74 b	10.30 q	1.65 i-l
T_4V_7	19.60 i-k	60.95 op	18.70 h-k	1.20 m
T_4V_8	32.67 fg	73.83 e-j	21.70 b-g	2.41 c-f
T_4V_9	22.93 h-j	72.75 f-k	10.82 q	1.67 i-l
T_4V_{10}	32.53 fg	70.38 g-m	20.71 d-i	2.29 fg
$LSD_{(0.05)}$	4.367	5.608	2.214	0.300
Level of significance	0.01	0.01	0.01	0.01
CV(%)	8.05	4.80	7.74	7.92

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability

T_1: Cowdung
T_2: Cowdung + Urea + TSP + MP
T_3: Urea + TSP + MP
T_4: TSP + MP

V_1: BARI Begun-1
V_2: BARI Begun-2
V_3: BARI Begun-3
V_4: BARI Begun-4
V_5: BARI Begun-5
V_6: BARI Begun-6
V_7: BARI Begun-7
V_8: BARI Begun-8
V_9: BARI Begun-9
V_{10}: BARI Begun-10

4.1.13 Length of brinjal

Application of different treatment varied significantly in terms of length of brinjal (Table 6). The highest length of brinjal (18.96 cm) was found from T_2 (application of cowdung + Urea + TSP + MP) which was closely followed (17.76 cm and 17.36 cm) by T_3 (application of Urea + TSP + MP) and T_1 (application of cowdung) and they were statistically similar, whereas the lowest length (16.18 cm) was recorded from T_4 (application of TSP + MP) treatment (Plate 1). Shilpi *et al.* (2014) reported that yield attributing parameters were recorded maximum in terms of fruit length (22.33 cm) under 25% RDF+ 75% Neem cake while, all the yield and yield attributing parameters found minimum under control. Ullah *et al.* (2008) reported that organic, inorganic and combined sources of nutrients, of which the combined treatment (60 % organic +40% inorganic) showed the best performances in terms of fruit length (14.1 cm).

Length of brinjal showed statistically significant variation due to different variety (Table 6). The highest length of brinjal (21.79 cm) was attained from V_4 (BARI Begun-4), which was statistically similar (21.35 cm, 21.24 cm, 21.11 cm and 20.95 cm) with V_7 (BARI Begun-7), V_1 (BARI Begun-7), V_8 (BARI Begun-7) and V_{10} (BARI Begun-10), while the lowest length (10.84 cm) was found from V_6 (BARI Begun-6). Kumar *et al.* (2000) reported that HLB-25 genotypes recorded the maximum length of brinjal fruit within eleven advance lines along with three standard control cultivars of brinjal.

Statistically significant variation was recorded for the combined effect of different treatment and variety in terms of length of brinjal (Table 7). The highest length of brinjal (27.06 cm) was observed from T_2V_4 (appliation of cowdung + Urea + TSP + MP and BARI Begun-4) treatment combination and the lowest length (10.30 cm) was recorded from T_4V_6 (application of TSP + MP and BARI Begun-6) treatment combination.

