International Journal of Economic Plants

https://ojs.pphouse.org/index.php/IJEP

Crossref

IJEP March 2026, 13(2): 01-06

Article IJEP6869b

Full Research

Natural Resource Management

Doi: HTTPS://DOI.ORG/10.23910/2/2026.6869b

Evaluation of Some Brinjal (*Solanum melongena* L.) Cultivars of Karbi Anglong District, Assam for Growth, Yield and Profitability

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Article History

Received on 12th December, 2025

Received in revised form on 27th February, 2026

Accepted in final form on 13th March, 2026

Published on 19th March, 2026

Abstract

The present investigation was carried out during the *rabi* season (December, 2023 to May, 2024) to evaluate the morphological and yield performance of seven brinjal (*Solanum melongena* L.) cultivars collected from the Karbi Anglong district of Assam. The experiment was conducted in a randomized block design (RBD) with three replications and seven treatments corresponding to the cultivars. Significant variations were recorded among the cultivars for various growth and yield-related parameters. Cultivar C_1 exhibited the maximum plant height throughout the growth stages, while C_3 recorded the minimum. Cultivar C_5 showed vigorous vegetative growth, producing the highest number of leaves and branches. Although cultivar C_7 produced the longest fruits (26.80 cm) with the greatest circumference (19.76 cm) and heaviest individual fruits (139.65 g), cultivar C_5 recorded the highest number of fruits per plant (26.12) and the maximum yield plant^{-1} (1.12 kg). On a yield basis, C_5 achieved the highest total yield (26.67 t ha^{-1}) and the maximum benefit-cost (B:C) ratio of 3.94:1, indicating its superior performance. In contrast, C_1 recorded the lowest yield (14.28 t ha^{-1}) and the minimum B:C ratio (2.11:1). The observed differences among cultivars were mainly attributed to their genetic potential rather than environmental factors, as all were grown under uniform conditions. Based on yield performance and economic returns, cultivar C_5 might be recommended for commercial cultivation in similar agro-climatic regions of Assam.

Keywords: Brinjal, cultivars, growth, yield, profitability, karbi Anglong

1. Introduction

Brinjal or Eggplant (*Solanum melongena* L.) is one of the most prevalent/widespread vegetablesof tropical and sub-tropical regions, which comes under the family of Solanaceae and has a diploid chromosome number, i.e, 2n=2x=24. It is an often-cross-pollinated vegetable with an annual to perennial growth habit, but is grown commercially as an annual crop. According to Vavilov (1931), India is considered the primary center of origin due to its extensive array of variability reported in the region, and China is regarded as the secondary center of origin. Though brinjal is grown throughout India, its productivity is very poor (17.5 t ha^{-1}) compared to the global average of 26.1t ha^{-1} (Anonymous, 2016). It has been estimated that 17.8% of hybrid brinjal, 50.0% of OP/HYV brinjal, and 32.2% of local types of brinjal are grown in India. (Tripathy et al., 2020). Per 100 g of edible fruit contains 2.80-3.40 g of dietary fiber, 0.80-1.01g of protein, 7.4-9.0mg of calcium, 0.8 mg of vitamin A, 1.8–2.2 mg of vitamin C, 4.70–5.88 g of carbohydrate, 0.20-0.24 mg of iron, 13.5-14 mg of magnesium and 22.5–25 mg of phosphorus (Naeem et al., 2019). Purple variety has higher copper content and polyphenol oxidase activity, whereas iron and catalase activity is highest in the green cultivars. Pigmented, dark purple brinjal has more vitamin C than those with white skin. Anthocyanin pigment present in the fruit is responsible for the purple color of the fruit skin. Amino acid content is higher in the purple variety (Devi and Kanaujia, 2020). White brinjal/egg plants are low in carbohydrates and high in fiber, so they are said to be good for diabetic patients. It can cure a toothache if fried brinjal fruit in tin oil is taken and acts as an excellent remedy for those suffering from liver complaints (Kanaujia et al., 2020). The brinjal plant also produces different types of alkaloids, like solasodine. If it is consumed in high amounts, it can be hazardous to humans (Keeler et al., 1976). Local people usually cultivate brinjal varieties that are easily available around them without justification of yield, performance as well as without cost-benefit analysis. So, for this, they never achieve the optimum output from their produce. Sometimes they can lose their whole capital rather than getting profits. In this regard, it is very urgent to evaluate the local brinjal germplasms for their yield and yield contributing attributes and to select the better varieties for commercial and profitable cultivation (Alam et al., 2021). Due to the use of low-yielding cultivars suitable for local needs, there is a lack of adoption of effective management practices and difficulties in disease and pest management. It is important to focus the breeding programs using regional varieties of brinjal to address these issues. It is more accurate information than any other statistic to choose superior genotypes for a crop improvement program based on mean performance (Verma et al., 2023). In the Karbi Anglong district of Assam, different cultivars of brinjal are grown by the local people,which have yet to attain commercial recognition. More attention and funding for agricultural research and development should be given to these cultivars than they currently receive. Due to their local use as well as their ability to be cultivated profitably in both rural and urban areas, they constitute a major component of crop biodiversity in horticulture. Increased research and development effortswould probably provide fruitful outcomes. Proper evaluation of those cultivars might screen out some superior cultivars that could help the vegetable growers of the state. Therefore, keeping in view of the above facts and considering the potential, this investigation was carried out to study the morphological performances of different brinjal cultivars aswell as to study the yield performances for higher profitability.

