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# IMPACT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON GROWTH, YIELD, AND FRUIT QUALITY OF BRINJAL (*SOLANUM MELONGENA* L.) CV. KASHI TARU

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**ABSTRACT**

The present investigation was carried out at Horticulture Research Farm- I, Department of Horticulture, School of Agricultural Sciences & Technology, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, to study the impact of organic manures and inorganic fertilizers on growth, yield, and fruit quality of brinjal (*Solanum melongena* L.) cv. Kashi Taru during the Rabi season of the year 2024-25. The experiment was laid down in Randomized Block Design (RBD) which consisted 11 treatment combinations viz; $T_0$- Control, $T_1$- 100 % (RDF), $T_2$- 100% Farm Yard Manure, $T_3$- 100 % Vermicompost, $T_4$- 100 % Poultry Manure, $T_5$- 50 % RDF + 50% Farm Yard Manure, $T_6$- 50 % RDF + 50 % Vermicompost, $T_7$- 50 % RDF + 50% Poultry Manure, $T_8$- 50% Farm Yard Manure + 50 % Vermicompost, $T_9$- 50% Farm Yard Manure + 50 % Poultry Manure and $T_{10}$ - 50 % Vermicompost + 50 % Poultry Manure and treatments were replicated thrice. The treatment 100% RDF ($T_1$) performed better in terms of growth parameters, and the combined application of 50% RDF + 50% FYM ($T_5$) resulted in the best yield and quality of brinjal.
***Keywords*:** Brinjal, Kashi Taru, organic manures, inorganic fertilizers, growth, yield & quality.

## Introduction

Brinjal (*Solanum melongena* L.) or eggplant is a significant vegetable in the Solanaceae family, associated with crops like tomatoes and peppers. Characterized by a chromosome count of 24, it thrives in warm climates with nutrient-rich, well-drained soil and is sensitive to temperature extremes. Cultivated in the Indian sub-continent since 3000 BC. Brinjal's propagation extended through Islamic trade routes to the Middle East and North Africa, later reaching the Americas via the Columbian Exchange in the 16th century. Crop advancements in the 19th and 20th centuries introduced hybrid varieties that enhanced yield, resilience, and fruit quality. Its wild ancestors are wild relatives like *Solanum incanum* and *Solanum torvum*. In India for the 2023-24 season, brinjal occupied 683.14 lakh hectares with significant production concentrated in West Bengal, Odisha, and Gujarat (Anonymous 2022-23). The plant's distinct characteristics include a fibrous root system and variable fruit shape, size, and color. Nutritionally, brinjal offers low calories, essential vitamins, minerals, and bioactive compounds contributing to health benefits, including digestive health and antioxidant properties (Basak, 2006). Though beneficial, it contains solanine, which can affect some individuals negatively. Its cultivation supports sustainable agriculture due to reduced water and chemical requirements, enhancing its economic value with versatility in culinary uses and potential in food processing (Bhattacharya *et al*. 2000). The use of biofertilizers, including vermicompost and farmyard manure (FYM), is enhancing vegetable production. Bio-fertilizers improve productivity by nitrogen fixation and nutrient solubilization. In brinjal cultivation, inorganic fertilizers (N, P, and K) are essential for vegetative growth, flowering, and fruit development, while also addressing soil nutrient deficiencies. These fertilizers should be applied judiciously to avoid environmental harm. Vermicompost enhances soil fertility, root development, and pest resistance. FYM improves soil structure and nutrient retention when mixed into the soil before transplanting. Poultry manure, rich in nutrients, also promotes plant growth and microbial activity, fostering a sustainable approach to brinjal cultivation when applied appropriately.

