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Evaluation of Optimum Doses of Nitrogen in Relation to Yield and Quality of Brinjal (*Solanum melongena* L.) in Balaghat Region of Madhya Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study aimed to investigate the impact of varying nitrogen levels on the growth and yield of the brinjal variety Pusa Purple Long. The research was conducted at the Horticulture Department's field within the School of Agriculture Science, Technology and Research at Sardar Patel University, Balaghat, Madhya Pradesh, during the *Rabi* season of 2023. The experiment utilised a Randomised Block Design (RBD) featuring eight treatments, each replicated three times. The treatment combinations consisted of different doses of nitrogen. The findings indicated that T8 (N at 230 kg/ha, P at 150 kg/ha, K at 100 kg/ha) significantly enhanced vegetative growth (including plant height and number of branches per plant) and yield attributes (such as number of fruits per plant, fruit weight, and overall fruit yield). Additionally, T8 yielded the highest net returns and one of the most favorable benefit-cost ratios. Therefore, the integrated application of nutrients is recommended to boost crop productivity and improve the overall performance of brinjal in the Balaghat region of Madhya Pradesh.

Keywords: Brinjal; DAP; urea; nitrogen; benefit cost ratio.

1. INTRODUCTION

Brinjal also called Eggplant or Aubergine in French, is botanically known as *Solanum elongena* (L.). It belongs to the family Solanaceae bearing chromosome number 2n=2X=24 (Choudhary, 2013). It originated from India (Zeven and Zhukovsky, 1975). The brinjal plants typically grow to 1–3 meters (3–10 ft) in height and have a weak stem that often sprawls over the ground and vines over other plants. Brinjal flowers are large, violet coloured and solitary or in clusters of two or more. Flower consists of calyx: sepals 5, united, persistent; corolla: petals 5, united, usually cup-shaped; Androecium: stamens 5, alternate with corolla; Gynoecium: carpels are united, ovary superior. The hypogynous gynoecium is syncarp located obliquely in relation to the median. Aubergine plays a major role in human nutrition. The fruit contain high nutritive value constituting high amount of carbohydrates (6.4%), protein (1.3%), fat (0.3%), calcium (0.02%), phosphorus (0.02%), iron (0.0013%) and other mineral matters. Apart from this, it also contains B-carotene (34 mg), riboflavin (0.05 mg), thiamine (0.05 mg), niacin (0.5 mg) and ascorbic acid (0.9 mg) per 100 g fruit (Choudhary, 2013). Brinjal has valuable vitamins and de-cholesterol zing agent due to presence of poly-unsaturated fatty acids (Linoleic and Linolenic acid) present in 65.1% of pulp and its seeds. Glycoalkaloids of brinjal range from 0.37 mg/100 gm of fruits in the Indian commercial cultivars. Brinjal is a warm-season crop. The best fruit colour and quality is obtained at a temperature range of 13-21°C. Brinjal contribute to a healthy, well-balanced diet. They are rich in minerals, vitamins, essential amino acids, sugars, dietary fibres, and it has many other uses tomato seed contain 24% oil is used as salad oil and in the manufacture of margarine. It has also been recommended as an excellent remedy for those suffering from liver complaints and used in the treatment of diabetes, asthma, cholera, bronchitis and diarrhoea, its fruits and leaves are reported to lower blood cholesterol levels (Lawande and Chavan, 2000). The higher phenolic content with high free radical scavenging properties makes brinjal a potential candidate for cancer treatments. Additionally, the roots of brinjal plant also have anti-asthmatic properties and leaves are used externally for the treatment of burns, cold sores, and abscesses. The area under brinjal production in India accounts to 7.62 lakh hectare with production of 11.15 million metric tonnes in the year 2021-22. West Bengal ranks first in area and production of brinjal in the year 2021-22 followed by Odisha, Gujarat, and Bihar. In the Uttar Pradesh area under production is 6.20 lakhs hectares while production is estimated to be 31.29 million metric tonnes for year 2021-22. (NHB, 2022.). Nitrogen is a crucial nutrient for plant physiology, enhancing photosynthetic efficiency and increasing yields. While moderate nitrogen application boosts flower production, excessive nitrogen can lead to reduced flower and fruit production and smaller fruit size. Higher nitrogen levels also result in increased plant height due to enhanced cell division and elongation (Shahi et al*.,* 2021). Nitrogen (N) is essential for vegetables but often limited in tropical soils. It is vital for synthesising amino acids, which form proteins, and for chlorophyll production and photosynthesis. As a primary nutrient, nitrogen is crucial for improving crop yield and growth (Aminifard et al*.,* 2010). Nitrogen is one of the key macronutrients required for plant growth, development, and yield (Jilani et al*.,* 2009). It is a major component of amino acids in proteins and lipids, which are essential for chloroplast function. Brinjal productivity is particularly responsive to nitrogen fertilisation. Pal et al*.* (2002) found that brinjal fruit yield increased with nitrogen application up to 187.5 kg N/ha. However, Rahman et al*.,* (2018) observed that higher nitrogen levels delayed flowering and extended the time to fruit setting. Additionally, nitrogen fertiliser affects various aspects of brinjal, including seed number, fruit pH, crude protein, total solids, and ascorbic acid content, with deficiencies leading to poorer physical and chemical properties (Akanbi et al*.,* 2007). Examining the impact of varying nitrogen concentrations on brinjal growth and yield entails manipulating nitrogen application rates to identify the optimal dosage for maximizing crop productivity. Nitrogen, an indispensable nutrient, plays a pivotal role in plant development, notably influencing vegetative growth, fruit formation, and overall yield in brinjal. By testing different nitrogen levels, researchers can pinpoint the threshold at which nitrogen optimally enhances yield without leading to detrimental effects such as excessive vegetative growth or nutrient imbalances. This methodical experimentation reveals insights into nutrient uptake, photosynthetic efficiency, and metabolic pathways within brinjal plants. Such research identifies the ideal nitrogen level that fosters balanced vegetative development while boosting fruit quality and yield. Additionally, these studies provide crucial data for agricultural practices, offering guidance on effective nitrogen management to achieve sustainable brinjal production. Understanding these dynamics is vital not only for optimizing yield and economic returns but also for mitigating environmental impacts linked to nitrogen runoff and greenhouse gas emissions. Consequently, exploring diverse nitrogen levels in brinjal cultivation refines agricultural methodologies, enhances resource efficiency, and supports sustainable food production systems.

