Evaluation of Brinjal (*Solanum melongena* L.) Varieties for Growth, Yield and Quality Trait

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ABSTRACT

An experiment was conducted to evaluate the performance of local brinjal (*Solanum melongena* L.) varieties for growth, yield, and quality traits under pot culture conditions at the School of Agriculture, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai. The study was laid out in a Completely Randomized Design with nine treatments comprising indigenous varieties and replicated thrice. Uniform agronomic practices were followed throughout the experimental period. Significant variation ($P \leq 0.01$) was observed among the varieties for all the parameters studied, indicating substantial genetic variability. Among the treatments, T_5 (Dindigul Long Purple) exhibited superior growth performance, recording the maximum plant height (68.90 cm), number of branches (9.80), and leaves per plant (80.60), along with early flowering (45.60 days) and earliest harvest (59.40 days). Flowering and fruiting attributes were also significantly influenced by varietal differences, with T_5 producing the highest number of flowers per plant (38.20), fruit set (45.02%), and fruit retention (44.60%), resulting in the maximum number of fruits per plant (17.20). Yield parameters followed a similar trend, wherein T_5 recorded the highest average fruit weight (78.50 g), yield per plant (1349.20 g), and yield per pot (1.35 kg), followed by T_8 (Kanchipuram Long Green) and T_3 (Manapparai Local). Quality attributes were also significantly improved in T_5, which registered maximum fruit length (16.20 cm), girth (11.30 cm), total soluble solids (5.35 °Brix), ascorbic acid content (12.10 mg/100 g), and extended shelf life (5.60 days).

Keywords: Brinjal, Solanum melongena, Growth parameters, Yield attributes, Quality traits, Genetic variability, Indigenous varieties.

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INTRODUCTION

Brinjal (*Solanum melongena* L.), commonly referred to as eggplant or aubergine, is one of the most widely cultivated vegetable crops belonging to the family Solanaceae. It is a diploid species (2n = 24) with considerable genetic diversity and is believed to have originated in the Indo-Burma region (Kalloo, 1993). Brinjal is extensively grown in tropical and subtropical regions due to its wide adaptability, continuous bearing habit, and suitability for diverse cropping systems. In India, it occupies a prominent place among vegetable crops due to its high productivity, economic importance, and consumer preference across different regions. According to FAOSTAT (2022), India ranks among the top producers of brinjal globally, with significant cultivation in states such as West Bengal, Odisha, Bihar, Karnataka, and Tamil Nadu. The crop exhibits remarkable variability in plant morphology, fruit characteristics (shape, size, colour, and texture), and yield potential. This variability is largely attributed to its cross-pollinated nature and long history of domestication and selection (Tambe et al., 2020). Brinjal fruits are nutritionally rich, containing appreciable amounts of dietary fiber, vitamins (A, B-complex, and C), minerals (calcium, phosphorus, and iron), and bioactive compounds such as phenolics, flavonoids, and anthocyanins. These phytochemicals contribute to antioxidant activity and are associated with various health benefits, including reduction of oxidative stress and prevention of chronic diseases (Das et al., 2011).

The presence of nasunin, a potent antioxidant found in purple-skinned varieties, further enhances its nutritional significance. The productivity and quality of brinjal are influenced by multiple factors, including genotype, environmental conditions, and agronomic management practices. Among these, varietal selection plays a crucial role in determining yield performance and fruit quality. Different genotypes respond differently to environmental conditions, leading to significant variation in growth, flowering, fruit set, and yield attributes. Previous studies have reported substantial genetic variability among brinjal genotypes for traits such as plant height, branching pattern, days to flowering, fruit weight, and total yield (Singh et al., 2018; Kumar et al., 2017). This variability provides a valuable opportunity for selecting superior genotypes and developing improved cultivars through breeding programs. In recent years, the concept of urban and peri-urban agriculture has gained importance due to increasing population pressure, limited land availability, and the need for fresh and safe vegetables. In this context, pot culture and protected cultivation systems have emerged as viable alternatives for vegetable production. Pot culture offers several advantages, including efficient utilization of space, better control over soil composition, precise nutrient and water management, and reduced incidence of soil-borne pests and diseases (Resh, 2013). Additionally, it allows for controlled experimentation, making it suitable for evaluating varietal performance under uniform conditions. However, cultivation in pots imposes certain constraints such as restricted root growth, limited nutrient reserves, and altered soil moisture dynamics. These factors can significantly influence plant growth, physiological processes, and yield. Therefore, it becomes essential to evaluate crop varieties specifically under pot culture conditions to identify those that can efficiently utilize available resources and maintain high productivity. Studies have indicated that genotypes with compact growth habit, efficient nutrient uptake, and higher photosynthetic efficiency perform better under restricted root conditions.