## Materials and Methods

The present investigation was carried out at Horticulture Research Farm- I, Department of Horticulture, School of Agricultural Sciences & Technology, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, to study the impact of organic manures and inorganic fertilizers on growth, yield, and fruit quality of brinjal (*Solanum melongena* L.) cv. Kasi Taru, during the Rabi season of the year 2024-25. The experiment was laid down in RBD which consisted 11 treatment combinations viz; $T_0$- Control, $T_1$- 100 % (RDF), $T_2$- 100% Farm Yard Manure, $T_3$- 100 % Vermicompost, $T_4$- 100 % Poultry Manure, $T_5$- 50 % RDF + 50% Farm Yard Manure, $T_6$- 50 % RDF + 50 % Vermicompost, $T_7$- 50 % RDF + 50% Poultry Manure, $T_8$- 50% Farm Yard Manure + 50 % Vermicompost, $T_9$- 50% Farm Yard Manure + 50 % Poultry Manure and $T_{10}$- 50 % Vermicompost + 50 % Poultry Manure and replicated three times. The land was brought to a fine tilth through tillage and ploughing. The plot size was 2.4 m × 1.8 m. The seedlings were planted at a spacing of 60 cm × 45 cm between plants within the row to ensure proper aeration, light interception, and space for growth. Each plot consisted of four rows, accommodating a total of 16 plants per plot. In total, 528 seedlings were transplanted across 33 experimental plots, ensuring uniform plant population and layout across the field. Bunds and irrigation channels were maintained properly. Different intercultural practices like gap filling, staking, irrigating, weeding, etc., were performed as per crop requirements. The five plants of each plot were randomly selected and tagged. The data was recorded for various growth, yield, and quality parameters in brinjal during investigation, subjected to statistical analysis by using Factorial RBD for analysis of variance (ANOVA) as suggested by the online OPSTAT software by Sheoran *et al.* (1998).

## Results and Discussion

### Growth Parameters

The maximum plant height (23.77 cm, 45.70 cm and 71.14 cm) at 30, 60 and 90 DAT, respectively was found in $T_1$ (100% RDF) and the minimum plant height (15.34 cm, 31.37 cm, and 49.87 cm) was recorded in $T_0$ (Control) at 30, 60 and 90 DAT, respectively. The significant increase in plant height under $T_1$ due to the increase in vegetative growth may be attributed to the adequate supply of essential nutrients—nitrogen, phosphorus, and potassium through chemical fertilizers applied near the root zone. These nutrients are efficiently absorbed and translocated within the plant, supporting key biological and physiological processes such as carbon assimilation, respiration, and nucleic acid synthesis. These processes are vital for cell division and the formation of new tissues, thereby promoting the growth of various plant parts. Similar findings have been reported by Patil *et al*. (2008) in tomato and Alias *et al*. (2021) in Brinjal.

The maximum number of branches per plant (15.49) was found in $T_1$ (100 % RDF) and the minimum number of branches per plant (9.06) was found in $T_0$ (Control). The result indicates that balanced nutrient application ensures an optimal hormonal balance, particularly between auxins and cytokinins. Adequate nitrogen levels can reduce apical dominance by modulating auxin transport, thus favouring lateral shoot emergence and ultimately increasing the number of branches per plant. Similar findings have been reported by Usha *et al*. (2018) in cluster bean and Samapika *et al*. (2019) in Dolichos bean.

The maximum number of leaves per plant (57.85) was found in $T_1$ (100 % RDF) and the minimum number of leaves per plant (37.81) was found in $T_0$ (Control). The result indicates nitrogen is particularly influential in promoting chlorophyll synthesis, protein formation, and vigorous vegetative development. A sufficient nitrogen supply stimulates meristematic activity, leading to increased cell division and expansion, which in turn supports the development of a greater number of leaves. Potassium plays a key role in enzyme activation and photosynthetic translocation both of which support sustained foliage development. Similar findings have been reported by Priyadarshani *et al*. (2017) in cluster bean and Shelke *et al*. (1999) in brinjal.

The maximum number of flowers per cluster (2.58) was found in $T_5$ (50 % RDF + 50% FYM), and the minimum number of flowers per cluster (1.56) was found in $T_0$ (Control). The result indicates that FYM improves the physical, chemical, and biological properties of the soil. It enhances soil structure, increases microbial activity, and promotes slow and sustained nutrient release. When used in combination with 50% RDF, the availability of macro and micro-nutrients improves, fostering a favorable environment for the synthesis of growth-regulating substances such as gibberellins and cytokinins, which are crucial for flower induction and development. Similar findings have been reported by Naidu *et al.* (2002) in brinjal, Prativa and Bhattarai (2011) in tomato, and Ogundare *et al.* (2015) in okra.