2. MATERIALS AND METHODS

The present investigation was done to understand the effect of different levels of nitrogen on fruit growth and yield of the brinjal variety Pusa Purple cluster. The details of the materials used, and the procedures adopted in the investigation, which was carried out at Field of Horticulture Department, School of Agriculture Research and Technology, Sardar Patel University, Balaghat, (M.P.) during the *Rabi* season of 2023. Balaghat district is located the south-eastern portion of the Satpura Range and the upper valley of the Wainganga River. The district extends from 21°19’ to 22°24’ north latitude and 79°31’ to 81°30’ east longitude. The treatments were T_1 (Control); T_2 (N at 170 kg/ha, P at 150 kg/ha, K at 100 kg/ha); T_3 (N at 180 kg/ha, P at 150 kg/ha, K at 100 kg/ha); T_4 (N at 190 kg/ha, P at 150 kg/ha, K at 100 kg/ha); T_5 (RDF at 200:150:100 kg NPK/ha); T_6 (N at 210 kg/ha, P at 150 kg/ha, K at 100 kg/ha); T_7 (N at 220 kg/ha, P at 150 kg/ha, K at 100 kg/ha); and T_8 (N at 230 kg/ha, P at 150 kg/ha, K at 100 kg/ha). At 30, 60, and 90 DAT (days after transplanting) and the harvest stage, the height of five randomly chosen grafted plants from each plot was measured in centimetres using a metre scale from ground level to the tip of the shoot. At the harvest stage, the number of branches on randomly chosen plants from each plot was counted. In experimental plots, the number of days from transplanting to 50% flowering was recorded as days to 50% flowering. For each treatment and replication, the number of flower fruits that set on the plant was counted and recorded as the number of fruits per plant. Ten fruits were randomly selected from each plant and weighed both treatment-wise and replication-wise. This was done for randomly selected five plants for data recording. The yield was calculated by weighing the total fruit yield per plot. The readings for all the harvest per plot were recorded. The statistical analysis was conducted using Fisher and Yates (1967).