2. Materials and Methods

The investigation was conducted at the Instructional Cum Experimental Farm, Department of Horticulture, Biswanath College of Agriculture, Assam Agricultural University, Biswanath Chariali, located at 26.72° N latitude and 93.12° S longitude at an elevation of 79m above mean sea level. The soil texture of the experimental site was sandy loam, with a pH of 5.21, an organic carbon content of 0.83%, an available N of 321.43 kg ha^{-1}, an available P_2O_5 of 33.41kg ha^{-1}, and an available K_2O of 335.23 kg ha^{-1}. Seeds of six local brinjal cultivars were collected from the Regional Agricultural Research Station, Diphu, Karbi Anglong, and one variety, JC-1, from Assam Agricultural University, Jorhat, which served as the check variety. The experiment comprised seven treatments, i.e., cultivars (Table 1 and Figure 1), and was laid out in a Randomized Block Design (RBD) with three replications. Seeds were sown in the nursery in the first week of December and seedlings were transplanted after one month of sowing at a spacing of 75×60 cm^2. Each plot measured 3.5×3 m^2. Fertilizer

Table 1: Details of the cultivars

Sl. No.	Nota-tions	Description of cultivars	Source
1.	C_1	Light greenish-white in color, egg-shaped	Local cultivar, Karbi Anglong, Assam
2.	C_2	Whitish in color, oblong-shaped	Local cultivar, Karbi Anglong, Assam
3.	C_3	Greenish-violet in color, oblong-shaped	Local cultivar, Karbi Anglong, Assam
4.	C_4	Dark Greenish-white in color, oblong-shaped	Local cultivar, Karbi Anglong, Assam
5.	C_5	Violet in color, medium-long and thick	Local cultivar, Karbi Anglong, Assam
6.	C_6	Violet in color, short, slender	Local cultivar, Karbi Anglong, Assam
7.	C_7 (JC-1)	Long, medium-sized, purple fruits with a pointed apex	Assam Agricultural University, Jorhat

Figure 1: Continue...

Figure 1: The brinjal cultivars

was applied at the rate of 50:50:50 kg ha^{-1} (N:P:K). The data were recorded on morphological characters and yield characters like plant height (cm), number of leaves plant^{-1}, number of branches plant^{-1}, leaf area plant^{-1}, stem colour, distribution of spines, fruit length (cm), fruit circumference (cm), pedicel length (cm), number of fruits plant^{-1}, individual fruit weight (g), fruit yield plant^{-1} (kg), total fruit yield (t ha^{-1}) and benefit: cost ratio of all the cultivars. The collected data were subjected to statistical analysis. Data were recorded from five randomly selected and tagged plants in each plot, excluding border plants, and subsequently analyzed for the specified parameters. Wherever results were found to be statistically significant, critical differences (CD) at the 5% level of probability were computed to enable accurate interpretation of the results.

3. Results and Discussion

3.1. Growth parameters

The data on growth parameters, namely, plant height, number of branches per plant, number of leaves per plant, and leaf area plant^{-1}, were found to be statistically significant. Table 2 shows significant variation in plant height among the brinjal cultivars at 30, 60 days after transplanting (DAT), and at harvest. Cultivar C_1 recorded the tallest plants at all stages (27.07 cm, 65.30 cm, and 75.47 cm), followed by C_7 (25.73 cm, 62.17 cm, and 73.07 cm). At 30 DAT, the height of C_1 was statistically at par with C_7. Cultivar C_3 consistently exhibited the shortest plant height across all stages (20.97 cm, 54.50 cm, and 67.73 cm). As shown in Table 2, the mean number of leaves per plant increased from 30 DAT to harvest across all brinjal cultivars. Cultivar C_5 recorded the highest leaf count at all stages (5.66, 22.55, and 52.62), and at 30 DAT, the leaf count is at par with C_1, C_2, and C_4. The lowest leaf count was observed in C_7 (4.11, 13.88, and 40.33). The data in Table 3 showed significant differences in the number of branches per plant among brinjal cultivars, with branch numbers increasing from 30 DAT to harvest. Cultivar C_5 recorded the highest number of branches at all stages (2.42 at 30 DAT, 7.89 at 60 DAT, and 10.99 at harvest), though at 30 DAT it was statistically similar to C_1, C_4, C_6 and C_7 and at 60 DAT to C_7. The lowest number of branches was consistently observed in cultivar C_3 (1.34 at 30 DAT, 3.44 at 60 DAT, and 7.11 at harvest), which was in par with C_2 at 30 DAT and harvest.The largest leaf area (4810.37 cm²) was noticed in C_7, closely followed by C_5 (4692.29 cm²), consistent with Sahuet al. (2022). These findings align with earlier reports by Shinde etal. (2012), Akshay et al. (2018), Gogoi et al. (2018), Shilpa et al. (2018), Chaitanya et al. (2022), and Patel and Chaurasiya (2022), which also noted significant varietal differences in plant height and branching. The observed variations were likely due to genetic differences among the cultivars rather than environmental factors. The superior growth of C_5 might be attributed to the efficient expression of favorable genes regulating physiological processes such as photosynthesis and dry matter accumulation. In contrast, the comparatively lower performance of C_1 might be the result ofthe absence of such traits.

