

EFFECT OF ORGANIC AND INORGANIC FERTILIZERS ON THE GROWTH, YIELD AND FRUIT QUALITY OF EGGPLANT (*SOLANUM MELONGENA* L.)

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Abstract

An in-vivo experiment was conducted to study the effect of organic and inorganic fertilizers on the growth, yield and fruit quality of eggplant (*Solanum melongena* L.). Fertilizer induced variability of *Solanum melongena* studied based on the data collected from seven treatments of organic and inorganic fertilizers. The variability was analyzed based on twenty-nine characters. Organic fertilizers such as vermicompost, groundnut cake and bonemeal; chemical fertilizers such as NPK 16:16:16 and NPK 10:5:20 and urea were used for the experiment. The plant only with potting mixture treated as standard. Application of fertilizer and harvesting of fruits for biometrical observation was carried out at the regular interval. The mean was calculated. Coefficients of variation of twenty-nine agronomic characters of the brinjal under different treatments explained that significant variation existed in all the characters. The characters studied include growth characters such as days to the first flower, days to first harvest, plant height, plant stem circumference, number of branches per plant, number of leaves, length of leaf lamina, breadth of leaf lamina, length of leaf petiole, petiole circumference, leaf area; yield characters like the number of fruits per plant, fruit length, fruit girth, length of fruit stalk, breadth of fruit stalk, fresh weight of fruit, cluster per plant, number of flowers, fresh weight of plant; quality characters of total carbohydrate, protein, vitamin C, crude fibre, total mineral, calcium, potassium, phosphorus, acidity. Among all six fertilizers applied in the experiment, organic treatments like vermicompost and groundnut cake gave better growth, yield and quality characters than inorganic fertilizers and vermicompost gave the highest results for ten characters. Groundnut cake gave the best results for thirteen characters. Following these two organic fertilizers, urea has some contribution to growth and yield. Among the characters studied, the highest variability was shown by cluster per plant (70.71%) and the lowest by potassium (0.04%), as shown by the coefficient of variation. Characters such as number of branches per plant (48.97%), number of fruits per plant (38.73%) and number of leaves (24.39%) also showed a comparatively high percentage of variability. In contrast, characters such as total carbohydrate, vitamin C, calcium, potassium showed a relatively low percentage of variability. Cluster per plant exhibited the highest value of variation in standard condition, whereas the lowest value in NPK 10:5:20.

I INTRODUCTION

Brinjal or eggplant (*Solanum melongena* L.) is a member of the Solanaceae family. Eggplant is supplemented with a sufficient amount of starch, protein, minerals, vitamins, dietary fibres and low-fat content. Production of brinjal can be increased by supplying quality inputs. Organic fertilizing is a safe and non-polluting method for recycling and recycling organic waste by its conversion into organic fertilizers. In this study. Effect of organic and inorganic fertilizers on the growth, yield and fruit quality of eggplant (*Solanum melongena* L.). Three organic fertilizers vermicompost, groundnut cake and bonemeal; three inorganic fertilizers such as NPK 16:16:16, NPK 10:5:20 and urea were selected as supplements to assess the variability in growth, yield and quality of brinjal. The use of chemical fertilizers for a long time has resulted in reduced soil health, lower production, and an increase in incidences of pests and disease and environmental pollution (Ansari and Ismail, 2001). Therefore, some efforts are required to fulfill a part of nutrients and improve the soil physical, chemical, and biological traits by applying organic fertilizers.

II MATERIALS AND METHODS

2.1 Experimental site and layout

The experiment was conducted in the experimental field of the Genetics and Plant Breeding Division of the Department of Botany, University of Calicut, Kerala, India. The plot is located at 75°46' E longitude and 11° 15' N latitude at an elevation of 50 m from MSL. The region enjoys a warm humid tropical climate. The soil used for the experiment is loamy. The average temperature of the study area ranges from 21.9° to 32.2°C with an annual rainfall of 290 cm. Haritha, bacterial wilt resistant open-pollinated variety of brinjal. Three organic fertilizers such as vermicompost, groundnut cake and bonemeal; three chemical fertilizers such as NPK 16:16:16 and NPK 10:5:20 and Urea were selected for nutrient supply. Potting mixture (1:1:1: sandy

soil, cow dung and coir fibre) was kept as control. Thirty days after germination, equal-sized seedlings were transplanted. Twenty-five replicates were taken in each treatment. Fertigation was started 16 days after transplanting (DAT) of seedlings at an interval of fifteen days. Fertilizer recommendation, equalization and application was done according to the Package of Practices Recommendations of Kerala Agricultural University.