3. RESULTS AND DISCUSSION

3.1 Plant Height

The maximum plant height (27.76, 37.38 and 57.67 cm) at 30, 60 and 90 DAT respectively were observed with treatment T_8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) followed by T_6 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) with 26.52, 35.09 and 55.15 cm at 30, 60 and 90 DAT respectively. Minimum height of plant (20.05, 29.51 and 48.68 cm) was observed in T_1 (control) at 30, 60 and 90 DAT respectively. The better plant height of brinjal observed in the treatment with higher nitrogen levels (N @ 230 kg/ha, P @ 150 kg/ha, K @ 100 kg/ha) compared to the recommended dose of fertilizer (RDF) (200:150:100 kg NPK/ha) can be attributed to the enhanced availability of nitrogen. Nitrogen is a critical macronutrient that significantly influences vegetative growth by promoting cell division and elongation. The increased nitrogen supply likely resulted in more vigorous stem and leaf development, leading to greater plant height. Additionally, optimal phosphorus and potassium levels in both treatments ensured balanced nutrient uptake, but the additional nitrogen in the 230 kg/ha treatment provided a further boost to overall growth and height. Findings were in accordance with conclusions by Sajiv et al., (2020) who found that optimizing nitrogen and potassium levels significantly enhanced the yield of brinjal grown under soil-less culture conditions. Among the different media tested, those enriched with balanced N and K combinations supported better plant growth, fruit development, and overall productivity. The results emphasized the importance of maintaining appropriate nutrient concentrations in soilless systems to improve nutrient uptake and yield efficiency. Media that provided good aeration and moisture retention, along with the right nutrient supply, were found to be most effective. These findings suggest that carefully managed nutrient regimes and media selection can play a critical role in improving brinjal production in controlled, soil-free environments.