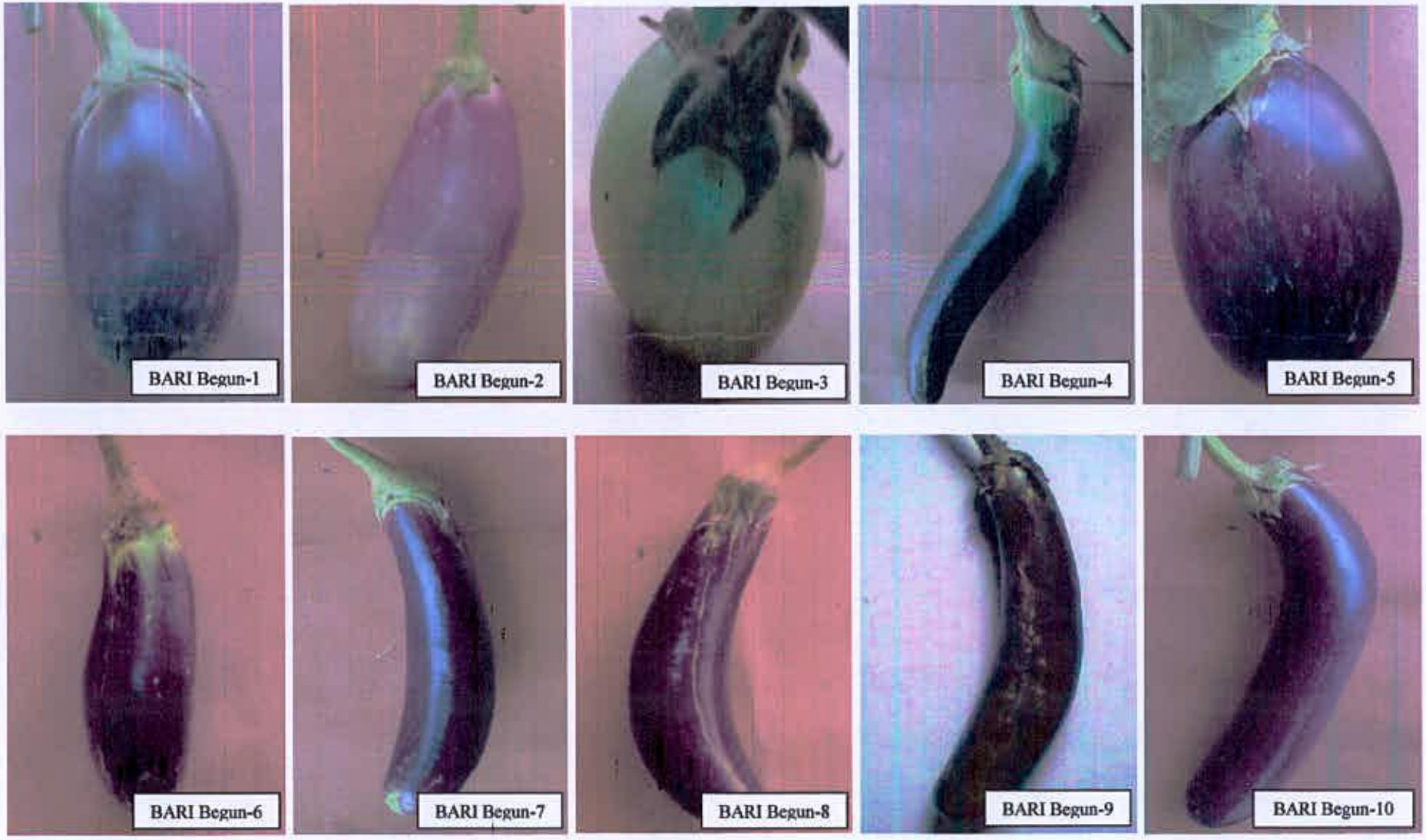


Plate 1. Photograph showing fruits of different brinjal variety

4.1.14 Diameter of brinjal

Diameter of brinjal varied significantly for application of different treatment (Figure 7). The highest diameter of brinjal (3.58 cm) was attained from T_2 (application of cowdung + Urea + TSP + MP) which was statistically similar (3.49 cm) with T_3 (application of Urea + TSP + MP) and closely followed (3.43 cm) by T_1 (application of cowdung), whereas the lowest diameter (3.16 cm) from T_4 (application of TSP + MP) treatment. Naidu *et al.* (1997) reported that NPK at 75:35:0 kg/ha + farmyard manure at 25 t/ha recorded the highest fruit girth. Shilpi *et al.* (2014) reported that yield attributing parameters were recorded maximum in terms of fruit diameter (4.88 cm) under 25% RDF+ 75% Neem cake while, all the yield and yield attributing parameters found minimum under control. Ullah *et al.* (2008) reported that organic, inorganic and combined sources of nutrients, of which the combined treatment (60 % organic +40% inorganic) showed the best performances in terms of fruit diameter (4.3 cm).

Statistically significant variation was recorded for different variety on diameter of brinjal (Figure 8). The highest diameter of brinjal (4.96 cm) was recorded from V_6 (BARI Begun-6), which was statistically similar (4.91 cm, 4.88 cm and 4.53 cm) with V_5 (BARI Begun-5), V_9 (BARI Begun-9) and V_2 (BARI Begun-2), again the lowest diameter (2.27 cm) was found from V_8 (BARI Begun-8). Kumar *et al.* (2000) reported that HLB-25 genotypes recorded the highest diameter within eleven advance lines along with three standard control cultivars of brinjal.

Combined effect of different treatment and variety showed significant differences on diameter of brinjal (Figure 9). The highest diameter of brinjal (5.68 cm) was found from T_2V_9 (appliation of cowdung + Urea + TSP + MP and BARI Begun-9) treatment combination, whereas the lowest diameter (1.78 cm) was found from T_4V_7 (application of TSP + MP and BARI Begun-7) treatment combination.

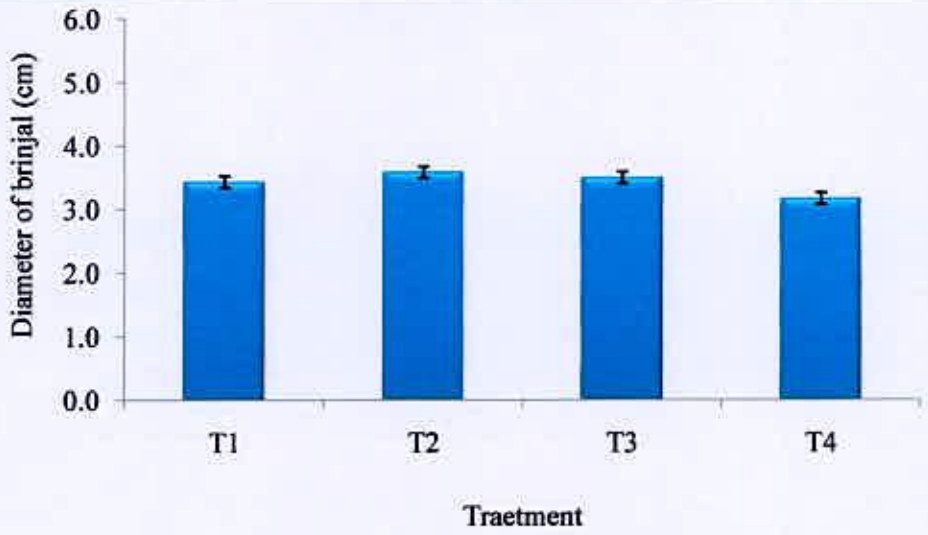


Fig. 7. Effect of different treatment on diameter of brinjal. Vertical bars represent LSD value. (T_1: Cowdung, T_2: Cowdung + Urea + TSP + MP, T_3: Urea + TSP +MP and T_4: TSP + MP)