Table 2: Performance of different brinjal Cultivars with respect to morphological parameters

Treat-ments	Plant height (cm)			No. of leaves plant^{-1}		
	30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest
C_1	27.07	65.30	75.47	5.33	21.56	50.66
C_2	24.13	58.90	72.13	5.11	18.78	48.84
C_3	20.97	54.50	67.73	4.22	14.89	43.33
C_4	22.57	56.07	69.93	4.99	17.66	47.11
C_5	23.37	60.07	71.87	5.66	22.55	52.62
C_6	23.97	60.33	71.77	4.56	20.89	45.78
C_7	25.73	62.17	73.07	4.11	13.88	40.33
SEd±	0.72	1.23	0.52	0.45	0.52	0.59
CD (p=0.05)	1.58	2.71	1.16	0.99	1.15	1.30

There were notable variations in the stem color across all cultivars (Table 3). Out of the seven cultivars, four had exhibited greenish violet stem color, one had violet colorand the rest two exhibited dark violet color. Different plant sections also expressed different pigmentation. Anthocyanin is the main pigment of brinjal, producing mainly purple and violet colors in different plant parts and chlorophyll content has a darkening effect on color. A similar result was obtained by Khan and Singh (2014) and Ansari et al. (2021).

The distributions of spines throughout the seven brinjal cultivars are shown in Table 3. Only one out of the seven cultivars lacked spines, two had spines in the fruit pedicel only and the rest of the four cultivars had spines in every part of the plant,i.e., in the leaves, stem and fruit pedicel.

3.2. Yield attributing parameters and yield

Yield-contributing parameters such as fruit length, fruit circumference, pedicel length, individual fruit weight, and fruit yield plant^{-1} varied significantly among the brinjal cultivars studied. Cultivar C_7 exhibited superiority in fruit

Table 3: Performance of different brinjal Cultivars with respect to morphological parameters

Treatments	No. of branches plant^{-1}			Leaf area plant^{-1} (cm^2)	Stem color	Distribution of spines
	30 DAT	60 DAT	At harvest			
C_1	2.00	5.44	8.22	3529.34	Greenish Violet	Present (all parts)
C_2	1.66	4.88	7.88	4050.94	Violet	Present (all parts)
C_3	1.34	3.44	7.11	2674.69	Dark Violet	Present (all parts)
C_4	2.22	6.22	8.78	3885.63	Greenish Violet	Absent
C_5	2.42	7.89	10.99	4692.29	Greenish Violet	Present (fruit pedicel only)
C_6	2.11	5.78	8.78	3138.57	Greenish Violet	Present (all parts)
C_7	2.33	7.33	9.77	4810.37	Dark Violet	Present (fruit pedicel only)
SEd±	0.28	0.34	0.39	85.26	-	-
CD (p=0.05)	0.62	0.74	0.88	187.83	-	-

size traits, recording the highest fruit length (26.80 cm), fruit circumference (6.37 cm), and individual fruit weight (139.65 g). The lowest fruit length (5.99 cm) and fruit circumference (7.54 cm) Were recorded in C_1. Similar observation with respect to fruit circumference was observed by Mahalakshmi et al. (2022). However, C_7 did not achieve the highest yield plant^{-1} due to a significantly lower number of fruits plant^{-1} (7.12). In contrast, cultivar C_5 produced the highest number of fruits plant^{-1} (26.12), which contributed to the maximum fruit yield plant^{-1} (1.12 kg), despite having a lower individual fruit weight compared to C_7. This suggests a positive correlation between the number of fruit plant^{-1} and total fruit yield. These observations are in agreement with the findings of Saikia et al. (2021), who reported that cultivars with heavier individual fruits generally bore fewer fruits, leading to reduced overall yield. Similar patterns were also reported by Malshe et al. (2016), Kumaret al., (2020), Singh et al. (2024)) and Mahla et al. (2025). The highest pedicel length (10.42 cm) was observed in $C_{6,}$ which was followed by C_5 (9.45 cm) and C_7 (7.74). On the other hand, the lowest pedicel length (4.62 cm) was observed in $C_{2.}$