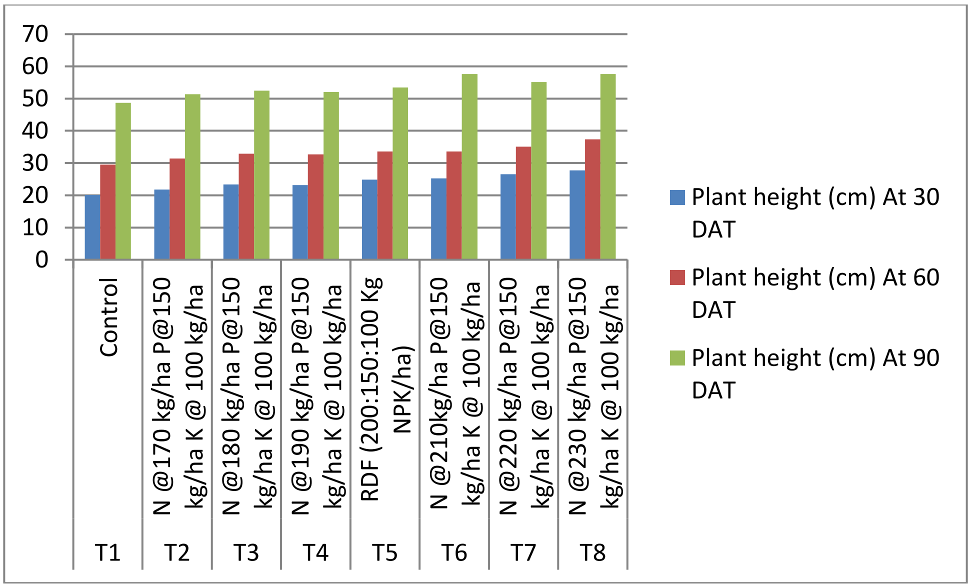

Fig. 1. Effect of different levels of nitrogen on plant height of brinjal

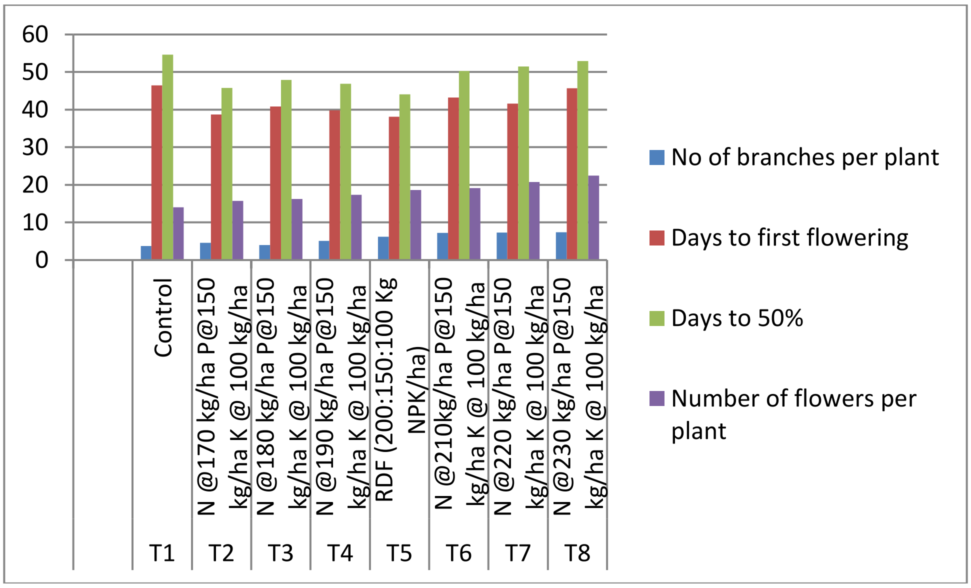

Fig. 2. Effect of different levels of nitrogen on Number of branches and flowers in brinjal

Table 1. Effect of different levels of nitrogen on growth and phenological parameters of brinjal

Treatment Symbols	Treatment combination	Plant height (cm)			No of branches per plant	Days to first flowering	Days to 50% flowering	Number of flowers per plant
		At 30 DAT	At 60 DAT	At 90 DAT				
T_1	Control	20.05	29.51	48.68	3.76	46.44	54.67	14.06
T_2	N @170 kg/ha P@150 kg/ha K @ 100 kg/ha	21.79	31.41	51.35	4.60	38.75	45.81	15.75
T_3	N @180 kg/ha P@150 kg/ha K @ 100 kg/ha	23.39	32.87	52.43	3.97	40.83	47.89	16.22
T_4	N @190 kg/ha P@150 kg/ha K @ 100 kg/ha	23.18	32.74	52.10	5.06	39.85	46.90	17.40
T_5	RDF (200:150:100 Kg NPK/ha)	24.85	33.62	53.46	6.19	38.15	44.09	18.62
T_6	N @210kg/ha P@150 kg/ha K @ 100 kg/ha	25.22	33.62	57.67	7.19	43.21	50.26	19.12
T_7	N @220 kg/ha P@150 kg/ha K @ 100 kg/ha	26.52	35.09	55.15	7.28	41.65	51.53	20.79
T_8	N @230 kg/ha P@150 kg/ha K @ 100 kg/ha	27.76	37.38	57.67	7.44	45.66	52.93	22.43
$CD_{0.05}$		1.95	2.57	2.04	0.64	1.99	2.56	2.67
SE. m (±)		0.65	0.86	0.68	0.21	0.66	0.86	0.89

Table 2. Effect of different levels of nitrogen on yield and quality parameters of brinjal

Treatment Symbols	Treatment combination	No of fruits per plant	Fruit weight (g)	Fruit yield per plant (kg/plant)	Fruit yield per plot (kg/plot)	Fruit yield per hectare (t/ha)	Total Soluble solids [°Brix]
T1	Control	5.27	182.13	0.96	8.04	10.90	3.90
T2	N @170 kg/ha P@150 kg/ha K @ 100 kg/ha	5.83	118.04	1.10	8.96	12.85	3.92
T3	N @180 kg/ha P@150 kg/ha K @ 100 kg/ha	6.36	191.32	1.22	9.81	13.39	4.25
T4	N @190 kg/ha P@150 kg/ha K @ 100 kg/ha	6.45	192.86	1.24	10.00	14.18	4.01
T5	RDF (200:150:100 Kg NPK/ha)	7.20	203.94	1.47	12.28	16.51	5.40
T6	N @210kg/ha P@150 kg/ha K @ 100 kg/ha	7.53	210.83	1.59	12.56	16.67	5.40
T7	N @220 kg/ha P@150 kg/ha K @ 100 kg/ha	8.13	212.48	1.73	13.79	17.81	4.50
T8	N @230 kg/ha P@150 kg/ha K @ 100 kg/ha	8.23	213.60	1.76	14.73	18.50	5.35
CD0.05		0.55	5.82	0.12	1.37	1.34	0.43
SE. m (±)		0.18	1.92	0.04	0.46	0.45	0.14