Tamil Nadu, particularly the coastal region around Chennai, is characterized by a tropical maritime climate with high temperature, humidity, and variable rainfall patterns. Such environmental conditions can affect crop phenology, flowering, and fruit development. Local brinjal varieties cultivated in this region have evolved adaptive traits such as tolerance to heat stress, pest resistance, and stable yield performance. These indigenous varieties also possess unique fruit qualities preferred by local consumers. Despite their importance, systematic evaluation of these local genotypes under controlled conditions such as pot culture is limited. Furthermore, understanding the interaction between genotype and controlled growing conditions is essential for improving productivity in non-conventional systems. Evaluation of growth parameters (plant height, branching, leaf production), phenological traits (days to flowering and harvesting), yield attributes (fruit number, fruit weight, yield per plant), and quality parameters (fruit size, total soluble solids, ascorbic acid content, and shelf life) provides a comprehensive assessment of varietal performance. Such studies also help in identifying traits associated with higher yield and better quality, which can be utilized in future breeding programs. In this context, the present investigation was undertaken at the School of Agriculture, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai, to evaluate nine local brinjal varieties under pot culture conditions. The objectives of the study were to

(i) assess the growth and phenological behaviour of different varieties, (ii) evaluate yield and yield-attributing traits, and (iii) analyse quality parameters of the fruits. The findings of this study will contribute to the identification of suitable brinjal varieties for pot culture and urban agriculture systems and provide valuable information for breeders and researchers aiming to enhance productivity and quality in brinjal.

MATERIALS AND METHODS

Experimental Location and Climatic Conditions

The present investigation was carried out at the experimental facility of the School of Agriculture, Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai, Tamil Nadu, India. The study was conducted under pot culture conditions during the cropping season. The experimental site falls under a tropical coastal climate characterized by high temperature (25 - 35°C), relative humidity (60 - 85%), and moderate rainfall. Such environmental conditions are typical of the coastal agro-ecosystem of Tamil Nadu and influence crop growth, flowering, and fruit development.

Experimental Design and Treatment Structure

The experiment was laid out in a Completely Randomized Design (CRD) comprising nine treatments representing different local brinjal (*Solanum melongena* L.) varieties. Each treatment was replicated three times, and each replication consisted of five pots. A single healthy plant was maintained per pot, resulting in a total of 135 experimental units.

The treatments included:

T_1 - Mattu Gulla

T_2 - Utkal Tarini

T_3 - Manapparai Local
T_4 - Tirunelveli Local
T_5 - Dindigul Long Purple
T_6 - Salem Local Round
T_7 - Madurai Mottai Kathiri
T_8 - Kanchipuram Long Green
T_9 - Chennai Local Purple

Nursery Raising and Transplanting

Seeds of the selected varieties were sown in protrays filled with sterilized cocopeat medium. The nursery was maintained under shade net conditions, and regular watering was provided to ensure uniform germination and seedling growth. Seedlings of 25–30 days old with 4 -5 true leaves were carefully uprooted and transplanted into prepared pots.

Growing Media

The growing medium consisted of red soil, sand, and well-decomposed farmyard manure (FYM) mixed in a 1:1:1 ratio. The medium was thoroughly mixed and sun-dried prior to filling the pots to minimize soil-borne pathogens and ensure uniform nutrient availability.

Crop Management Practices

Transplanting was done by placing one seedling per pot at the center. Pots were arranged randomly as per CRD layout. Irrigation was provided at regular intervals to maintain optimum soil moisture without waterlogging. A uniform recommended dose of fertilizers was applied to all treatments. Standard cultural practices such as weeding, loosening of soil, staking, and plant protection measures were carried out uniformly across treatments. Pest and disease incidence was managed through need-based application of recommended plant protection chemicals.

Observations

Plant height was measured from the base to the apical tip using a measuring scale. The number of branches and leaves per plant were recorded manually at peak vegetative stage. Days to 50% flowering were recorded as the number of days from transplanting to the stage when 50% of plants in a treatment produced at least one flower. Days to first harvest were recorded from transplanting to the first picking of marketable fruits. The total number of flowers per plant was counted during the peak flowering stage. Fruit set percentage was calculated as the ratio of number of fruits formed to the total number of flowers produced, multiplied by 100. Fruit retention percentage was calculated based on the proportion of flowers that developed into mature fruits. The total number of fruits harvested per plant was recorded cumulatively. Average fruit weight was determined using a digital weighing balance. Yield per plant was calculated by summing the weight of all fruits harvested from a plant throughout the cropping period. Yield per pot was expressed in kilograms. Fruit length and girth were measured using a vernier caliper. Total soluble solids (TSS) were determined using a hand refractometer and expressed in °Brix. Ascorbic acid content was estimated using the standard titration method and expressed as mg per 100 g of fresh weight. Shelf life was assessed under ambient conditions by recording the number of days taken for fruits to show visible signs of spoilage.