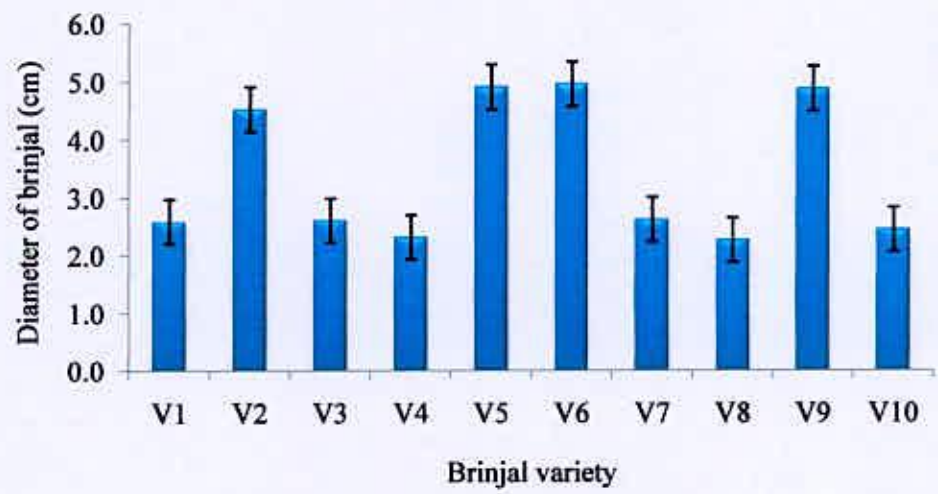


Fig. 8. Effect of different variety on diameter of brinjal. Vertical bars represent LSD value. (V_1: BARI Begun-1, V_2: BARI Begun-2, V_3: BARI Begun-3, V_4: BARI Begun-4, V_5: BARI Begun-5, V_6: BARI Begun-6, V_7: BARI Begun-7, V_8: BARI Begun-8, V_9: BARI Begun-9, V_{10}: BARI Begun-10)

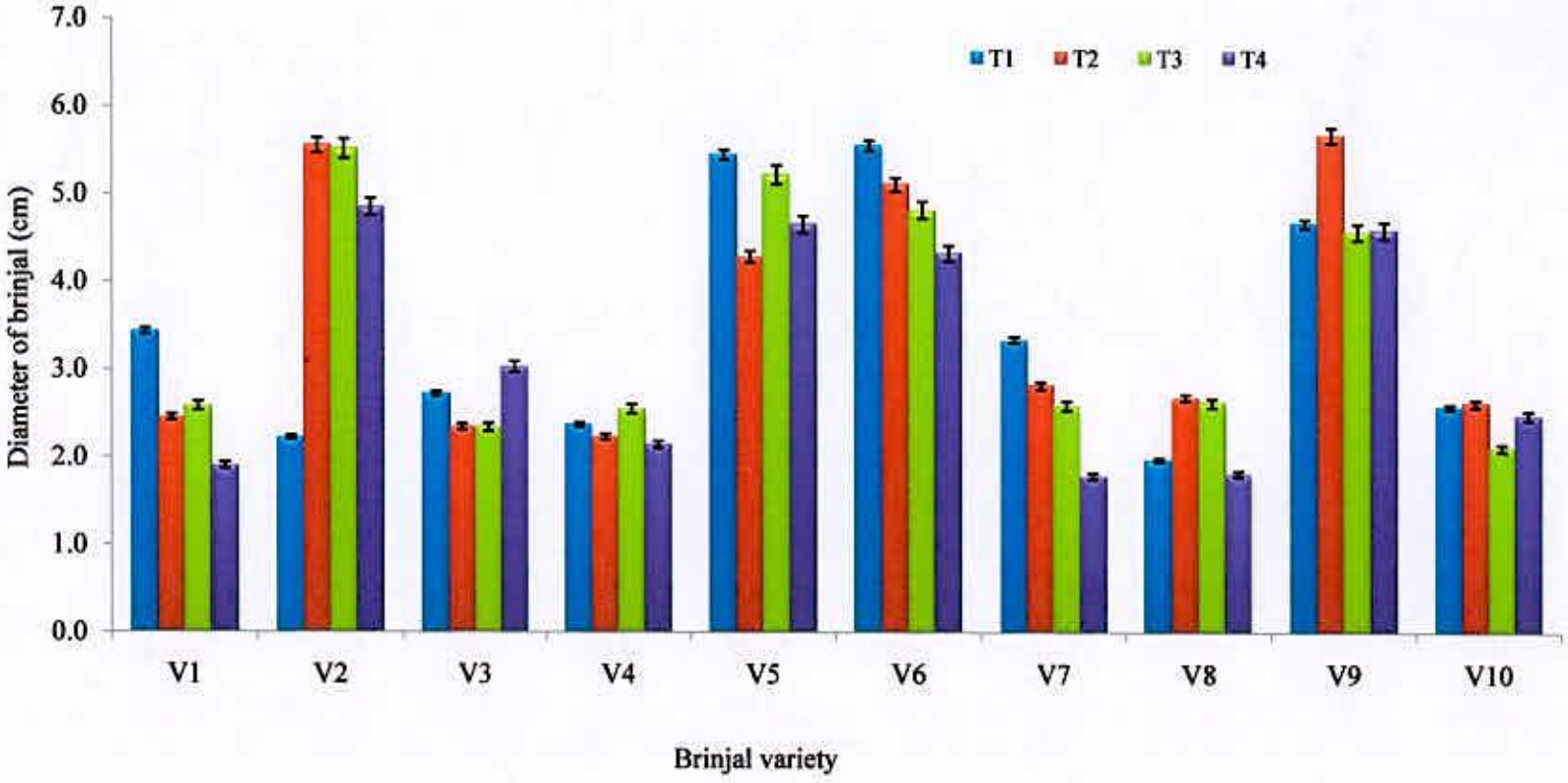


Fig. 9. Combined effect of treatment and different variety on diameter of brinjal. Vertical bars represent LSD value. (T_1: Cowdung, T_2: Cowdung + Urea + TSP + MP, T_3: Urea + TSP +MP and T_4: TSP + MP; and V_1: BARI Begun-1, V_2: BARI Begun-2, V_3: BARI Begun-3, V_4: BARI Begun-4, V_5: BARI Begun-5, V_6: BARI Begun-6, V_7: BARI Begun-7, V_8: BARI Begun-8, V_9: BARI Begun-9, V_{10}: BARI Begun-10)