Table 3. Economics as influenced by different treatments applied in Brinjal

Treatment Symbols	Treatment combination	Cost of cultivation (Rs)	Gross return (Rs)	Net return (Rs)	BC ratio
T1	Control	146026	2,18,067	72,041	1.49
T2	N @170 kg/ha P@150 kg/ha K @ 100 kg/ha	147352	2,57,000	1,09,648	1.74
T3	N @180 kg/ha P@150 kg/ha K @ 100 kg/ha	147473	2,67,800	1,20,327	1.82
T4	N @190 kg/ha P@150 kg/ha K @ 100 kg/ha	147594	2,83,533	1,35,939	1.92
T5	RDF (200:150:100 Kg NPK/ha)	147715	3,30,267	1,82,552	2.24
T6	N @210kg/ha P@150 kg/ha K @ 100 kg/ha	147830	3,33,467	1,85,637	2.26
T7	N @220 kg/ha P@150 kg/ha K @ 100 kg/ha	147951	3,56,200	2,08,249	2.41
T8	N @230 kg/ha P@150 kg/ha K @ 100 kg/ha	148072	3,69,933	2,21,861	2.50
Selling price of brinjal: Rs 20/kg					

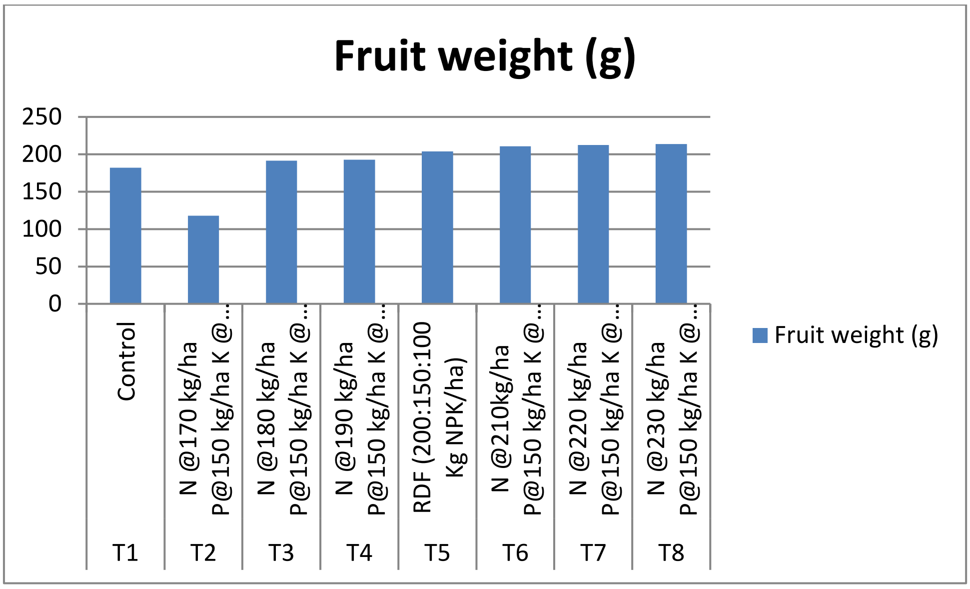

Fig. 3. Effect of different levels of nitrogen on fruit weight in brinjal

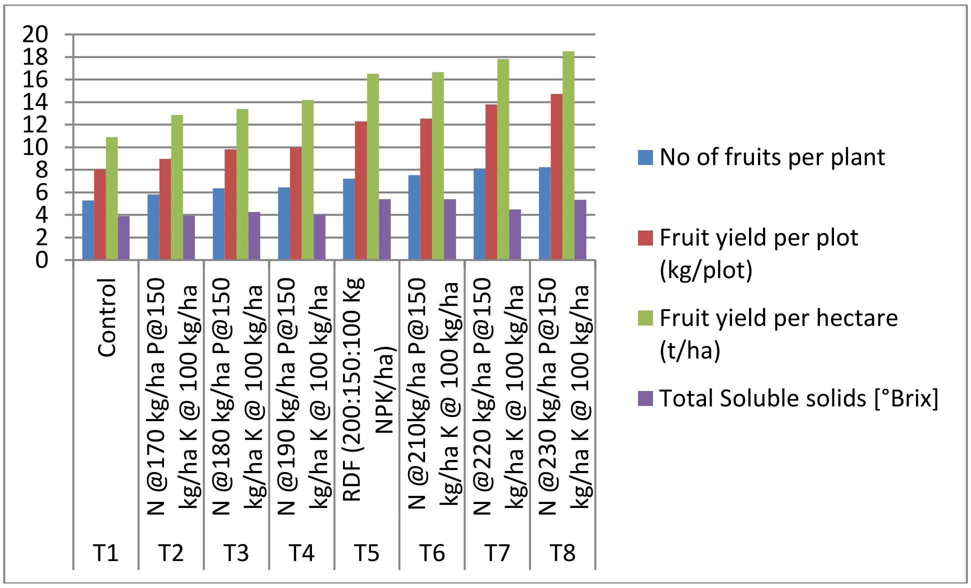

Fig. 4. Effect of different levels of nitrogen on fruit yield in brinjal

3.2 Number of Branches Per Plant

The maximum number of branches per plant (7.44 branches) was observed at the harvest stage with treatment T8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) followed by T7 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) with 7.28 branches. The minimum number of branches per plant (3.76 branches) was observed in T1 (control). The increased number of branches in brinjal observed under the treatment with higher nitrogen levels (N @ 230 kg/ha, P @ 150 kg/ha, K @ 100 kg/ha) compared to the recommended dose of fertilizer (RDF) (200:150:100 kg NPK/ha) can be primarily attributed to the elevated nitrogen availability. Nitrogen is crucial for promoting vegetative growth, including