**Yield parameters**

The maximum fruit length (25.61 cm) was found in $T_5$ (50 % RDF + 50% FYM) and the minimum fruit length (12.53 cm) was found in $T_0$ (Control). The result indicates FYM serves not only as a source of macro and micronutrients but also improves soil physical properties, such as porosity, water-holding capacity, and microbial activity. When combined with inorganic fertilizers, it ensures a steady and balanced nutrient supply throughout the crop growth period. This improves cell division, elongation, and the biosynthesis of plant hormones such as auxins and gibberellins, which are critical for fruit development. Similar findings have been reported by Anburani *et al.* (2003) in brinjal and Harikrishna *et al.* (2002) in chilli.

The maximum fruit diameter (3.41cm) was found in $T_5$ (50% RDF + 50% FYM and the minimum fruit diameter (2.12 cm) was found in $T_0$ (Control). The result indicates the synergistic effects of integrated nutrient management (INM), which combines the immediate nutrient availability of inorganic fertilizers with the long-term soil health benefits of organic manure. The combined application of 50% RDF with 50% FYM ensures a sustained and balanced supply of essential nutrients like nitrogen, phosphorus, and potassium as well as secondary and micronutrients. This balanced nutrition plays a critical role in improving cell division and cell expansion in the fruit tissues, which directly contributes to increased fruit girth and weight. Close findings have been reported by Jose *et al*. (1988) in brinjal and Prabu *et al*. (2003) in okra.

The maximum fruit weight (105.68 g) was found in $T_5$ (50% RDF + 50% FYM), and the minimum fruit weight (80.53 g) was found in $T_0$ (Control). The result indicates that the application of 50% RDF ensures the immediate supply of essential nutrients, which are critical for cell division, photosynthesis, and the translocation of assimilates to developing fruits. When supplemented with 50% FYM, the treatment not only provides a slow and steady release of nutrients but also improves soil organic carbon, microbial activity, and enzymatic functions in the rhizosphere. This synergistic nutrient availability enhances plant metabolism, leading to greater accumulation of dry matter in the fruits, thereby increasing fruit weight**.** Similar findings have been reported by Kumaran *et al*. (1998) in tomato and by Gore & Sreenivasa (2011) in tomato.

The maximum number of fruits per plant (12.07) was found in $T_5$ (50% RDF + 50% FYM and the minimum number of fruits per plant (7.03) was found in $T_0$ (Control). The result indicates that the FYM has been reported to stimulate endogenous phytohormones such as auxins and cytokinins, which promote floral bud differentiation and reduce flower drop. Furthermore, the steady and prolonged nutrient release from FYM complements the quicker nutrient availability from RDF, ensuring continuous support during the critical stages of flowering and fruit development. The combined effect leads to increased fruit set, lower fruit abortion, and ultimately a higher number of fruits per plant. Similar findings have been reported by Anburani *et al.* (2003) and Aminifard *et al.* (2010) in brinjal.

The maximum fruit yield per plant (1.32 kg) was found in $T_5$ (50% RDF + 50% FYM and the minimum fruit yield per plant (0.80 kg) was found in $T_0$ (Control). The result indicates the inorganic component supplies essential macronutrients in readily available forms, promoting rapid vegetative growth, increased photosynthesis and early flowering. Meanwhile, the organic component (FYM) contributes to long-term soil health by enhancing soil structure, microbial activity and water-holding capacity. As a result, higher fruit set, larger fruit size and greater fruit number all of which cumulatively enhanced total fruit yield per plant**.** Similar findings have been reported by Suge *et al.* (2011) in rice and Rafi *et al.* (2002) in tomato.