4.1.15 Yield per plant

Statistically significant variation was recorded in terms of yield per plant of brinjal due to application of different treatment (Table 6). The highest yield per plant of brinjal (2.53 kg) was recorded from T_2 (application of cowdung + Urea + TSP + MP) which was closely followed (2.42 kg) by T_3 (application of Urea + TSP + MP). On the other hand, the lowest yield per plant (2.04 kg) was observed from T_4 (application of TSP + MP) treatment. Vizayakumar *et al.* (1995) reported that NPK fertilizers increase the yield of brinjal. Shilpi *et al.* (2014) reported that yield attributing parameters were recorded maximum in terms of fruit yield per plant (2.05 kg) under 25% RDF+ 75% Neem cake while, all the yield and yield attributing parameters found minimum under control. Reddy *et al.* (1988) found the highest response at the combination of 187:150:75 kg NPK/ha.

Different variety showed statistically significant variation in terms of yield per plant of brinjal (Table 6). The highest yield per plant of brinjal (3.16 kg) was observed from V_2 (BARI Begun-2), which was statistically similar (3.11 kg) with V_4 (BARI Begun-4) and closely followed (2.88 kg) by V_1 (BARI Begun-1), while the lowest yield per plant (1.48 kg) was recorded from V_7 (BARI Begun-7). Kumar *et al.* (2000) reported that HLB-25 genotypes recorded the highest fruit yield (980.38 g/plant) followed by HLB-18 (863.76 g/plant), HLB-106 (858.28 g/plant) and HLB-24 (824.23 g/plant).

Statistically significant variation was recorded due to combined effect of different treatment and variety on yield per plant brinjal (Table 7). The highest yield per plant of brinjal (3.63 kg) was found from T_2V_4 (appliation of cowdung + Urea + TSP + MP and BARI Begun-4) treatment combination, whereas the lowest yield per plant (1.20 kg) was recorded from T_4V_7 (application of TSP + MP and BARI Begun-7) treatment combination.

4.2 Variability study for 15 traits of brinjal

For different variety mean sum square for replication, variety and error presented in Table 8. All the characters showed highly significant difference. Genotypic and phenotypic variance, heritability, genetic advance and genetic advance in percentage of mean was estimated for 15 traits in 10 variety of brinjal and presented in Table 9 which describe below:

4.2.1 Days required for 1st flowering

Days required for 1st flowering refers to phenotypic variance (42.01) was higher than the genotypic variance (32.82) that indicating that high environmental influence on this characters which was supported by narrow difference between phenotypic (12.32%) and genotypic (10.89%) co-efficient of variation. The moderate difference for this parameter was also suggested a considerable influence of environment. High heritability (78.13%) in days required for 1st flowering attached with moderate genetic advance (13.37) and moderate genetic advance in percentage of mean (25.41). As this trait possessed high variation, it was potential for effective selection for further genetic improvement. Ram *et al.* (2007) reported high heritability coupled with high genetic advance indicating additive gene action was exhibited by characters days to flowering.

4.2.2 Days required for 1st harvest

Data revealed that that days required for 1st harvest refers to phenotypic variance (31.44) was higher than the genotypic variance (22.93) that indicating that high environmental influence on this characters which was supported by narrow difference between phenotypic (8.93%) and genotypic (7.62%) co-efficient of variation. The moderate difference for this parameter was also suggested a considerable influence of environment. High heritability (72.93%) in days required for 1st harvest attached with moderate genetic advance (11.80) and moderate genetic advance in percentage of mean (17.19). The high heritability along with moderate genetic advance in percentage of mean of this trait indicated the possible scope for improvement through selection of the character. Ram *et al.* (2007) reported high heritability coupled with high genetic advance indicating additive gene action was exhibited by characters days to marketable maturity.

Table 8. Analysis of variance (ANOVA) for yield and yield contributing characters of brinjal variety

Characters	Degrees of freedom (df)			Mean Sum of Squares (MSS)		
	Replication	Genotypes	Error	Replication	Variety	Error
Days required for 1st flowering	2	9	72	0.941	107.654**	9.189
Days required for 1st harvest	2	9	72	1.378	77.295**	8.512
Number of leaves per plant	2	9	72	36.177	1887.407**	264.482
Length of leaf	2	9	72	0.340	11.801**	2.763
Breadth of leaf	2	9	72	0.061	0.488**	0.133
Plant height	2	9	72	11.267	327.679**	92.454
Number of branches per plant	2	9	72	0.079	2.911**	0.684
Root length	2	9	72	0.230	2.524**	0.383
Fresh weight of plant	2	9	72	273.562	1752.150**	297.526
Dry matter content of plant	2	9	72	0.168	1.280**	0.199
Number of fruits per plant	2	9	72	0.290	1343.851**	7.198
Weight of individual fruit	2	9	72	3.584	1196.636**	11.870
Length of brinjal	2	9	72	1.191	254.674**	1.850
Diameter of brinjal	2	9	72	0.001	17.841**	0.247
Yield per plant	2	9	72	0.003	4.192**	0.034

**: Significant at 0.01 level of probability;

Table 9. Variability of different yield and yield contributing characters of brinjal variety