the development of lateral shoots and branches. The additional nitrogen in the 230 kg/ha treatment likely stimulated more robust meristem activity, leading to the formation of more branches. Furthermore, the balanced application of phosphorus and potassium provided a supportive environment for nutrient uptake and overall plant health, but the extra nitrogen specifically enhanced branching by encouraging shoot proliferation and reducing apical dominance, thus leading to a bushier plant structure. This is justified by the known role of nitrogen in promoting vegetative growth—it is a key component of amino acids, nucleic acids, and chlorophyll, which are essential for cell division and shoot development. Higher nitrogen availability often shifts plant hormonal balance, particularly by reducing auxin dominance at the apical meristem and enhancing cytokinin activity, both of which stimulate lateral bud outgrowth and result in bushier morphology. Phosphorus, on the other hand, plays a critical role in energy transfer (ATP) and root development, while potassium regulates enzyme activation, water balance, and stress tolerance, creating optimal conditions for nutrient mobility and utilization. The findings of Sajiv et al. (2020) confirmed that increased nitrogen and potassium levels in soilless media led to better vegetative growth and higher yields in brinjal, while Ihsan et al. (2023) reported similar trends in solanaceous crops, linking nitrogen enrichment to increased branching and canopy development. These studies collectively support the conclusion that targeted nitrogen enhancement, alongside balanced P and K, can significantly influence plant architecture and productivity.