The maximum fruit yield (12.45 kg/plot) was found in $T_5$ (50% RDF + 50% FYM), and the minimum fruit yield (6.25 kg/plot) was found in $T_0$ (Control). The result indicates that the partial substitution of chemical fertilizers with FYM not only enhanced soil physico-chemical properties but also improved soil microbial activity, thereby facilitating better nutrient mineralization and uptake. FYM contributed to improved soil structure, water-holding capacity, and aeration, all of which are conducive to enhanced root proliferation and nutrient absorption. Simultaneously, the application of 50% RDF ensured the availability of readily accessible macronutrients necessary for vigorous vegetative growth, flowering, and fruit development. Similar findings have been reported by Harikrishana *et al*. (2002) in brinjal and Mallangouda *et al*. (1995) in capsicum.

The maximum fruit yield (549.87 q/ha) was found in $T_5$ (50% RDF + 50% FYM), and the minimum fruit yield (174.84 q/ha) was found in $T_0$ (Control). The result indicates the combined benefits of organic and inorganic nutrient sources. This treatment improved soil health, enhanced nutrient availability and uptake, increased nutrient use efficiency and promoted better plant growth and fruit development. The FYM improved soil structure and microbial activity, while RDF provided immediate nutrients, creating a balanced and sustainable environment for higher productivity. This integrated approach reduced nutrient losses and potential toxicity, leading to superior yields. Similar findings have been reported by Nanthakumar & Veeeragavathatham (1999) and Harish & Patil (2012) in brinjal.

**Quality parameters**

The T.S.S. content was measured using a digital refractometer. The maximum T.S.S (4.75 ºB) was found in $T_5$ (50% RDF + 50% FYM), and the minimum T.S.S (4.01 ºB) was found in $T_0$ (Control). The result indicates that this combination improved soil physical properties, enhanced microbial activity and promoted efficient nutrient uptake particularly of potassium, which plays a key role in sugar translocation and accumulation in fruits. Moreover, the improved soil moisture retention and aeration resulting from FYM addition supported consistent physiological processes such as photosynthesis and assimilate partitioning. These favourable conditions led to enhanced carbohydrate synthesis and their translocation into the fruit, thus increasing the T.S.S content and playing the role of the most effective treatment in enhancing fruit sweetness and quality, as indicated by the highest T.S.S value. Similar findings have been reported by Kumaran *et al*. (1998) and Patil *et al.* (2004) in tomato.

The Lane and Eynon method were used to estimate sugar content (Ranganna, 2001). The maximum reducing sugar (0.42%) was found in $T_5$ (50% RDF + 50% FYM), and the minimum reducing sugar (0.21%) were found in $T_0$ (Control). The result indicates that the reducing sugars are primarily derived from the breakdown of complex carbohydrates like starch, a process that is strongly influenced by nutrient availability, particularly nitrogen and potassium. The presence of FYM improves microbial activity in the rhizosphere, which in turn supports better nutrient mineralization and enzymatic functions involved in carbohydrate metabolism. This promotes the accumulation of simple sugars (reducing sugars) in fruits. Close finding has been reported by Rodge and Yadlod (2009) and Kumaran *et al.* (1998) in tomato.

The maximum total sugars (2.21%) were found in $T_5$ (50% RDF + 50% FYM), and the minimum total sugars (1.31%) were found in $T_0$ (Control). The results indicate that the total sugars in fruits include both reducing and non-reducing sugars, and their accumulation is directly related to the availability of assimilates, proper nutrient balance (especially nitrogen and potassium) and efficient translocation processes. The Lane and Eynon method was used to estimate sugar content (Ranganna, 2001). FYM improves soil structure, microbial activity, and enzymatic functions, which support the breakdown of complex carbohydrates into simple sugars, boosting the total sugar concentration in the fruit. Similar findings have been reported by Kumaran *et al.* (1998) and Rodge and Yadlod (2009) in tomato.