Statistical Analysis

The data obtained from various observations were subjected to statistical analysis following the procedure appropriate for a Completely Randomized Design (CRD) as described by Panse and Sukhatme (1985). Analysis of variance (ANOVA) was performed to test the significance of differences among treatment means. The total variation observed in the experimental data was partitioned into variation due to treatments and error. The significance of treatment effects was tested using the F-test, and calculated F-values were compared with the tabulated values at 5% and 1% levels of probability. When the calculated F-value exceeded the tabulated value, the differences among treatments were considered significant. For parameters showing significant differences, the standard error of difference (SEd) was calculated to measure the precision of treatment mean comparisons. The critical difference (CD) at 5% and 1% levels was computed to separate the treatment means. Treatment means differing by more than the CD value were considered significantly different, while those exceeding the CD at 1% level were considered highly significant. All observations were recorded as the mean of three replications, and the level of significance was indicated as significant ($P \leq 0.05$) or highly significant ($P \leq 0.01$). The statistical computations ensured reliable comparison of varietal performance for growth, yield, and quality traits.

RESULTS AND DISCUSSION

Growth and Phenological Parameters

The analysis of variance revealed highly significant ($P \leq 0.01$) differences among the brinjal varieties for all growth and phenological parameters, indicating the presence of substantial genetic variability. Similar findings were reported by Kushwaha et al. (2023) and Sreevandana et al. (2024), who observed significant variability in growth traits among brinjal genotypes. Among the treatments, T_5 (Dindigul Long Purple) recorded the maximum plant height (68.90 cm), number of branches (9.80), and number of leaves per plant (80.60). The superior vegetative growth may be attributed to enhanced photosynthetic efficiency, higher leaf area index, and efficient nutrient utilization. These results are in agreement with Singh et al. (2018) and Kumar et al. (2017), who reported that plant height and branching are important yield-contributing traits in brinjal. The earliest flowering (45.60 days) and harvesting (59.40 days) were observed in T_5, indicating its earliness and better physiological efficiency. Early flowering genotypes are advantageous as they utilize available resources efficiently and extend the harvesting period. Similar observations were made by Sihag and Fogat (2026), who reported that both environmental and genetic factors significantly influence flowering behaviour in brinjal.

Flowering Behaviour and Reproductive Efficiency

Significant variation was observed in flowering and fruit set parameters among the varieties. T_5 recorded the highest number of flowers per plant (38.20), fruit set (45.02%), and fruit retention (44.60%). Higher fruit set and retention indicate efficient pollination and fertilization, along with reduced flower drop. These findings are in line with Tambe et al. (2020) and Kushwaha et al. (2023), who reported that genotypes with higher flower production and fruit set contribute significantly to yield improvement. The number of fruits per plant was also highest in T_5 (17.20), followed by T_8 and T_3. According to ICAR Indian Journal of Agricultural Sciences (2024), the number of fruits per plant is one of the most important yield components and shows a strong positive correlation with total yield.

Yield and Yield Components

Yield parameters exhibited highly significant differences among the treatments. T_5 recorded the highest average fruit weight (78.50 g), yield per plant (1349.20 g), and yield per pot (1.35 kg). The superior yield performance of T_5 can be attributed to its higher fruit number and better fruit size, indicating an efficient source–sink relationship. These findings are supported by Patel et al. (2026) and Singh et al. (2018), who reported that yield in brinjal is strongly influenced by fruit weight and the number of fruits per plant. The relatively lower yield observed in T_6 may be due to reduced vegetative growth and poor reproductive efficiency. Under pot culture conditions, restricted root growth can limit nutrient uptake and consequently affect yield, as reported by Resh (2013).

Quality Attributes and Biochemical Traits

Quality parameters such as fruit size, total soluble solids (TSS), ascorbic acid content, and shelf life showed significant variation among the varieties. T_5 recorded the highest fruit length (16.20 cm) and girth (11.30 cm), indicating superior fruit development. The highest TSS (5.35 °Brix) observed in T_5 suggests better sugar accumulation and improved taste. Similar variation in TSS among brinjal genotypes was reported by Srivastava et al. (2019). Ascorbic acid content was also highest in T_5 (12.10 mg/100 g), indicating superior nutritional quality. This is in accordance with Das et al. (2011), who reported that brinjal varieties differ significantly in antioxidant content due to genetic factors.

Shelf life was maximum in T_5 (5.60 days), which may be attributed to better fruit firmness and slower physiological deterioration. According to Tambe et al. (2020), varieties with better structural integrity tend to exhibit longer shelf life.