2.2 Field experiment

Haritha seeds are sown into trays filled with seed raising mix (8 parts pre-moistened coco coir, 1 part vermiculite and 1 part perlite). The nursery was raised in 750 UV sterilized- 150 microns grow bags of size 35x20x20 cm and soil capacity 26 kg for testing the vegetative growth parameters of *Solanum melongena* L. Grow bags were filled with the potting mixture (1:1:1: sandy soil, cow dung and coir fibre). The design was Randomized Complete Block Design (RCBD) with twenty-five replicates. Application of 60:20:25 kg N:P₂O₅:K₂O per ha is optimum for getting a maximum yield of fruits. The first dose was given sixteen days after transplanting. It was continued for one month. After 46 days of transplantation, the dose of fertilizer was doubled. A triple dose of fertilizer was given to the plants from 75 days after transplantation and it was continued till the completion of the experiment. Weeding was done twice, on 60 and 100 days after planting, depending upon the weed intensity. The plants were irrigated twice in a non-rainy day to maintain a sufficient level of soil moisture. Recommended package of practices and plant protection measures were followed to raise a healthy crop. Harvesting of fruits was carried out after 97 days of sowing. Fruits were collected and stored in paper collection bags and transferred to the laboratory for further measurements and analysis in all fruiting time. It was continued till the completion of the experiment. The growth and yield data were collected for average days to First Flower, days to first harvest, plant height (cm), plant stem circumference, number of branches per plant, number of leaves, length of leaf lamina, breadth of leaf lamina, length of leaf petiole, petiole circumference, leaf area, number of fruits per plant, fruit length, fruit girth, length of fruit stalk, breadth of fruit stalk, fresh weight of fruit, cluster per plant, number of flowers and fresh weight of the plant.

Table 1: Fertilizer doses

| | VM | GNC | BM | N16 | N10 | UR |
|-------------------|------|-------|-----|-----|-----|-------|
| 16-46 DAT | 39g | 32.5g | 28g | 4g | 4g | 0.7g |
| 46-75 DAT | 78g | 65g | 56g | 8g | 8g | 1.4g |
| 75-150 DAT | 117g | 97.5 | 83g | 12g | 12g | 2.1 g |

**VM- vermicompost; GNC- groundnut cake; BM-bonemeal N16- NPK 16:16:16;

N5- NPK 10:5:20; UR-urea *DAT- Days after transplantation

2.3 Quality parameters

2.3.1 Total carbohydrate

Carbohydrate was estimated by the anthrone method (Sadasivam and Manickam, 2008). Briefly, 100 mg of leaf sample was hydrolysed with 5mL of 2.5 N HCl for three hour and neutralized with sodium carbonate. It was then filtered and volume made up to 25 ml. From the filtrate, 0.25 mL aliquot was taken and volume made up to 1 mL with distilled water. After adding 4 ml of anthrone reagent, it was thoroughly mixed, heated for 8 min on a water bath and cooled rapidly. The green-dark green colour was measured by spectrophotometer at 630 nm and carbohydrate content was calculated from the standard graph prepared by glucose and expressed as mg g⁻¹ fresh weight of tissue.

2.3.2. Protein

Protein was determined by the Kjeldahl method. A 0.5 g of the powdery form of each *S. melongena*. It was digested with 5 ml of concentrated sulphuric acid in the presence of Kjeldahl catalyst. At that point it is treated with sulphuric corrosive (98%) and 2.5 % Brucine reagent(5 ml) to create a hued compound. Imprint the absorbance at 470 nm. The level of nitrogen was determined and increased by 6.25 to get the estimation of the rough protein (AOAC., 1990).

2.3.4. Vitamin C

Pipette 50 ml of unconcentrated juice (or the equivalent of concentrated juice) into a 100 ml volumetric flask, add 25 ml of 20 % metaphosphoric acid as a stabilizing agent and dilute to volume. Pipette 10 ml in a small flask and add 2.5 ml acetone. Titrate with indophenol solution until a faint pink colour persists for 15 seconds (Sadasivam and Manickam, 2008).