Characters	Genotypic variance (σ^2g)	Phenotypic variance (σ^2p)	Genotypic coefficient of variation (%)	Phenotypic coefficient of variation (%)	Heritability (%)	Genetic Advance (GA)	GA in percentage of mean
Days required for 1st flowering	32.82	42.01	10.89	12.32	78.13	13.37	25.41
Days required for 1st harvest	22.93	31.44	7.62	8.93	72.93	10.80	17.19
Number of leaves per plant	540.86	805.70	15.84	19.34	67.13	50.30	34.27
Length of leaf	3.01	5.78	12.27	16.98	52.16	3.31	23.39
Breadth of leaf	0.118	0.251	7.87	11.47	47.08	0.623	14.26
Plant height	78.41	170.86	10.26	15.15	45.89	15.84	18.36
Number of branches per plant	0.742	1.43	6.25	8.66	52.03	1.64	11.90
Root length	0.712	1.10	6.45	8.00	65.03	1.80	13.73
Fresh weight of plant	484.87	782.40	9.99	12.70	61.97	45.76	20.77
Dry matter content of plant	0.360	0.559	7.49	9.34	64.42	1.27	15.88
Number of fruits per plant	445.55	452.75	63.29	63.80	98.41	55.28	165.76
Weight of individual fruit	394.92	406.79	27.69	28.10	97.08	51.69	72.02
Length of brinjal	84.27	86.12	52.28	52.85	97.85	23.97	136.52
Diameter of brinjal	5.86	6.11	71.02	72.50	95.96	6.26	183.65
Yield per plant	1.39	1.42	50.30	50.91	97.60	3.07	131.19

4.2.3 Number of leaves per plant

Phenotypic variance (805.70) was the highest than the genotypic variance (540.86) for number of leaves per plant refers to high environmental influence on this characters which was supported by narrow difference between phenotypic (19.34%) and genotypic (15.84%) co-efficient of variation. The moderate difference for this parameter was also suggested a considerable influence of environment. High heritability (67.13%) in number of leaves per plant attached with high genetic advance (50.30) and high genetic advance in percentage of mean (34.27). The high heritability estimate coupled with high expected genetic advance for this trait indicated the importance of both additive and non additive genetic effects for the controlling the character. The heritability estimates provides the basis for selection on the phenotypic performance.

4.2.4 Length of leaf

It was observed that phenotypic variance (5.78) was the highest than the genotypic variance (3.01) in terms of length of leaf that indicating that high environmental influence on this characters which was supported by narrow difference between phenotypic (16.98%) and genotypic (12.27%) co-efficient of variation. The moderate difference for this parameter was also suggested a considerable influence of environment. High heritability (52.16%) in length of leaf attached with low genetic advance (3.31) and high genetic advance in percentage of mean (23.39). The high heritability along with high genetic advance in percentage of mean of length of leaf indicated the possible scope for improvement through selection of the character.

4.2.5 Breadth of leaf

Data revealed that breadth of leaf refers to phenotypic variance (0.251) was higher than the genotypic variance (0.118) that indicating that high environmental influence on this characters which was supported by high difference between phenotypic (11.47%) and genotypic (7.87%) co-efficient of variation. The high difference for this parameter was also suggested a significant influence of environment. Moderate heritability (47.08%) in breadth of leaf attached with low

genetic advance (0.623) and high genetic advance in percentage of mean (14.26). Moderate estimate of heritability and low genetic advance were registered for days to flowering of male suggested that this character was predominantly controlled by environment with complex gene interaction.

4.2.6 Plant height

Phenotypic variance (170.86) was highest than the genotypic variance (78.41) in terms of plant height indicating that high environmental influence on this characters which was supported by high difference between phenotypic (15.15%) and genotypic (10.26%) co-efficient of variation. The high difference for this parameter was also suggested a significant influence of environment. Moderate heritability (45.89%) in plant height attached with high genetic advance (15.84) and high genetic advance in percentage of mean (18.36). The moderate heritability estimate coupled with high expected genetic advance for length of fruit indicated the importance of both additive and non additive genetic effects for the control of this character. Vedivel and Bapu (1990) reported that plant height exhibited high genotypic variance. Mandal and Dana (1992) studied 20 genotypes of brinjal for the yield contributing characters and indicated that plant height were important traits for the selection of superior genotypes. Ram *et al.* (2007) reported high heritability coupled with high genetic advance indicating additive gene action was exhibited by characters plant height.

4.2.7 Number of branches per plant

Number of branches per plant refers to phenotypic variance (1.43) was highest than the genotypic variance (0.742) that indicating that high environmental influence on this characters which was supported by high difference between phenotypic (8.66%) and genotypic (6.25%) co-efficient of variation. The high difference for this parameter was also suggested a significant influence of environment. High heritability (52.03%) in number of branches per plant attached with low genetic advance (1.64) and high genetic advance in percentage of mean (11.90). High estimate of heritability and low genetic advance were registered for days to flowering of male suggested that this character was predominantly

controlled by environment with complex gene interaction. Mandal and Dana (1992) studied 20 genotypes of brinjal for the yield contributing characters and indicated that branches/plant were important traits for the selection of superior genotypes. Ram *et al.* (2007) reported high magnitude of variability was observed in the mean among the parents for number of branches per plant.

4.2.8 Root length

Data revealed that root length refers to phenotypic variance (1.10) was highest than the genotypic variance (0.712) that indicating that high environmental influence on this characters which was supported by high difference between phenotypic (8.00%) and genotypic (6.45%) co-efficient of variation. The high difference for this parameter was also suggested a significant influence of environment. High heritability (65.03%) in root length attached with low genetic advance (1.80) and high genetic advance in percentage of mean (13.73). The high heritability along with high genetic advance in percentage of mean of root length indicated the possible scope for improvement through selection of the character.

4.2.9 Fresh weight of plant

Phenotypic variance (782.40) was highest than the genotypic variance (484.87) in consideration of fresh weight of plant indicating that high environmental influence on this characters which was supported by high difference between phenotypic (12.70%) and genotypic (9.99%) co-efficient of variation. The high difference for this parameter was also suggested a significant influence of environment. High heritability (61.97%) in fresh weight of plant attached with high genetic advance (45.76) and high genetic advance in percentage of mean (20.77). The high heritability along with high genetic advance in percentage of mean of fresh weight of plant indicated the possible scope for improvement through selection of the character and breeder may expect reasonable benefit in next generation in respect of this trait.