In the present study, cultivar C_5 emerged as the most promising in terms of yield with the highest fruit yield (26.67 t ha^{-1}), followed by C7 (25.24 t ha^{-1}), while C_1 recorded the lowest (14.28 t ha^{-1}) among the seven brinjal cultivars evaluated. Morphological traits such as the number of leaves and branches per plant were highest in C_5, which likely contributed to its superior yield performance. As all cultivars were grown under uniform environmental conditions and identical cultural practices, the observed differences in growth and yield can be primarily attributed to genetic factors. These findings are in close agreement with earlier reports by Chattopadhyay et al. (2011), Shekar et al. (2012), Chaturvedi et al. (2016), Akshay et al. (2018), and Gogoi et al. (2018), who also documented significant genetic variation among brinjal cultivars with respect to yield attributes (Table 4).

3.3. *Economics*

Among the various factors influencing growers' adoption of new cultivars, economic viability plays a critical role. One key

Table 4: Performance of different brinjal Cultivars with respect to yield attributing parameters and yield

Treatments	Fruit length (cm)	Fruit circumference (cm)	Pedicel length (cm)	No. of fruits plant^{-1}	Individual fruit weight (g)	Fruit yield (kg plant^{-1})	Fruit yield (t ha^{-1})
C_1	5.99	15.85	5.06	18.12	33.03	0.60	14.28
C_2	7.09	8.74	4.62	20.89	31.17	0.65	15.48
C_3	7.71	9.28	5.55	23.12	30.59	0.71	16.90
C_4	8.27	9.62	5.15	22.56	33.90	0.76	18.09
C_5	18.22	10.76	9.45	26.12	42.79	1.12	26.67
C_6	13.52	7.54	10.42	21.12	36.79	0.78	18.57
C_7	26.80	19.76	7.74	7.12	139.65	1.06	25.24
SEd±	0.48	0.35	0.20	0.46	0.39	0.02	0.09
CD (p=0.05)	1.06	0.77	0.44	1.03	0.86	0.04	0.19

indicator of a cultivar's economic potential is the benefit-cost (B:C) ratio, which reflects its profitability and practical utility for farmers. In the present study, cultivar C_5 recorded the highest gross return (₹ 5,33,340/-), resulting in the maximum net profit (₹ 3,98,127.50/-) and the highest benefit-cost ratio of 3.94. This superior economic performance can be attributed to the higher yield observed in C_5. In contrast, the other cultivars exhibited lower net returns and B:C ratios, likely due to their comparatively lower yields. The minimum net profit was obtained in C_1 (₹ 1,50,507.50/-) with B:C ratio of 2.11:1. These findings are consistent with previous studies by Shinde et al. (2012), Sahu et al. (2022) and Kuzhalarasi et al. (2024), who also reported a strong correlation between higher yields and increased economic returns in brinjal cultivation (Table 5).

Table 5: Economics of production

Treatments	Gross expenditure (₹ ha^{-1})	Gross return (₹ ha^{-1})	Net return (₹ ha^{-1})	Benefit-cost ratio
C_1	1,35,212.00	2,85,720.00	1,50,507.50	2.11
C_2	1,35,212.00	3,09,520.00	1,74,307.50	2.29
C_3	1,35,212.00	3,38,100.00	2,02,887.50	2.50
C_4	1,35,212.00	3,61,900.00	2,26,687.50	2.68
C_5	1,35,212.00	5,33,340.00	3,98,127.50	3.94
C_6	1,35,212.00	3,71,420.00	2,36,207.50	2.75
C_7	1,35,212.00	5,04,760.00	3,69,547.00	3.73

Sale price: ₹ 20 kg^{-1}

4. Conclusion

The study revealed considerable variability among seven brinjal cultivars in morphological traits, yield attributes, and overall productivity. Genetic factors appeared to exert a stronger influence than environmental conditions under uniform management condition. Despite identical cultivation practices, the cultivars exhibited distinct performances, with C_5 demonstrating superior yield potential and the highest benefit-cost ratio, making it the most promising for the farming community of Assam. To validate these findings, multi-location and multi-season evaluations were recommended to assess consistency across varied agro-ecological conditions.

5. Acknowledgement

The authors are thankful to the Directorate of Post Graduate Research, Assam Agricultural University, Jorhat for providing the financial support for carrying out the experiment.

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