2.3.5. Crude fibre

The estimation did by AOAC (1990) method. Five grams of *S. melongena* powder and 200 ml of 1.25 % H₂SO₄ were heated for 30 min and filtered with a Buchner funnel. The residue was washed with distilled water until it was acid-free. 200 ml of 1.25% NaOH was used to boil the residue 30 min. It was filtered and washed several times with distilled water until it was alkaline free. It was then rinsed once with 10% HCl and twice with ethanol. Finally, it was rinsed with petroleum ether three times. The

residue was put in a crucible and dried at 105°C in an oven overnight and cooling in a desiccator, and it was ignited in a muffle furnace at 550°C for 90 minutes to obtain the ash's weight.

2.3.6. Determination of mineral content

The method of AOAC (1990) was employed for the determination of mineral content. One gram of the pulverized *Solanum* samples put in a crucible and ignited in a muffle furnace at 550°C for 6 hours. The resulting ash was dissolved in 10 ml of 10 % HNO₃ and heated slowly for 20 minutes. After heating, it was filtered and the filtrate was used for the determination of mineral content. Atomic absorption spectrophotometer (AAS) was used to determine Ca, Mg, Fe, P and Zn, while the flame photometer was used to determine Na and K in the filtrate.

2.3.7 Calcium, Potassium and Phosphorus

For estimation of Calcium, 500 mg of dry finely ground of the brinjal part was digested using the triple acid mixture. After digestion, add 30 ml of distilled water and filter by using Whatman No.1 and finally makeup to 100 ml with distilled water. The sample was stored in polypropylene bottles. Ca content was estimated by using AAS by selecting a suitable wavelength. Phosphorous is determined colorimetrically using ammonium molybdate and Potassium by applying the AAS technique (Sadavivam and Manickam, 2008). All determinations were performed in three replications.

2.3.8. Acidity (%)

Take 10 gm of well-mixed brinjal juice, dilute to 250 ml with neutralized or recently boiled water. Titrate with 0.1 N NaOH using 0.3 ml phenolphthalein for every 100 ml solution to pink endpoint persisting for 30 seconds. Report acidity as ml 0.1 N NaOH per 100 gm or 100 ml as required (Sadavivam and Manickam, 2008).

III RESULTS AND DISCUSSION

Vermicompost gave the highest mean value for the number of leaves (46.24), the breadth of leaf lamina (26.82 cm) and leaf area (521.06 cm²), length of fruit (20.62cm), the girth of fruit (13.24cm), length of fruit stalk (5.86 cm), breadth of fruit stalk (2.82 cm), total carbohydrate (1.2), calcium (22.89), phosphorus (36.17). Plant height (145.57cm), the circumference of plant stem (5.13), number of branches per plant (6.68), length of leaf lamina (32.57cm), length of leaf petiole (12.96cm), the circumference of petiole (2.92cm), fresh weight of fruit (95.62g), fresh weight of plant (277.40g), protein (1.62), vitamin C (5.81), crude fibre (2.89), total mineral (0.82), potassium (190.93) were recorded highest in groundnut cake treated plants. Some parameters were highest in inorganic fertilizers.

Number of Flowers (13.60) and acidity (0.19) was highest in NPK 16:16:16 treatment. Urea treated plants gave the first flower within an average day of 80.7. The first harvest of fruits was also done urea treated plants within 97 days after transplanting. The number of fruits per plant (3.4) and cluster per plant (3.4) showed the highest value in urea treatment. Among all six fertilizers applied in the experiment, organic treatments like vermicompost and groundnut cake gave better growth, yield and quality characters than inorganic fertilizers. Among the twenty-nine characters studied, vermicompost gave the highest results for ten characters. Groundnut cake gave the best results for thirteen characters. Following these two organic fertilizers, urea has some contribution to growth and yield. Urea treated brinjal plants flowered and gave fruits earlier than all other treatments. A maximum number of fruits were obtained from urea treated plants. The number of flowers and acidity showed the highest mean value in NPK 16:16:16 treated plants. NPK 10:5:20 was only predominate when compared to the standard condition. While comparing quality characters alone, groundnut cake gave nutritionally adequate brinjal fruits. Bonemeal played a significant performance as compared to inorganic fertilizers. Vegetables are consumed both fresh and cooked. To avoid them from the residual effects of chemical fertilizers, organic nutrition should be preferred to improve food quality and provide health security to the people. Vermicompost and groundnut cake improved the growth, yield and quality of eggplant.

