**Cost-Benefit Analysis of Various Treatments for White Brinjal (*Solanum melongena* L.) cv. Hybrid Snow Ball in the Bundelkhand Region**

## ABSTRACT

The present experiment was design and optimized under Randomized block design with three replication *Rabi* Season (2022-2023) brinjal variety Hybrid snow ball (white) **Cropping Season:** Rabi Season (2022-2023). Brinjal variety Hybrid Snow Ball (White) was **designed** under Randomized Block Design (R.B.D.) with three replication and 8 treatments of **Spacing (Row × Plant):** 60 cm × 45 cm with **Net Plot Size (Length × Width):** 2.7 meters × 3.0 meters**, Irrigation Channel Size:** 50 cm, **Bund Size:** 30 cm with **total Net Area of Experimental Field:** 24.3 meters × 9 meters. The economic evaluation of different treatments for White Brinjal (*Solanum melongena* L.) Cv. Hybrid Snow Ball was conducted in the Bundelkhand region, focusing on cost of cultivation, gross return, net return, and benefit-cost ratio. The analysis revealed that the highest cost of cultivation was recorded in treatment T2 (100% vermicompost + jeevamrit) at Rs 178,150 ha-1, while the lowest cost was observed in treatment T1 (100% Farmyard Manure + jeevamrit) at Rs 106,150 ha-1. Gross returns were highest in treatment T7 (33% FYM + 33% P.M. + 33% V.C. + jeevamrit) at Rs 570,000 ha-1, with the minimum return in treatment T1 (100% Farmyard Manure + jeevamrit) at Rs 390,000 ha-1. Net returns followed a similar trend, with the highest returns of Rs 427,900 ha-1 in treatment T7 and the lowest at Rs 283,850 ha-1 in T1. The benefit-cost ratio was also highest in treatment T7 (3.01), followed by T3 (100% Poultry Manure + jeevamrit) at 2.87, while the control treatment (T0) had the lowest ratio of 1.78. The study concludes that integrated nutrient management, particularly T7, offers the best economic outcomes for White Brinjal cultivation in the Bundelkhand region.

**Keywords:** Brinjal, Hybrid, Jeevamrit, Morphological, Organic and Snow Ball.

**INTRODUCTION**

Brinjal, or Solanum melongena L., is a member of the Solanaceae family, which includes other well-known plants like tomatoes, potatoes, and peppers [2]. While typically grown as an annual crop, it is technically a herbaceous perennial. The plant blooms striking, star-shaped flowers, ranging in color from white to lavender or purple, with a yellow center, and clusters at the branch tips. Its chromosomal number is 2n = 24, indicating it has 24 paired chromosomes per somatic cell, a typical feature of many cultivated plants Hui-Lian *et al.*(2024). Brinjal is low in calories and fats, making it suitable for weight management. It's a good source of dietary fiber that aids digestion and promotes satiety Hazra*,* (2023) and Krishnaveni *et al.*(2023). Additionally, it contains essential vitamins, such as vitamin C for immune health and collagen production, and vitamin K for blood clotting and bone strength. High in potassium, brinjal helps maintain fluid balance and supports heart health. Rich in antioxidants like anthocyanins and chlorogenic acid, it protects the body from oxidative stress and inflammation Kalika *et al.*(2021) and Laily *et al.*(2021). Including brinjal in one's diet can significantly support overall well-being.

White brinjal, a variety of Solanum melongena L., offers the same health benefits as its purple counterpart Palia *et al.*(2021). It is low in calories and fat, making it a great choice for weight management. White brinjal also supports digestive health with its high fiber content, regulates blood sugar levels, and maintains heart health through its potassium content Nisar *et al.*(2025). In 2023, India’s brinjal production was estimated at 12.61 million metric tons, with major cultivation regions including Andhra Pradesh, Bihar, Karnataka, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh, and West Bengal. Brinjal accounts for approximately 8.14% of India's vegetable area and 9% of the total vegetable production. Globally, major producers include India, China, Egypt, Turkey, Iran, Indonesia, Iraq, Japan, Italy, the Philippines, and parts of Africa, with Asia dominating production, led by China (53%), India (28%), and Turkey (4%) Rangaiah *et al*.(2024).