The maximum non-reducing sugar (1.78%) were found in $T_5$ 50% RDF + 50% FYM) and the minimum non-reducing sugars (1.10%) were found in $T_0$ (Control). The result indicates that the application of 50% RDF combined with 50% Farm Yard Manure (FYM) provides a well-balanced and sustained nutrient supply. This biochemical transformation is driven by enzymes like sucrose-phosphate synthase, whose activity is stimulated by improved nutrient availability and overall plant vigour. The addition of FYM enhances microbial activity and enzyme functions in the root zone, promoting the conversion of reducing sugars into non-reducing sugars such as sucrose. Close findings have been reported by Kumaran *et al.* (1998) and Irshad (2011) in tomato.

The maximum Vitamin C (13.29 mg/100 g) was found in $T_5$ (50% RDF + 50% FYM), and the minimum Vitamin C (2.83 mg/100 g) was found in $T_0$ (Control). The procedure used for estimation is the 2,6-Dichlorophenol Indophenol (DCPIP) Titrimetric Method, also commonly referred to as the Visual Titration Method or the A.O.A.C. Official Method (1975) The results indicate that the balanced nutrient supply from both RDF and FYM enhances plant metabolic activity and fruit quality. FYM improves soil structure, microbial activity, and micronutrient availability (eg., Fe, Zn, Mn), all of which support ascorbic acid synthesis. RDF ensures quick access to essential macronutrients. Together, these inputs reduce plant stress, boost photosynthesis and create optimal conditions for Vitamin C accumulation in fruits. Similar findings have been reported by Irshad (2011) and Kipkosgel *et al*. (2003) in tomato.

## Conclusion

Based on the present investigation, it is concluded that among the treatments, 100% RDF performed better in terms of growth parameters, and the combined application of 50% RDF + 50% FYM resulted in the best yield and quality of brinjal.

**Table 1:** Impact of organic manures and inorganic fertilizers on growth and yield parameters of brinjal (*Solanum melongena* L.) cv. Kashi Taru.

| Treatments | Plant height (cm) | | | No. of branches /plant | No. of leaves /plant | No. of flowers/ cluster | Fruit length (cm) | Fruit diameter (cm) | Fruit weight (g) | No. of fruit /plant | Fruit yield per plant (kg) | Fruit yield (kg/plot) | Fruit yield (q/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAT | 60 DAT | 90 DAT | | | | | | | | | | |
| $T_{0}$- Control | 15.34 | 31.37 | 49.87 | 9.06 | 37.81 | 1.56 | 12.53 | 2.12 | 80.53 | 7.03 | 0.80 | 6.25 | 174.84 |
| $T_{1}$- 100% Recommended dose of fertilizer (RDF) | 23.77 | 45.70 | 71.14 | 15.49 | 57.85 | 1.93 | 17.46 | 2.64 | 89.84 | 9.10 | 0.97 | 9.05 | 309.18 |
| $T_{2}$- 100% Farm Yard Manure | 17.84 | 37.23 | 57.29 | 10.76 | 44.26 | 1.84 | 16.50 | 2.53 | 86.20 | 8.49 | 0.91 | 8.41 | 276.18 |
| $T_{3}$- 100% Vermicompost | 16.92 | 35.80 | 54.70 | 10.18 | 41.92 | 1.75 | 15.42 | 2.43 | 84.83 | 8.01 | 0.87 | 7.22 | 222.93 |
| $T_{4}$- 100% Poultry Manure | 16.14 | 33.92 | 51.99 | 9.64 | 41.16 | 1.64 | 13.88 | 2.32 | 82.14 | 7.54 | 0.83 | 6.60 | 196.21 |
| $T_{5}$- 50% RDF + 50% FYM | 22.88 | 44.63 | 69.18 | 14.75 | 56.34 | 2.58 | 25.61 | 3.41 | 105.68 | 12.07 | 1.32 | 12.45 | 549.87 |
| $T_{6}$- 50% RDF + 50% Vermicompost | 22.07 | 43.56 | 67.70 | 14.12 | 54.33 | 2.44 | 23.46 | 3.28 | 103.41 | 11.53 | 1.29 | 11.89 | 503.39 |
| $T_{7}$- 50% RDF + 50% Poultry Manure | 21.18 | 42.53 | 65.80 | 13.33 | 52.17 | 2.36 | 22.41 | 3.18 | 101.34 | 11.02 | 1.25 | 11.36 | 479.16 |
| $T_{8}$- 50% FYM+ 50% Vermicompost | 20.21 | 41.38 | 63.92 | 12.66 | 50.65 | 2.27 | 21.42 | 2.99 | 98.08 | 10.50 | 1.12 | 10.78 | 431.93 |
| $T_{9}$- 50% FYM + 50% Poultry Manure | 19.43 | 40.34 | 61.65 | 12.01 | 47.79 | 2.13 | 20.22 | 2.89 | 95.80 | 10.09 | 1.06 | 10.20 | 391.79 |
| $T_{10}$- 50% Vermicompost +50% Poultry Manure | 18.66 | 39.18 | 59.15 | 11.34 | 45.52 | 2.02 | 18.65 | 2.75 | 92.34 | 9.51 | 1.02 | 9.64 | 356.64 |
| **SE(m)** | **0.23** | **0.33** | **0.33** | **0.06** | **0.20** | **0.02** | **0.12** | **0.02** | **0.37** | **0.12** | **0.01** | **0.06** | **0.65** |
| **CD $_{5\%}$** | **0.70** | **0.99** | **1.00** | **0.19** | **0.61** | **0.08** | **0.36** | **0.08** | **1.10** | **0.36** | **0.02** | **0.20** | **1.94** |