All the characters showed statistically significant differences between the populations of the species. Among the characters studied, the highest variability was shown by cluster per plant (70.71%) and the lowest by potassium (0.04%), as shown by the coefficient of variation. Characters like number of branches per plant (48.97%), number of fruits per plant (38.73%) and number of leaves (24.39%) also showed a comparatively high percentage of variability. In contrast, characters such as total carbohydrate, vitamin C, calcium, potassium showed a relatively low percentage of variability. Cluster per plant exhibited the highest value of the coefficient of variation in standard condition, whereas the lowest value in NPK 10:5:20.

Table 3: Growth characters of *Solanum melongena*: Mean \pm Standard Error

| | Days to first flower | Days to first harvest | Plant height (cm) | Circumference of plant stem | Number of branches per plant | Number of leaves | Length of leaf lamina | Breadth of leaf lamina | Length of leaf petiole | Circumference of petiole | Leaf area |
|---------|----------------------------------|----------------------------------|-----------------------------------|---------------------------------|---------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|---------------------------------|------------------------------------|
| STD | 108.00 \pm 1.06 | 122.20 \pm 1.24 | 66.39 \pm 0.95 | 2.57 \pm 0.08 | 2.32 \pm 0.13 | 15.48 \pm 0.76 | 21.98 \pm 0.10 | 13.74 \pm 0.12 | 7.57 \pm 0.07 | 1.68 \pm 0.05 | 184.38 \pm 2.15 |
| VM | 93.50 \pm 0.81 | 106.70 \pm 1.58 | 135.62 \pm 1.09 | 4.78 \pm 0.06 | 4.92 \pm 0.19 | 46.24\pm1.36 | 31.80 \pm 0.30 | 26.82\pm0.32 | 12.46 \pm 0.14 | 2.74 \pm 0.04 | 521.06\pm10.03 |
| GNC | 98.80 \pm 0.68 | 110.10 \pm 1.54 | 145.57\pm1.64 | 5.13\pm0.06 | 6.68\pm0.35 | 41.76 \pm 0.94 | 32.57\pm0.17 | 26.05 \pm 0.37 | 12.96\pm0.16 | 2.92\pm0.04 | 518.20 \pm 9.45 |
| BM | 89.00 \pm 0.58 | 104.70 \pm 1.26 | 127.62 \pm 1.97 | 4.67 \pm 0.07 | 3.08 \pm 0.21 | 38.56 \pm 0.61 | 29.36 \pm 0.14 | 24.64 \pm 0.21 | 12.42 \pm 0.13 | 2.18 \pm 0.03 | 441.38 \pm 4.46 |
| N16 | 84.90 \pm 0.62 | 100.70 \pm 1.18 | 88.68 \pm 1.61 | 4.83 \pm 0.09 | 3.32 \pm 0.33 | 28.20 \pm 0.61 | 26.52 \pm 0.29 | 17.53 \pm 0.21 | 11.54 \pm 0.11 | 2.54 \pm 0.04 | 283.70 \pm 5.12 |
| N10 | 101.40 \pm 0.92 | 112.50 \pm 1.95 | 85.24 \pm 1.20 | 3.81 \pm 0.06 | 5.48 \pm 0.27 | 23.04 \pm 0.81 | 23.83 \pm 0.14 | 19.76 \pm 0.10 | 10.37 \pm 0.13 | 2.14 \pm 0.02 | 287.16 \pm 1.97 |
| UR | 80.70\pm1.24 | 97.00\pm0.58 | 95.27 \pm 1.33 | 3.47 \pm 0.09 | 3.56 \pm 0.22 | 26.48 \pm 0.70 | 27.70 \pm 0.11 | 23.96 \pm 0.16 | 9.08 \pm 0.08 | 2.10 \pm 0.02 | 404.92 \pm 3.23 |
| Mean | 93.76 | 107.70 | 106.34 | 4.18 | 4.19 | 31.39 | 27.68 | 21.79 | 10.91 | 2.33 | 377.26 |
| SD | 8.93 | 7.68 | 27.58 | 0.86 | 1.43 | 10.26 | 3.63 | 4.53 | 1.85 | 0.40 | 119.22 |
| CD (5%) | 2.08 | 17.97 | 4.98 | 0.06 | 1.74 | 4.74 | 0.36 | 1.56 | 0.62 | 0.2 | 0.196 |