4.2.10 Dry matter content of plant

Dry matter content of plant refers to phenotypic variance (0.559) was highest than the genotypic variance (0.360) that indicating that high environmental influence on this characters which was supported by medium difference between phenotypic (9.34%) and genotypic (7.49%) co-efficient of variation. The high difference for this parameter was also suggested a significant influence of environment. High heritability (64.42%) in dry matter content of plant attached with low genetic advance (1.27) and high genetic advance in percentage of mean (15.88). The high heritability along with high genetic advance in percentage of mean of dry matter content of plant indicated the possible scope for improvement through selection of the character.

4.2.11 Number of fruits per plant

It was observed that number of fruits per plant refers to phenotypic variance (452.75) was highest than the genotypic variance (445.55) that indicating that high environmental influence on this characters which was supported by low difference between phenotypic (63.80%) and genotypic (63.29%) co-efficient of variation. The low difference for this parameter was also suggested a minimum influence of environment. High heritability (98.41%) in number of fruits per plant attached with high genetic advance (55.28) and high genetic advance in percentage of mean (165.76). The high heritability estimate coupled with high expected genetic advance for number of fruits per plant indicated the importance of both additive and non additive genetic effects for the control of this character. Genetic improvement of this character would therefore be highly effective. Ram *et al.* (2007) reported high magnitude of variability was observed in the mean among the parents number of fruits per plant.

4.2.12 Weight of individual fruit

Weight of individual fruit refers to phenotypic variance (406.79) was highest than the genotypic variance (394.92) that indicating that high environmental influence on this characters which was supported by low difference between phenotypic (28.10%) and genotypic (27.69%) co-efficient of variation. The low difference for

this parameter was also suggested a minimum influence of environment. High heritability (97.08%) in weight of individual fruit attached with high genetic advance (51.69) and high genetic advance in percentage of mean (72.02). The high heritability estimate coupled with high expected genetic advance for weight of individual fruit indicated the simultaneous importance of additive genetic and environmental effects for the control of this character. Gopimony *et al.* (1984) found that the phenotypic coefficient of variation ranged being highest for single fruit weight, heritability and genetic advance being highest for single fruit weight and over all mean. The association of high heritability and genetic advance shown by single fruit weight was taken as an indication of additive gene effects.

4.2.13 Length of brinjal

Phenotypic variance (86.12) was higher than the genotypic variance (84.27) in terms of length of brinjal refers to high environmental influence on this characters which was supported by low difference between phenotypic (52.85%) and genotypic (52.28%) co-efficient of variation. The low difference for this parameter was also suggested a minimum influence of environment. High heritability (97.85%) in length of brinjal attached with high genetic advance (23.97) and high genetic advance in percentage of mean (136.52). The high heritability along with high genetic advance in percentage of mean of length of brinjal indicated the possible scope for improvement through selection of the character. Vedivel and Bapu (1990) reported that fruit length indicated the predominance of additive gene effects. Ram *et al.* (2007) reported high magnitude of variability was observed in the mean among the parents for length of fruit.

4.2.14 Diameter of brinjal

Data revealed that diameter of brinjal refers to phenotypic variance (6.11) was higher than the genotypic variance (5.86) that indicating that high environmental influence on this characters which was supported by low difference between phenotypic (72.50%) and genotypic (71.02%) co-efficient of variation. The low difference for this parameter was also suggested a minimum influence of environment. High heritability (95.96%) in diameter of brinjal attached with high

genetic advance (6.26) and high genetic advance in percentage of mean (183.65). The high heritability along with high genetic advance in percentage of mean of diameter of brinjal indicated the possible scope for improvement through selection of the character. Gopimony *et al.* (1984) found that the association of high heritability and genetic advance shown by fruit diameter was taken as an indication of additive gene effects.

4.2.15 Yield per plant

Yield per plant refers to phenotypic variance (1.42) was minimum than the genotypic variance (1.39) that indicating that high environmental influence on this characters which was supported by low difference between phenotypic (50.91%) and genotypic (50.30%) co-efficient of variation. The low difference for this parameter was also suggested a minimum influence of environment. High heritability (97.60%) in yield per plant attached with lowest genetic advance (3.07) and high genetic advance in percentage of mean (131.19). The high heritability along with high genetic advance in percentage of mean of yield per plant indicated the possible scope for improvement through selection of the character. Gopimony *et al.* (1984) found that the phenotypic coefficient of variation ranged being highest for yield. The association of high heritability and genetic advance shown by yield was taken as an indication of additive gene effects. Vedivel and Bapu (1990) reported that fruit weight exhibited high genotypic variance. High heritability coupled with high genetic gain from fruit yield per plant indicated the predominance of additive gene effects. Ram *et al.* (2007) reported high magnitude of variability was observed in the mean among the parents for yield per plant.

The highest genetic advance along with high heritability was recorded for days required for 1st flowering, number of leaves per plant, number of fruits per plant, length of brinjal, diameter of brinjal and yield per plant, indicating the importance of these traits in selection for high yield.

CHAPTER V

SUMMARY AND CONCLUSION

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The present piece of research work was conducted during the period from September 2013 to February 2014 in rabi season in the experimental area of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka to find out the performance of brinjal genotypes (*Solanum melongena* L.) under different growth conditions. The experiment consisted of two factors: Factor A: Cowdung and chemical fertilizers; T_1: Cowdung, T_2: Cowdung + Urea + TSP + MP, T_3: Urea + TSP + MP and T_4: TSP + MP; Factor B: Different brinjal variety, V_1: BARI Begun-1, V_2: BARI Begun-2, V_3: BARI Begun-3, V_4: BARI Begun-4, V_5: BARI Begun-5, V_6: BARI Begun-6, V_7: BARI Begun-7, V_8: BARI Begun-8, V_9: BARI Begun-9, V_{10}: BARI Begun-10. The two factors experiment was laid out in Split-plot design with three replications. Mean performance and variability studies were done on different yield and yield contributing characters of brinjal variety due to the environmental condition created by application of cowdung and chemical fertilizers treatment.