3.3 Days to First Flowering and 50% Flowering

The minimum days to first flowering (38.75 days) was observed with treatment T_2 (N @170 kg/ha P@150 kg/ha K @ 100 kg/ha) followed by T_4 (N @200 kg/ha P@150 kg/ha K @ 100 kg/ha) with 39.85 days. Maximum days to first flowering (46.44 days) were observed in T_1 (control). The minimum days to 50% flowering (45.81 days) was observed with treatment T_2 (N @170 kg/ha P@150 kg/ha K @ 100 kg/ha) followed by T_4 (N @200 kg/ha P@150 kg/ha K @ 100 kg/ha) with 46.90 days. Maximum days to 50% flowering (54.67 days) were observed in T_1 (control). The earliness in flowering observed in brinjal under the treatment with lower nitrogen levels (N @ 170 kg/ha, P @ 150 kg/ha, K @ 100 kg/ha) compared to the recommended dose of fertilizer (RDF) (200:150:100 kg NPK/ha) can be attributed to the more moderated nitrogen supply. Nitrogen is essential for vegetative growth, but excessive nitrogen can delay flowering as the plant focuses on leaf and stem development. The reduced nitrogen level in the 170 kg/ha treatment likely shifted the plant's energy towards reproductive development, triggering earlier flowering. Additionally, the consistent levels of phosphorus and potassium supported the timely initiation of flowering, as these nutrients are critical for flower development and energy transfer within the plant. This balanced nutrient management allowed for quicker transition from vegetative to reproductive stages, promoting earlier flowering. Similar findings were reported by Ihsan et al*.,* (2023).

3.4 Number of Flowers and Fruits Per Plant

The maximum number of flowers per plant (22.43 flowers) was observed with treatment T_8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) followed by T_7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) with 20.79 flowers. The minimum number of flowers per plant (14.06 flowers) was observed in T_1 (control). The maximum number of fruits per plant (8.23 fruits) was observed with treatment T_8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) followed by T_7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) with 8.13 fruits. The minimum number of fruits per plant (5.27 fruits) was observed in T_1 (control). The higher number of flowers and, subsequently, more fruits in brinjal observed under the treatment with increased nitrogen levels (N @ 230 kg/ha, P @ 150 kg/ha, K @ 100 kg/ha) compared to the recommended dose of fertilizer (RDF) (200:150:100 kg NPK/ha) can be attributed to the enhanced vegetative growth and improved nutrient availability. The additional nitrogen in the 230 kg/ha treatment likely promoted more robust plant growth, resulting in greater biomass and a stronger overall plant structure, which can support a higher number of flowers. This increased flowering potential directly correlates with a higher fruit set. Furthermore, the balanced phosphorus and potassium levels ensured proper flower and fruit development, enhancing the plant's ability to convert flowers into fruits. The combination of optimal nutrient supply with the extra nitrogen contributed to better overall reproductive success, leading to more flowers and fruits. Similar findings were reported by Shahi et al*.,* (2021).

3.5 Fruit Weight and Fruit Yield

The maximum fruit weight (213.60 grams) was observed with treatment T_8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) followed by T_7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) with 212.48 grams. Minimum fruit weight (182.13 grams) was observed in T_1 (control). The maximum fruit yield per plant (1.76 kg/plant) was observed with treatment T8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) at par with T7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) with 1.73 kg/plant. Minimum fruit yield per plant (0.96 kg/plant) was observed in T1 (control). The maximum fruit yield per plot (14.73 kg/plot) was observed with treatment T8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) at par with T7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) with 13.79 kg/plot. Minimum fruit yield per plot (8.04 kg/plot) was observed in T1 (control). The maximum fruit yield per hectare (18.50 t/ha) was observed with treatment T8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) at par with T7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) with 17.81 t/ha. Minimum fruit yield per hectare (10.90 t/ha) was observed in T1 (control). The increased fruit weight and overall fruit yield of brinjal observed under the treatment with higher nitrogen levels (N @ 230 kg/ha, P @ 150 kg/ha, K @ 100 kg/ha) compared to the recommended dose of fertilizer (RDF) (200:150:100 kg NPK/ha) can be attributed to the enhanced vegetative growth and nutrient uptake facilitated by the additional nitrogen. Nitrogen plays a key role in cell division and enlargement, which contributes to the development of larger fruits with higher weight. The elevated nitrogen levels likely improved photosynthetic efficiency, leading to better carbohydrate accumulation in the fruits, thereby increasing their size and weight. Moreover, the balanced phosphorus and potassium levels supported optimal fruit development and nutrient translocation within the plant, ensuring that the increased nitrogen supply was effectively utilized for fruit growth. This combination of factors resulted in heavier fruits and a higher overall yield, as the plants were able to produce more and larger fruits compared to those treated with the recommended dose of fertilizer (RDF). While nitrogen is widely recognized for promoting vegetative growth, its role in enhancing fruit yield is linked to its indirect influence on reproductive success. Increased nitrogen availability leads to a more vigorous plant canopy with greater leaf area, thereby improving photosynthetic capacity and overall assimilate production. These additional carbohydrates and nutrients are crucial during fruit set and development, allowing plants to support more fruiting sites and supply enough energy for larger fruit formation. Moreover, a well-developed vegetative framework helps in prolonged flowering and better retention of fruits, contributing to both fruit number and size. Sajiv et al. (2020) observed that higher nitrogen and potassium levels in soilless media led not only to enhanced vegetative parameters but also to increased fruit yield and weight in brinjal. Similarly, Shahi et al. (2021) reported that nitrogen supplementation beyond RDF improved fruiting potential and yield in solanaceous crops by supporting a strong vegetative base that sustained reproductive growth. Therefore, although nitrogen is primarily a vegetative nutrient, its role in building plant infrastructure and supporting metabolic activity is foundational to high-yield outcomes when applied in balanced proportions.