Table 4: Yield characters of *Solanum melongena*: Mean \pm Standard Error

| | Number of fruits per plant | Length of fruit | Girth of fruit | Length of fruit stalk | Breadth of fruit stalk | Fresh weight of fruit | Number of flowers | Cluster per plant | Fresh weight of plant |
|------------|---------------------------------|----------------------------------|----------------------------------|---------------------------------|---------------------------------|----------------------------------|----------------------------------|---------------------------------|-----------------------------------|
| STD | 1.20 \pm 0.20 | 9.15 \pm 0.22 | 7.78 \pm 0.17 | 3.86 \pm 0.06 | 2.07 \pm 0.02 | 33.41 \pm 0.85 | 3.00 \pm 0.32 | 1.00 \pm 0.32 | 67.88 \pm 1.44 |
| VM | 1.80 \pm 0.20 | 20.62\pm0.21 | 13.24\pm0.10 | 5.86\pm0.07 | 2.82\pm0.03 | 87.29 \pm 3.43 | 9.20 \pm 0.66 | 1.40 \pm 0.24 | 223.60 \pm 6.90 |
| GNC | 1.80 \pm 0.20 | 19.78 \pm 0.22 | 13.30 \pm 0.13 | 5.83 \pm 0.09 | 2.79 \pm 0.03 | 95.62\pm1.21 | 6.60 \pm 0.51 | 1.20 \pm 0.20 | 277.40\pm7.92 |
| BM | 2.00 \pm 0.32 | 17.48 \pm 0.10 | 13.28 \pm 0.17 | 5.85 \pm 0.08 | 2.75 \pm 0.04 | 78.60 \pm 1.14 | 6.60 \pm 0.51 | 1.60 \pm 0.40 | 202.20 \pm 4.60 |
| N16 | 3.00 \pm 0.32 | 10.76 \pm 0.12 | 9.05 \pm 0.12 | 4.50 \pm 0.08 | 2.20 \pm 0.02 | 46.55 \pm 1.47 | 13.60\pm0.51 | 2.00 \pm 0.32 | 154.80 \pm 2.67 |
| N10 | 2.66 \pm 0.42 | 10.62 \pm 0.18 | 8.00 \pm 0.20 | 4.88 \pm 0.08 | 2.43 \pm 0.04 | 46.37 \pm 0.94 | 9.20 \pm 0.37 | 2.00 \pm 0.32 | 93.16 \pm 2.02 |
| UR | 3.40\pm0.40 | 13.37 \pm 0.23 | 10.88 \pm 0.18 | 5.02 \pm 0.06 | 2.20 \pm 0.04 | 49.99 \pm 1.35 | 12.20 \pm 0.58 | 3.40\pm0.24 | 155.20 \pm 3.02 |
| Grand mean | 2.27 | 14.54 | 10.79 | 5.11 | 2.47 | 62.55 | 8.63 | 1.80 | 167.75 |
| SD | 0.72 | 4.36 | 2.34 | 0.72 | 0.30 | 22.32 | 3.34 | 0.74 | 67.81 |
| CD (5%) | 0.76 | 0.99 | 0.76 | 1.29 | 1.93 | 8.89 | 2.19 | 0.19 | 25.47 |