Farmyard manure (FYM), a valuable organic fertilizer, consists of animal dung, urine, bedding, and leftover feed, rich in nitrogen (0.5-1.5%), phosphorus (0.2-0.4%), potassium (0.5-1.0%), calcium, magnesium, and sulfur. Poultry manure, depending on the type of poultry and its feed, contains about 1-2% nitrogen, 0.5-1% phosphorus, and 0.5-1% potassium. Vermicomposting, an efficient method of composting organic materials, produces high-quality compost faster than traditional methods and is odorless and pest-free. Jeevamrut, an organic liquid manure made from cow dung, cow urine, jaggery, and gram flour, is fermented for 5-7 days and serves as a nutrient-rich supplement for plants Rakibuzzaman *et al*.(2024).Organic farming presents multiple benefits, emphasizing sustainable practices by eliminating synthetic fertilizers, pesticides, and GMOs Sanni *et al*.(2016). It relies on methods such as crop rotation, composting, and biological pest control, reducing chemical pollution and improving soil fertility. Organic farming promotes soil health by nurturing beneficial organisms like bacteria, fungi, and earthworms, ensuring better nutrient availability and water retention. It also enhances biodiversity by conserving natural habitats and encouraging diverse crop planting. These practices also benefit pollinators and natural pest controllers Sultana *et al.* (2022) and Rathore *et al*. (2023) Additionally, organic farming offers health benefits by reducing chemical residues in food, providing a safer and more natural option for consumers. From an economic standpoint, organic farming can be financially rewarding, as organic products often fetch higher prices, and farmers can achieve self-sufficiency by utilizing natural pest control methods, composting, and diverse seed cultivation.

**MATERIAL AND METHODS**

The study was conducted at the Organic Research Farm, Karguan ji, Bundelkhand University, Jhansi (U.P.) from November 2022 to April 2023. Located at 25.45°N latitude, 78.61°E longitude, and 285 meters above sea level, the site has a sub-tropical climate and focuses on evaluating vegetative growth and yield parameters.

Jhansi has a semi-arid climate with hot summers (35°C to 45°C) and cool winters (5°C to 10°C). The monsoon lasts from July to September, with an average annual rainfall of 800 mm. Humidity is low year-round, and dust storms occur occasionally in summer.

Jhansi’s soil is significant for crop growth, with its unique properties influencing agricultural productivity. The soil's characteristics are essential in determining the success of various vegetation types in the region. The region is primarily covered by red soil, rich in iron oxide and aluminum, but has low fertility. Alluvial soils are also present along the Betwa and Dhasan riverbanks.The soil texture in Jhansi is mostly sandy loam to sandy clay loam, with good water retention. However, due to low organic matter, it can dry out quickly and lose fertility.

The present experiment was design and optimized under Randomized block design with three replication *Rabi* Season (2022-2023) brinjal variety Hybrid snow ball (white) **Cropping Season:** Rabi Season (2022-2023). Brinjal variety Hybrid Snow Ball (White) was **designed** under Randomized Block Design (R.B.D.) with three replication and 8 treatments *viz*., **T0**: Control – Water spray only, **T1**: 100% Farmyard Manure + Jeevamrit, **T2**: 100% Vermicompost + Jeevamrit, **T3**: 100% Poultry Manure + Jeevamrit, **T4**: 50% Farmyard Manure + 50% Vermicompost + Jeevamrit, **T5**: 50% Farmyard Manure + 50% Poultry Manure + Jeevamrit, **T6**: 50% Poultry Manure + 50% Vermicompost + Jeevamrit, **T7**: 33% Farmyard Manure + 33% Poultry Manure + 33% Vermicompost + Jeevamrit. The **Spacing (Row × Plant):** 60 cm × 45 cm with **Net Plot Size (Length × Width):** 2.7 meters × 3.0 meters, **Irrigation Channel Size:** 50 cm, **Bund Size:** 30 cm with **total Net Area of Experimental Field:** 24.3 meters × 9 meters.

