THE INFLUENCE OF DIFFERENT NITROGEN LEVELS ON LOCAL EGGPLANT CULTIVAR

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Abstract

At the University of Agriculture Peshawar, a field experiment was done to determine the best nitrogen dosage for brinjal (*S. melongena*) growth and yield response. The experiment was set up using a randomised complete block design (RCBD) with four replications, and there were six different urea treatments: 0, 275, 300, 325, 350, and 375 kg ha^{-1}. The experimental soil had a sandy loam texture and had extremely poor fertility. The following parameters are measured: yield, fruit weight, fruit diameter, fruit length, number of fruit clusters plant^{-1}, and number of flower clusters plant^{-1}. The findings of the current investigation demonstrated that the greatest dose of urea applied had a beneficial, substantial impact on the development and reproductive characteristics of brinjal (*S. melongena*). Similar to this, urea application rates rose along with brinjal (*S. melongena*) yield and yield-contributing features. The application of 375 kg ha^{-1} urea produced the maximum yield (18.01 tonnes ha^{-1}), whereas the control treatment produced the lowest yield (10 tonnes ha^{-1}). Thus, according to the total study findings, the University of Agriculture, Peshawar's 375 kg ha^{-1} urea had the greatest performance. The study came to the conclusion that more research in various agro-ecological zones of Pakistan is required before a definite recommendation of the application dose can be made.

Keywords: brinjal, fertilizer, yield, urea

Introduction

Brinjal (Solanum melongena L.), commonly known as eggplant, is a popular vegetable crop cultivated worldwide for its culinary and nutritional value. Nitrogen (N) is one of the essential nutrients required for the growth and development of brinjal plants. Adequate nitrogen management plays a pivotal role in optimizing crop productivity and achieving higher yields. However, improper or excessive nitrogen application can lead to various adverse effects, such as increased susceptibility to diseases, environmental pollution through nitrogen leaching, and reduced fruit quality. Therefore, optimizing the nitrogen requirement for brinjal cultivation is crucial to ensure sustainable and profitable production (Dua et al., 2014). Optimizing nitrogen management involves strategies that aim to provide the plant with an adequate and balanced supply of nitrogen throughout its growth stages. This involves understanding the plant's nitrogen requirements at different growth stages, considering factors such as soil fertility, crop variety, climate conditions, and local agricultural practices (Samui et al., 2019). Several studies have focused on the optimization of nitrogen requirement in brinjal cultivation to enhance growth and maximize yield. Researchers have investigated different nitrogen management techniques, including various fertilizer application rates, timing, and methods, to determine the most efficient and environmentally friendly approach. Additionally, advancements in precision agriculture techniques, such as remote sensing, soil sensors, and crop models, have provided valuable tools to monitor and optimize nitrogen application in real-time (Sabra and Mohamed, 2019; Rahman et al., 2018). This study aims to review the existing literature on the optimization of nitrogen requirement for better growth and yield of brinjal. It will explore various factors affecting nitrogen uptake and utilization by brinjal plants and summarize the current best practices for nitrogen management in brinjal cultivation. The findings of this review will provide valuable insights and recommendations to farmers, agronomists, and researchers for optimizing nitrogen application strategies to achieve sustainable brinjal production with improved growth and higher yields.

Material and Methods

Experimental site

The experiment was conducted at the University of Agriculture Peshawar during 2022.

Treatments and layout

T0 (control), T1 (275 kg ha-1), T2 (300 kg ha-1), T3 (325 kg ha-1), T4 (350 kg ha-1) and T5 (375 kg ha-1) were the six urea treatments. At 20, 40, and 60 days after transplanting, urea was evenly distributed throughout the plot in three equal portions. The experiment followed the randomised complete block design (RCBD) method of planning. The experimental area is split into 6 plots that are of the same size, or 0.25m2 (0.5m 0.5m), within each of the 4 blocks that represent the 4 replications. Consequently, there were 24 plots in all (6 x 4). Six plots with six nitrogen (urea) treatments were allocated at random within each replication. For intercultural operations, there were spaces between blocks and plots of 40 cm and 30 cm, respectively.

Application of fertilizers

Fertilisers were administered to the plots in accordance with the Fertiliser Recommendation Guide's (FRG, 2012) recommendations for high yield goals and extremely low soil fertility status. For phosphate, potassium, sulphur, zinc, and cow dung, the suggested dosages were 42, 105, 18, 2.5 kg/ha, and 5 tons/ha, respectively. Triple superphosphate (TSP), muriate of potash (MoP), gypsum, and zinc sulphate fertilisers were used to apply the necessary nutrients. At 20, 40, and 60 days after transplanting, potassium was administered in three equal doses along with the urea treatments described in FRG (2012).