For different treatment, the maximum days required for 1st flowering (53.73) was observed from T_4, while the minimum days (51.54) from T_2. The maximum days required for 1st harvest (63.88) was recorded from T_4 and the minimum days (62.07) from T_2. The maximum number of leaves per plant (154.63) was found from T_2, whereas the minimum number (135.20) from T_4. The longest leaf (14.75 cm) was recorded from T_2 and the shortest leaf (13.33 cm) from T_4. The highest breadth of leaf (4.55 cm) was recorded from T_2, while the lowest breadth (4.23 cm) from T_4. The tallest plant (88.46 cm) was observed from T_2, wheras the shortest plant (81.21 cm) from T_4. The maximum number of branches per plant (14.03) was recorded from T_2, while the minimum number (13.33) from T_4. The tallest root (13.31 cm) was found from T_2, again the shortest root (12.71 cm) from T_4. The highest fresh weight of plant (229.79 g) was found from T_2, while the lowest weight (205.67 g) from T_4. The highest dry matter content of plant (8.21%)

was recorded from T_2, while the lowest (7.69%) from T_4. The maximum number of fruits per plant (34.29) was recorded from T_2 and the minimum number (31.57) from T_4. The highest weight of individual fruit (75.61 g) was observed from T_2, again the lowest weight (66.66 g) from T_4. The highest length of brinjal (18.96 cm) was found from T_2, whereas the lowest length (16.18 cm) from T_4. The highest diameter of brinjal (3.58 cm) was attained from T_2, whereas the lowest diameter (3.16 cm) from T_4. The highest yield per plant of brinjal (2.53 kg) was recorded from T_2 and the lowest yield (2.04 kg) from T_4.

For different variety, the maximum days required for 1st flowering (57.52) was recorded from V_7, whereas the minimum days (48.32) from V_2. The maximum days required for 1st flowering (66.87) was found from V_7, again the minimum days (58.68) from V_2. The maximum number of leaves per plant (165.50) was observed from V_2, while the minimum number (140.17) from V_7. The longest leaf (15.44 cm) was found from V_2, whereas the shortest leaf (12.56 cm) from V_7. The highest breadth of leaf (4.64 cm) was attained from V_2, while the lowest (4.02 cm) from V_7. The tallest plant (93.04 cm) was recorded from V_2, while the shortest plant (77.75 cm) from V_7. The maximum number branches per plant (14.33) was found from V_2, while the minimum number (13.05) from V_6. The tallest root (13.76 cm) was attained from V_2, whereas the shortest root (12.49 cm) from V_6. The highest fresh weight of plant (236.38 g) was recorded from V_2, whereas the lowest weight (203.24 g) from V_5. The highest dry matter content of plant (8.48%) was attained from V_4, while the lowest (7.59%) from V_6. The maximum number of fruits per plant (52.73) was found from V_1, whereas the minimum number (19.33) from V_6. The highest weight of individual fruit (95.52 g) was obtained from V_6, whereas the lowest weight (54.57 g) from V_1. The highest length of brinjal (21.79 cm) was attained from V_4, while the lowest length (10.84 cm) from V_6. The highest diameter of brinjal (4.96 cm) was recorded from V_6, again the lowest diameter (2.27 cm) from V_8. The highest yield per plant of brinjal (3.16 kg) was observed from V_2 (BARI Begun-2), while the lowest yield per plant (1.48 kg) from V_7.

In case of combined effect of treatments and variety, the maximum days required for 1st flowering (60.60) was recorded from T_4V_8 and the minimum days (44.33) from T_3V_2. The maximum days required for 1st harvest (69.07) was found from T_3V_7, while the minimum days (55.00) from T_3V_2. The maximum number of leaves per plant (245.00) was obtained from T_1V_2, whereas the minimum number (104.33) from T_4V_6. The longest leaf (20.08 cm) was found from T_2V_4 and the shortest leaf (10.18 cm) from T_1V_1. The highest breadth of leaf (5.33 cm) was found from T_1V_4, while the lowest (3.69 cm) from T_3V_1. The tallest plant (115.77 cm) was observed from T_2V_4 and the shortest plant (64.15 cm) from T_4V_7. The maximum number branches per plant (16.13) was found from T_2V_4, while the minimum number (11.87) from T_2V_6. The tallest root (15.27 cm) was recorded from T_2V_4, again the shortest root (11.15 cm) from T_1V_9. The highest fresh weight of plant (286.61 g) was attained from T_2V_4 and the lowest weight (175.14 g) from T_4V_3. The highest dry matter content of plant (9.88%) was found from T_2V_4, while the lowest (6.69%) from T_4V_3. The maximum number of fruits per plant (55.60) was found from T_2V_1, again the minimum number (17.67) from T_3V_6. The highest weight of individual fruit (99.40 g) was attained from T_2V_6, whereas the lowest weight (47.78 g) from T_4V_1. The highest length of brinjal (27.06 cm) was observed from T_2V_4 and the lowest length (10.30 cm) from T_4V_6. The highest diameter of brinjal (5.68 cm) was found from T_2V_9, whereas the lowest (1.78 cm) from T_4V_7. The highest yield per plant of brinjal (3.63 kg) was found from T_2V_4, whereas the lowest yield (1.20 kg) from T_4V_7. In consideration of yield and yield contributing characters T_2V_4 treatment combination was the best for brinjal cultivation.