**RESULTS AND DISCUSSION**

Economics of all treatments were calculated according to the expenditure occurred from then nursery raising till harvesting of fruits *viz*., Cost of cultivation, gross return, net return, and benefit: cost ratio has been worked out and presented in table 1. Maximum cost of cultivation was recorded in treatment T2 (100% vermicompost + jeevamrit) with (Rs 1,78,150 ha-1) and the minimum (Rs 1,06,150 ha-1) was recorded in treatment T1 (100% Farmyard Manure + jeevamrit) followed by T0 (control) with Rs. 80,650 ha-1. Similar result have been reported by Elayaraja *et al*. (2023), Gao *et al*. (2023) and Arun *et al*. (2024). Maximum gross return was recorded in treatment T7 (33% FYM + 33% P.M. + 33% V.C. + jeevamrit) with (Rs 5,70,000 ha-1) and the minimum (Rs 3,90,000 ha-1) was recorded in treatment T1 (100% Farmyard manure + jeevamrit) followed by T0 (control) with Rs. 2,25,000 ha-1. The present result have been consistent with the findings of [6,8,9,12]. Maximum net return was recorded in treatment T7 (33% FYM + 33% P.M. + 33% V.C. + jeevamrit) with (Rs 4,27,900 ha-1) and the minimum (Rs 2,83,850 ha-1) was recorded in treatment T1 (100% Farmyard manure + jeevamrit) followed by T1 (control) with Rs. 1,44,350 ha-1. The present result have been incorporated by [7,10,13,15].Maximum benefit cost was recorded in treatment T7 (33% FYM + 33% P.M. + 33% V.C. + jeevamrit) with 3.01 followed by T3 (100% Poultry Manure + jeevamrit) with 2.87 and the minimum (1.78) was recorded in treatment T0 (control).The present result is in agreements with that of with the findings of Turhan *et al.* (2021), Ujjwal *et al.*(2022), Shukla *et al.* (2023), Shubham *et al.*(2025).

**CONCLUSION**

The economic evaluation of various treatments for White Brinjal cultivation, from nursery raising to fruit harvesting, provides valuable insights into the financial outcomes of each treatment. Among the treatments analyzed, treatment T2 (100% vermicompost + jeevamrit) incurred the highest cost of cultivation (Rs 1,78,150 ha-1), while treatment T1 (100% Farmyard Manure + jeevamrit) recorded the lowest cost (Rs 1,06,150 ha-1). In terms of gross returns, treatment T7 (33% FYM + 33% P.M. + 33% V.C. + jeevamrit) yielded the highest return (Rs 5,70,000 ha-1), while T1 (100% Farmyard Manure + jeevamrit) produced the least (Rs 3,90,000 ha-1). Net returns followed a similar pattern, with T7 generating the highest net return (Rs 4,27,900 ha-1) and T1 showing the lowest net return (Rs 2,83,850 ha-1). Furthermore, the benefit-cost ratio was highest for treatment T7 (3.01), demonstrating the most favorable economic efficiency, followed by treatment T3 (100% Poultry Manure + jeevamrit) with a ratio of 2.87. In contrast, the control treatment (T0) had the lowest benefit-cost ratio (1.78). These findings indicate that integrated nutrient management, particularly the combination of FYM, poultry manure, vermicompost, and jeevamrit (T7), offers the most economically beneficial approach for White Brinjal cultivation in the Bundelkhand region. Therefore, adopting treatment T7 can lead to better profitability, making it the most viable option for farmers aiming to maximize both yield and return on investment.