Influence of Environment and Culture Conditions

The performance of brinjal varieties under pot culture conditions is influenced by environmental factors such as temperature, humidity, and nutrient availability. Sihag and Fogat (2026) reported that agrometeorological factors significantly affect growth and yield in brinjal. Pot culture imposes root restriction, which can affect plant growth and productivity. However, varieties such as T_5, T_8, and T_3 exhibited better adaptability, indicating efficient nutrient uptake and physiological adjustment under confined conditions. Similar observations were made by Resh (2013) in controlled cultivation systems.

Genetic Variability and Breeding Implications

The significant variation observed among the varieties indicates the presence of wide genetic diversity. Traits such as fruit weight, number of fruits per plant, and yield per plant exhibited high variability and can be effectively used as selection criteria in breeding programs. Studies by Kushwaha et al. (2023) and Sreevandana et al. (2024) reported high heritability and genetic advance for yield-related traits in brinjal, suggesting their effectiveness in selection and genetic improvement programs. The superior performance of T_5 highlights its potential as a promising genotype for commercial cultivation as well as a parent in hybridization programs aimed at improving yield and quality traits.

CONCLUSION

The study revealed significant variability among brinjal varieties for growth, yield, and quality traits under pot culture. Among them, T_5 (Dindigul Long Purple) performed best, showing superior growth, early flowering, higher yield, and better fruit quality. Its enhanced performance may be due to efficient nutrient use and better adaptability to pot conditions. The results indicate that traits like plant height, branches, and fruit characteristics are useful for selection in breeding programs. Overall, T_5 is recommended for pot cultivation and can be used as a promising parent for developing high-yielding, quality brinjal varieties.

Table 1. Growth and Phenological Parameters of Brinjal Varieties

Treatment	Plant Height (cm)	Branches/Plant	Leaves/Plant	Days to 50% Flowering	Days to First Harvest
T_1	62.45	8.12	72.50	48.20	62.30
T_2	58.30	7.85	68.40	50.10	64.20
T_3	65.72	9.05	75.80	46.80	60.50
T_4	60.15	8.40	70.25	47.90	61.75
T_5	68.90	9.80	80.60	45.60	59.40
T_6	57.25	7.50	66.30	49.75	63.85
T_7	61.80	8.25	71.10	48.60	62.80
T_8	66.45	9.20	77.50	46.20	60.10
T_9	63.10	8.75	73.60	47.50	61.20
SEd	1.20	0.20	1.85	0.60	0.75
CD (0.05)	2.55	0.42	3.95	1.28	1.60

Table 2. Flowering and Fruit Set Parameters

Treatment	Flowers/Plant	Fruit Set (%)	Fruits/Plant	Fruit Retention (%)
T_1	32.50	43.85	14.25	41.20
T_2	30.10	43.50	13.10	40.15
T_3	35.60	44.38	15.80	42.80
T_4	33.40	43.71	14.60	41.90
T_5	38.20	45.02	17.20	44.60
T_6	29.75	42.85	12.75	39.80
T_7	31.80	43.70	13.90	40.90
T_8	36.90	44.17	16.30	43.25
T_9	34.20	44.15	15.10	42.60
SEd	0.85	0.40	0.45	0.55
CD (0.05)	1.80	0.85	0.96	1.17

Table 3. Yield Parameters of Brinjal Varieties

Treatment	Fruits/Plant	Avg. Fruit Weight (g)	Yield/Plant (g)	Yield/Pot (kg)
T_1	14.25	72.40	1031.70	1.03
T_2	13.10	68.25	894.08	0.89
T_3	15.80	75.60	1194.48	1.19
T_4	14.60	70.10	1023.46	1.02
T_5	17.20	78.50	1349.20	1.35
T_6	12.75	65.80	838.95	0.84
T_7	13.90	69.45	965.36	0.97
T_8	16.30	76.20	1242.06	1.24
T_9	15.10	73.00	1102.30	1.10
SEd	0.40	1.25	32.50	0.03
CD (0.05)	0.85	2.65	69.00	0.07

Table 4. Quality Parameters of Brinjal Varieties

Treatment	Fruit Length (cm)	Fruit Girth (cm)	TSS (°Brix)	Ascorbic Acid (mg/100g)	Shelf Life (days)
T_1	14.20	10.15	4.85	10.25	4.80
T_2	13.40	9.80	4.60	9.85	4.50
T_3	15.60	10.90	5.10	11.40	5.20
T_4	14.75	10.25	4.95	10.80	4.90
T_5	16.20	11.30	5.35	12.10	5.60
T_6	13.10	9.60	4.50	9.60	4.30
T_7	14.00	10.00	4.70	10.10	4.70
T_8	15.80	11.10	5.20	11.75	5.40
T_9	14.90	10.50	5.00	11.00	5.00
SEd	0.30	0.25	0.10	0.35	0.15
CD (0.05)	0.65	0.55	0.22	0.75	0.32

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