**Table 2:** Impact of organic manures and inorganic fertilizers on fruit quality parameters of brinjal (*Solanum melongena* L.) cv. Kashi Taru

| Treatments | Total Soluble Solids ($^{0}$B) | Reducing sugar (%) | Total sugars (%) | Non-Reducing sugar (%) | Vitamin C (mg/100g) |
|---|---|---|---|---|---|
| $T_{0}$- Control | 4.01 | 0.21 | 1.31 | 1.100 | 2.83 |
| $T_{1}$- 100% Recommended dose of fertilizer (RDF) | 4.31 | 0.27 | 1.77 | 1.497 | 6.14 |
| $T_{2}$- 100% Farm Yard Manure | 4.23 | 0.26 | 1.62 | 1.360 | 5.38 |
| $T_{3}$- 100% Vermicompost | 4.15 | 0.25 | 1.54 | 1.290 | 4.49 |
| $T_{4}$- 100% Poultry Manure | 4.08 | 0.23 | 1.41 | 1.180 | 3.64 |
| $T_{5}$- 50% RDF + 50% FYM | 4.75 | 0.42 | 2.21 | 1.787 | 13.29 |
| $T_{6}$- 50% RDF + 50% Vermicompost | 4.68 | 0.39 | 2.14 | 1.750 | 11.43 |
| $T_{7}$- 50% RDF + 50% Poultry Manure | 4.61 | 0.36 | 2.07 | 1.710 | 9.51 |
| $T_{8}$- 50% FYM+ 50% Vermicompost | 4.53 | 0.34 | 2.00 | 1.657 | 8.62 |
| $T_{9}$- 50% FYM + 50% Poultry Manure | 4.45 | 0.31 | 1.93 | 1.620 | 7.88 |
| $T_{10}$- 50% Vermicompost +50% Poultry Manure | 4.38 | 0.28 | 1.85 | 1.570 | 7.01 |
| **SE(m)** | **0.02** | **0.01** | **0.02** | **0.01** | **0.11** |
| **CD $_{5\%}$** | **0.06** | **0.03** | **0.06** | **0.05** | **0.34** |

## Graphical Representations of the Impact of Organic Manures and Inorganic Fertilizers on Growth, Yield and Fruit Quality Parameters of Brinjal (*Solanum melongena* L.) cv. Kashi Taru