Table 5: Quality characters of *Solanum melongena*: Mean \pm Standard Error

| Parameters | STD | VM | GNC | BM | N16 | N10 | UR |
|----------------------------|-------------------|----------------------------------|-----------------------------------|-------------------|---------------------------------|-------------------|-------------------|
| Total carbohydrate (g/100) | 0.58 \pm 0.01 | 1.20\pm0.12 | 0.74 \pm 0.01 | 0.67 \pm 0.04 | 0.87 \pm 0.01 | 0.66 \pm 0.04 | 0.65 \pm 0.02 |
| Protein (g/100) | 0.64 \pm 0.01 | 0.93 \pm 0.01 | 1.62\pm0.02 | 0.86 \pm 0.02 | 0.70 \pm 0.01 | 1.41 \pm 0.02 | 0.79 \pm 0.02 |
| Vitamin C (mg/100) | 3.10 \pm 0.23 | 4.97 \pm 0.01 | 5.81\pm0.01 | 5.11 \pm 0.02 | 3.13 \pm 0.01 | 4.26 \pm 0.05 | 3.87 \pm 0.02 |
| Crude fiber (%) | 2.46 \pm 0.03 | 2.66 \pm 0.05 | 2.89\pm0.02 | 2.51 \pm 0.04 | 2.37 \pm 0.02 | 1.91 \pm 0.01 | 2.33 \pm 0.03 |
| Total mineral (%) | 0.20 \pm 0.01 | 0.59 \pm 0.01 | 0.82\pm0.01 | 1.00 \pm 0.11 | 0.36 \pm 0.03 | 0.59 \pm 0.02 | 0.20 \pm 0.03 |
| Calcium (mg/100) | 17.67 \pm 0.09 | 22.89\pm0.16 | 18.28 \pm 0.02 | 16.26 \pm 0.04 | 19.16 \pm 0.04 | 17.89 \pm 0.01 | 18.32 \pm 0.02 |
| Potassium (mg/100) | 136.77 \pm 0.18 | 185.18 \pm 0.16 | 190.93\pm0.92 | 134.00 \pm 0.11 | 176.99 \pm 0.16 | 144.33 \pm 0.04 | 154.74 \pm 0.05 |
| Phosphorus (mg/100) | 16.57 \pm 0.09 | 36.17\pm0.12 | 30.67 \pm 0.07 | 22.29 \pm 0.02 | 20.47 \pm 0.03 | 18.35 \pm 0.01 | 25.19 \pm 0.01 |
| Acidity (%) | 0.13 \pm 0.01 | 0.17 \pm 0.01 | 0.13 \pm 0.01 | 0.07 \pm 0.02 | 0.19\pm0.01 | 0.13 \pm 0.02 | 0.13 \pm 0.01 |
| Grand mean | 0.99 | 4.32 | 2.45 | 0.54 | 18.64 | 160.42 | 24.24 |
| SD | 0.35 | 0.95 | 0.28 | 0.28 | 1.92 | 21.93 | 6.50 |
| CD (5%) | NS | 0.05 | 0.05 | 0.09 | 0.06 | 22.48 | 0.06 |

In the case of days to first flower, number of leaves and fruit length showed minimum value by bonemeal and the maximum value by urea in the case of days to first flower and standard in both number of leaves and fruit length. Number of branches per the plant, fresh weight of fruit, leaf area, and fresh weight of plant showed comparatively higher values of coefficient of variation in vermicompost treatment. Total mineral and acidity displayed the highest coefficient of variation in urea. Plant stem circumference, number of leaves, leaf area, fruit length, number of flowers, vitamin C and phosphorus, has maximum variation in standard treatment. Groundnut cake treated brinjal gave maximum variability in breadth of leaf lamina and potassium. Characters such as plant height, number of branches per plant, length of leaf lamina, length of leaf petiole, number of fruits per plant, and fruit stalk length were highest in NPK 16:16:16. NPK 10:5:20 also has some highly varied characters like days first to harvest, length of leaf petiole, number of fruits per plant and fruit girth. Considering all the 29 characters, standard treatment exhibited a total coefficient of variation of 333.6 and it is the highest value among the seven treatments studied. The minimum variability was shown by groundnut cake. However, in all the cases, the variability was statistically significant, as mentioned earlier.

Genetic variability is the fundamental requirement of any crop breeding program to develop superior cultivars. Several studies carried out to estimate the genetic variability and determine the correlation among crop plants' different quantitative traits. Similar studies were carried out in sugarcane (Couto *et al.*, 2013). All the variables presented specific ranges of classification, showing the need to consider the nature of the variable studied in the type of coefficients of variation. Ranges were very high for all the parameters. This wide range in the values of the traits was adequate to distinguish the inbred lines using these traits. The zero and low CVs in the values of the traits expected because the lines have undergone inbreeding depression resulting in the fixation of recessive genes and thus increasing homozygosity within the lines (Ogunniyan and Olakojo, 2015).