Days required for 1st flowering refers to phenotypic variance (42.01) was higher than the genotypic variance (32.82) with high heritability (78.13%) attached with moderate genetic advance (13.37) and moderate genetic advance in percentage of mean (25.41). Data revealed that that days required for 1st harvest refers to phenotypic variance (31.44) was higher than the genotypic variance (22.93) with high heritability (72.93%) attached with moderate genetic advance (11.80) and

moderate genetic advance in percentage of mean (17.19). Phenotypic variance (805.70) was highest than the genotypic variance (540.86) for number of leaves per plant with high heritability (67.13%) in number of leaves per plant attached with high genetic advance (50.30) and high genetic advance in percentage of mean (34.27). It was observed that phenotypic variance (5.78) was highest than the genotypic variance (3.01) in terms of length of leaf with high heritability (52.16%) in length of leaf attached with low genetic advance (3.31) and high genetic advance in percentage of mean (23.39). Data revealed that breadth of leaf refers to phenotypic variance (0.251) was higher than the genotypic variance (0.118) with moderate heritability (47.08%) in breadth of leaf attached with low genetic advance (0.623) and high genetic advance in percentage of mean (14.26). Phenotypic variance (170.86) was highest than the genotypic variance (78.41) in terms of plant height with moderate heritability (45.89%) in plant height attached with high genetic advance (15.84) and high genetic advance in percentage of mean (18.36). Number of branches per plant refers to phenotypic variance (1.43) was highest than the genotypic variance (0.742) with igh heritability (52.03%) in number of branches per plant attached with low genetic advance (1.64) and high genetic advance in percentage of mean (11.90). Data revealed that root length refers to phenotypic variance (1.10) was highest than the genotypic variance (0.712) with high heritability (65.03%) in root length attached with low genetic advance (1.80) and high genetic advance in percentage of mean (13.73). Phenotypic variance (782.40) was highest than the genotypic variance (484.87) in consideration of fresh weight of plant with high heritability (61.97%) in fresh weight of plant attached with high genetic advance (45.76) and high genetic advance in percentage of mean (20.77). Dry matter content of plant refers to phenotypic variance (0.559) with high heritability (64.42%) in dry matter content of plant attached with low genetic advance (1.27) and high genetic advance in percentage of mean (15.88). It was observed that number of fruits per plant refers to phenotypic variance (452.75) was highest than the genotypic variance (445.55) with high heritability (98.41%) in number of fruits per plant attached with high genetic advance (55.28) and high genetic advance in percentage of mean (165.76).

Weight of individual fruit refers to phenotypic variance (406.79) was highest than the genotypic variance (394.92) with high heritability (97.08%) attached with high genetic advance (51.69) and high genetic advance in percentage of mean (72.02). Phenotypic variance (86.12) was higher than the genotypic variance (84.27) with high heritability (97.85%) in length of brinjal attached with high genetic advance (23.97) and high genetic advance in percentage of mean (136.52). Data revealed that diameter of brinjal refers to phenotypic variance (6.11) was higher than the genotypic variance (5.86) with high heritability (95.96%) in diameter of brinjal attached with high genetic advance (6.26) and high genetic advance in percentage of mean (183.65). Yield per plant refers to phenotypic variance (1.42) was higher than the genotypic variance (1.39) with high heritability (97.60%) in yield per plant attached with high genetic advance (3.07) and high genetic advance in percentage of mean (131.19). The highest genetic advance along with high heritability was recorded for days required for 1st flowering, number of leaves per plant, number of fruits per plant, length of brinjal, diameter of brinjal and yield per plant, indicating the importance of these traits in selection for high yield.

Conclusion:

Based on the performance of ten brinjal variety, BARI Begun-2 was found to be highest yielder followed by BARI Begun-4 and the other variety showed much less yields compared to the former. So the variety BARI Begun-2 was found to be promising in the application of Cowdung + Urea + TSP + MP. In consideration of yield and yield contributing characters T_2V_4 treatment combination was the best for brinjal cultivation.

Recommendations

Considering the above findings of the present experiment, the following recommendations and suggestions may be made:

1. Selected varieties are needed in different agro-ecological zones (AEZ) of Bangladesh for regional adaptability and other performance.
2. More genotypes with different crosses with different environment may be included for further study.

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APPENDICES

Appendix I. Monthly average of air temperature, relative humidity and total rainfall of the experimental site during the period from September, 2013 to February, 2014

Month	*Air temperature (°C)		*Relative humidity (%)	*Total rainfall (mm)
	Maximum	Minimum		
Septmber, 2013	27.6	22.9	82	76
October, 2013	26.5	19.4	81	22
November, 2013	25.8	16.0	78	00
December, 2013	22.4	13.5	74	00
January, 2014	25.2	12.8	69	00
February, 2014	27.3	16.9	66	39

* Monthly average,

* Source: Bangladesh Meteorological Department (Climate & weather division) Agargoan, Dhaka – 1212

Appendix II. Characteristics of soil of experimental field

A. Morphological characteristics of the experimental field

Morphological features	Characteristics
Location	Agronomy field , SAU, Dhaka
AEZ	Madhupur Tract (28)
General Soil Type	Shallow red brown terrace soil
Land type	High land
Soil series	Tejgaon
Topography	Fairly leveled

B. Physical and chemical properties of the initial soil

Characteristics	Value
% Sand	27
% Silt	43
% clay	30
Textural class	Silty-clay
pH	5.6
Organic matter (%)	0.78
Total N (%)	0.03
Available P (ppm)	20.00
Exchangeable K (me/100 g soil)	0.10
Available S (ppm)	45

Source: Soil Resources Development Institute (SRDI), Khamarbari, Farmgate, Dhaka