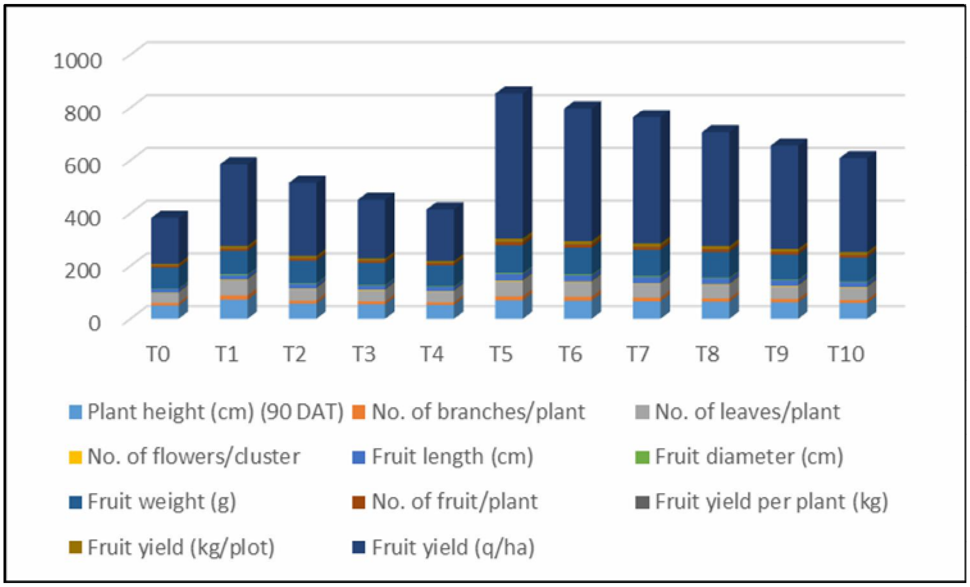


**Fig. 1 :** Graphical Representation of the Impact of Organic Manures and Inorganic Fertilizers on Growth and Yield Parameters of Brinjal (*Solanum melongena* L.) cv. Kashi Taru

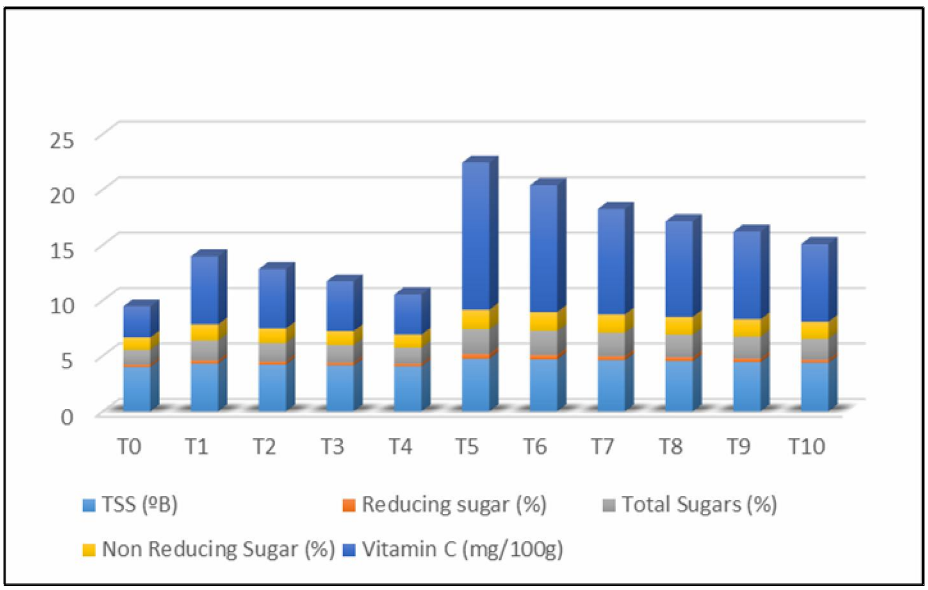


**Fig. 2 :** Graphical Representation of the Impact of Organic Manures and Inorganic Fertilizers on Fruit Quality Parameters of Brinjal (*Solanum melongena* L.) cv. Kashi Taru

## Competing Interests

The authors have declared that no competing interests exist.

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