**FUTURE SCOPE**

Future research could explore the long-term effects of these organic treatments on brinjal yield and soil health. Further studies could also evaluate the environmental impact of various organic fertilizers and investigate optimal combinations for different regions. Additionally, similar experiments could be conducted on other vegetable crops to assess the broader applicability of these organic practices. Exploring the economic viability and scalability of such treatments could be beneficial for promoting sustainable farming practices.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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**Table 1: Cost of cultivation of brinjal (fixed cost for all the treatment) per hectare**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sr No. | Particulars | Unit | Unit rate(Rs.) | Cost of cultivation (Rs.) |
| **A.** | **Land preparation** |  |  |  |
|  | Ploughing and harrowing | 6 hours | 850/ hour | 5,100 |
|  | Layout preparation | 8 labors | 350/labor | 2,800 |
|  | Planting | 12 labors | 350/labor | 4,200 |
|  | Gap filling | 4 labors | 350/labor | 1,400 |
|  | Manure application | 15 labors | 350/labor | 5,250 |
| **B.** | **Seed** |  |  |  |
|  | Cost of seed | 300 g | 3.5/g | 1,050 |
| **C.** | **Intercultural operations** |  |  |  |
|  | Weeding | 12 labors | 350/labor | 4,200 |
|  | Spraying | 5 labors | 350/labor | 1,750 |
|  | Insecticide and pesticide | 6 liter | 650/liter | 3,900 |
| **D.** | **Irrigation** |  |  |  |
|  | Irrigation | 15 irrigation | 300/irrigation | 4,500 |
|  | Tube well charge |  |  | 3,000 |
| **E.** | **Harvesting** | 32 labor | 350/ labor | 11,200 |
|  | Transportation |  |  | 10,000 |
|  | Supervision charge |  |  | 12,600 |
|  | Rental value | 4 months | 1800/month | 7,200 |
|  | Miscellaneous |  |  | 2,500 |
|  | **Total** |  |  | **80,650** |

**Table 2: Variable costs of different treatments of brinjal.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Treatments | Amount required (hac-1) | Costing per material (Rs.) | Total variable (Rs.) | Fixed cost (Rs.) | Total cost (Rs.) |
| T1 | 100% farmyard manure + jeevamrit | 24 t. + 500 l. | 24000 + 1500 | 25,500 | 80,650 | 1,06150 |
| T2 | 100% vermicompost + jeevamrit | 6 t. + 500 l. | 96000 + 1500 | 97,500 | 80,650 | 1,78,150 |
| T3 | 100% poultry manure + jeevamrit | 4 t. + 500 l. | 60000 + 1500 | 65,500 | 80,650 | 1,46,150 |
| T4 | 50% FYM + 50% V.C.+ jeevamrit | 12 t. + 3 t. + 500 l. | 12000 + 48000 + 1500 | 61,500 | 80,650 | 1,42,150 |
| T5 | 50% FYM + 50% P.M. + jeevamrit | 12 t. + 2 t. + 500 l. | 12000 + 30000 + 1500 | 43,500 | 80,650 | 1,24,150 |
| T6 | 50% P.M. + 50% V.C. + jeevamrit | 2 t. + 3 t. + 500 l. | 30000 + 48000 + 1500 | 79,500 | 80,650 | 1,60,150 |
| T7 | 33% FYM + 33% V.C. + 33% P.M. + jeevamrit | 8 t. + 2 t. + 1.33 t. + 500 l. | 8000 + 32000 + 19950 + 1500 | 61,450 | 80,650 | 1,42,100 |
| T0 | Control | …… | 00 | 00 | 80,650 | 80,650 |

Cost of farmyard manure : Rs. 1000/t.

Cost of poultry manure : Rs. 15000/t.

Cost of vermi compost : Rs. 16000/t.

Cost of jeevamrit making : Rs. 1500/500 l.

**Table-3. Benefit cost ratio different treatments of brinjal.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatment | Fruit yield (q/ha) | Gross return (Rs.) | Net return (Rs.) | B:C Ratio |
| T1 | 100% farmyard manure + jeevamrit | 260 | 39,0000 | 2,83,850 | 2.67 |
| T2 | 100% vermicompost + jeevamrit | 340 | 51,0000 | 3,31,850 | 1.86 |
| T3 | 100% poultry manure + jeevamrit | 378 | 5,67,000 |  4,20,850 | 2.87 |
| T4 | 50% FYM + 50% V.C.+ jeevamrit | 320 | 4,80,000 | 3,37,850 | 2.37 |
| T5 | 50% FYM + 50% P.M. + jeevamrit | 315 | 4,72,500 | 3,48,350 | 2.80 |
| T6 | 50% P.M. + 50% V.C. + jeevamrit | 360 | 5,40000 | 3,79,850 | 2.37 |
| T7 | 33% FYM + 33% V.C. + 33% P.M. + jeevamrit | 380 | 5,70000 | 4,27,900 | 3.01 |
| T0 | Control | 150 | 22,5000 | 1,44,350 | 1.78 |

Rate of per kg white brinjal : Rs. 15