3.6 Fruit TSS

The maximum total soluble solids (5.40 °Brix) were observed with both treatment T5 (RDF (200:150:100 Kg NPK/ha)) and T6 (N @210 kg/ha P@150 kg/ha K @ 100 kg/ha). Minimum total soluble solids (3.90 °Brix) were observed in T1 (Control). The Total Soluble Solids (TSS) content in brinjal fruits observed under the treatment with the recommended dose of fertilizer (RDF) (200:150:100 kg NPK/ha) compared to all other treatments can be attributed to the balanced nutrient availability, particularly the moderate nitrogen levels. While nitrogen is essential for vegetative growth, excessive nitrogen can dilute the concentration of sugars and other soluble solids in the fruit by promoting excessive vegetative growth. The RDF treatment provided an optimal balance between vegetative growth and fruit development, allowing the plant to allocate sufficient resources towards the synthesis and accumulation of sugars, acids, and other soluble compounds that contribute to TSS. Additionally, the adequate levels of phosphorus and potassium in the RDF treatment supported efficient energy transfer and metabolism, further enhancing the quality of the fruits. As a result, the fruits developed under RDF conditions likely had a more concentrated and favorable balance of soluble solids, leading to higher TSS values compared to other treatments with either higher or lower nitrogen levels. Similar findings were reported by Ihsan et al., (2023).

3.7 Economics Parameters

The maximum cost of cultivation incurred in treatment T8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) with (Rs 1,48,072 ha^{-1}) and the minimum (Rs 1,46,026 ha^{-1}) was recorded in treatment T1 (Control). Maximum gross returns were recorded in treatment T8 (N @230 kg/ha

P@150 kg/ha K @ 100 kg/ha) with (Rs 3,69,933 ha^{-1}) followed by T_7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) having Rs 3,56,200 ha^{-1} and the minimum (Rs 2,18,067 ha^{-1}) was recorded in treatment T_1 (Control). Maximum net returns were recorded in treatment T_8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) with (Rs 2,21,861 ha^{-1}) followed by T_7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) having Rs 2,08,249 ha^{-1} and the minimum (Rs 72,041 ha^{-1}) was recorded in treatment T_1 (Control). Maximum benefit-cost ratio was recorded in treatment T_8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) with (2.50) followed by T_7 (N @220 kg/ha P@150 kg/ha K @ 100 kg/ha) having 2.41 and the minimum (1.49) was recorded in treatment T_1 (control). Similar findings were reported by Shahi et al*.,* (2021).

4. CONCLUSION

The overall results obtained from this present investigation clearly revealed that the application of T_8 (N @230 kg/ha P@150 kg/ha K @ 100 kg/ha) showed the better performance for vegetative growth i.e., plant height of 57.67 cm at 90 DAT, number of branches per plant (7.44 branches), minimum days to 50% flowering (45.81 days), yield attributes like number of fruits per plant (8.23 fruits), fruit weight (213.60 grams), fruit yield (18.50 t/ha) of brinjal. T_8 also recorded maximum total soluble solids (5.40 °Brix) and the highest net return (Rs 2,21,861 ha^{-1}) and one of the best benefit-cost ratios of 2.50. Thus, nitrogen dose of 230 kg/ha may be suggested for higher crop productivity along with over all betterment of brinjal under Balaghat (M.P.) conditions.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

I hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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