Table 6: Growth, yield and quality characters of *Solanum melongena*: Coefficients of variation (%)

| | CHARACTERS | STD | VM | GNC | BM | N16 | N10 | UR |
|----|------------------------------|--------------|--------------|-------------|-------------|--------------|--------------|--------------|
| 1 | Days to first flower | 3.12 | 2.73 | 2.18 | 2.05 | 2.32 | 2.87 | 4.85 |
| 2 | Days to first harvest | 3.20 | 4.68 | 4.42 | 3.80 | 3.72 | 5.48 | 1.88 |
| 3 | Plant Height (cm) | 7.18 | 4.03 | 5.63 | 7.73 | 9.06 | 7.07 | 6.97 |
| 4 | Plant Stem Circumference | 16.05 | 5.81 | 5.41 | 7.19 | 9.48 | 7.88 | 13.37 |
| 5 | Number of Branches per Plant | 27.03 | 19.39 | 25.83 | 33.69 | 48.97 | 24.21 | 30.43 |
| 6 | Number of Leaves | 24.39 | 14.67 | 11.20 | 7.85 | 10.74 | 17.65 | 13.13 |
| 7 | Length of Leaf Lamina | 2.38 | 4.78 | 2.59 | 2.32 | 5.51 | 3.00 | 1.92 |
| 8 | Breadth of Leaf Lamina | 4.54 | 6.04 | 7.03 | 4.36 | 6.13 | 2.51 | 3.39 |
| 9 | Length of Leaf Petiole | 4.54 | 5.65 | 6.01 | 5.27 | 4.64 | 6.15 | 4.15 |
| 10 | Petiole Circumference | 4.91 | 7.07 | 7.32 | 7.78 | 7.01 | 4.46 | 4.67 |
| 11 | Leaf Area | 5.83 | 9.62 | 9.12 | 5.05 | 9.02 | 3.44 | 3.98 |
| 12 | Number of Fruits per Plant | 37.27 | 24.85 | 24.85 | 35.36 | 23.57 | 38.73 | 26.31 |
| 13 | Fruit Length | 11.92 | 5.05 | 5.52 | 2.84 | 5.46 | 8.70 | 8.55 |
| 14 | Fruit Girth | 10.79 | 3.85 | 5.03 | 6.33 | 6.43 | 12.53 | 8.46 |
| 15 | Length of Fruit Stalk | 8.05 | 6.19 | 7.93 | 6.69 | 8.84 | 8.41 | 5.84 |
| 16 | Breadth of Fruit stalk | 5.83 | 5.14 | 5.31 | 8.07 | 5.63 | 8.11 | 8.05 |
| 17 | Fresh Weight of Fruit | 12.76 | 19.65 | 6.35 | 7.23 | 15.81 | 10.17 | 13.49 |
| 18 | Cluster per plant | 70.71 | 39.12 | 37.27 | 55.90 | 35.36 | 35.36 | 16.11 |
| 19 | Number of Flowers | 23.57 | 16.12 | 17.28 | 17.28 | 8.38 | 9.09 | 10.69 |
| 20 | Fresh Weight of Plant | 10.57 | 15.43 | 14.27 | 11.38 | 8.62 | 10.83 | 9.73 |
| 21 | Total Carbohydrate (g/100) | 3.61 | 16.67 | 2.80 | 9.32 | 2.38 | 0.12 | 4.07 |
| 22 | Protein (g/100) | 3.13 | 1.24 | 1.63 | 4.19 | 2.47 | 2.13 | 3.35 |
| 23 | Vitamin C (mg/100) | 12.90 | 0.31 | 0.30 | 0.52 | 0.64 | 1.86 | 0.78 |
| 24 | Crude Fiber (%) | 1.86 | 3.50 | 0.92 | 2.79 | 1.12 | 1.05 | 1.97 |
| 25 | Total mineral (%) | 7.77 | 3.51 | 2.44 | 18.54 | 14.70 | 6.11 | 21.79 |
| 26 | Calcium (mg/100) | 0.86 | 1.25 | 0.14 | 0.37 | 0.33 | 0.10 | 0.14 |
| 27 | Potassium (mg/100) | 0.22 | 0.15 | 0.84 | 0.14 | 0.16 | 0.04 | 0.06 |
| 28 | Phosphorus (mg/100) | 0.92 | 0.58 | 0.37 | 0.12 | 0.22 | 0.09 | 0.04 |
| 29 | Acidity (%) | 7.69 | 9.17 | 15.38 | 37.80 | 9.12 | 20.35 | 20.35 |
| | Total | 333.6 | 256.25 | 235.37 | 311.96 | 265.84 | 258.5 | 248.52 |

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