Test crop and intercultural operations

The experiment made use of the Neelam cultivar of brinjal (*S. melongena*). The seeds for this cultivar were given by the Horticulture Department of the Agriculture Research Institute at Tarnab, Peshawar. Seedlings were obtained and raised in containers for 30 days before being moved onto the experimental field. For intercultural activities like weeding, irrigation, disease control, and pest management, conventional methods were applied when necessary. The brinjal shoot and fruit borer was managed in the experimental field using a sex pheromone trap.

Data collection and processing

We monitored the growth, yield, and yield-increasing traits of each plot. The total yield was calculated by multiplying the plant population by the average plant yield. The data collected were statistically examined using Statistix 8.1.

Results and discussion

Effect of nitrogen on brinjal reproductive and yield traits

On the number of flower cluster plants^{-1}, flowers plants^{-1}, fruits plants^{-1}, fruit length and weight of brinjal (*S. melongena*), different nitrogen levels had a statistically significant influence, whereas the fruit diameter was significant at 5% level of probability (Table 1). The most flower cluster plants^{-1} were generated by treatment T4 (12.34), which statistically matched treatment T5. On the other hand, flower cluster plant^{-1} production was lowest in the treatment T1 (7.25). Similar to this, the T5 treatment generated 17.06 times as many blooms plant^{-1} as the control treatment did, while only 11.26 blooms plant^{-1} were generated by the control treatment. The results of the present investigation demonstrate that the highest mean values of flowers per plant that were statistically significant were obtained when urea was applied at a rate of 375 kg ha^{-1}. This result is compatible with Mirdad's (2011) findings, who asserted that aubergine plants outperformed all other plant species and responded favourably to high nitrogen fertilisation. The application of various nitrogen levels significantly affected the brinjal (*S. melongena*) fruit length and number of fruits per plant^{-1} (Table 1). The T5 treatment, which used the highest dose of urea, generated the highest numbers of fruits plant^{-1} and the longest fruits (10.02 and 25.04 cm, respectively), compared to the control treatment's lowest results (6.33 and 20.26 cm, respectively). Table 1 shows that the amount of fruits on Plant^{-1} and the length of the brinjal (*S. melongena*) fruit both increased as nitrogen input increased. Therefore, it follows from the current study that the production of brinjal (*S. melongena*) is extremely sensitive to the addition of additional nitrogen. Furthermore, it has been said that each plant cell requires an adequate quantity of various nitrogenous compounds in order to operate effectively (Mengel and Kirkby, 1987). The T5 treatment produced the fruits with the highest diameter and weight. In comparison, the brinjal (*S. melongena*) fruit's diameter and weight ranged from 5.75 to 8.11 cm and 77.00 to 98.06 g, respectively. This result is in line with those of Aujla et al. (2007), who observed a comparable rise in the average fruit weight and fruit volume upon increasing the nitrogen fertiliser rate. Similar results were observed by Mirdad (2011), who discovered that increasing nitrogen treatment to developing plants—up to 300 kg N ha^{-1}—significantly improved all reproductive and yield components in brinjal (*S. melongena*). Akanbi et al. (2007) found that a lack of nitrogen reduced the physical and chemical characteristics of fruits and that nitrogen fertiliser affected the amount of seeds, fruit pH, crude protein, total solids, and ascorbic acid in eggplant.

Effect of nitrogen on yield of brinjal

The treatment of varied nitrogen levels has a significant influence on the production of brinjal (*S. melongena*). The control treatment had the lowest yield (Figure 1), while the T5 treatment provided the highest yield (18.01 tonnes ha^{-1}). Figure 1 demonstrates unequivocally that, comparable to other yield-contributing features, the yield of brinjal (*S. melongena*) increased when urea rates increased. Therefore, it follows from the current study that the production of brinjal (*S. melongena*) is extremely sensitive to the addition of additional nitrogen. Because the plant produced more leaves, which would have increased photosynthetic efficiency and yield, more nitrogen may have been needed. This result is in line with Wange and Kale's (2004) finding that increasing the recommended rate of N fertiliser resulted in a significant boost in aubergine yield (74%). Pal et al. (2002) claim that an increase in nitrogen increased the output of aubergine fruit by up to 187.5 kg ha^{-1}. The results from the current study regarding the brinjal's (*S. melongena*) fruit yield are broadly in agreement with those from Mirdad (2011) and Aujla et al. (2007), both of which demonstrated that fruit yield increased significantly as nitrogen levels ascended. Similar conclusions were made by Mohammad et al. (2010), who said that nitrogen fertilisation has been used to increase aubergine growth and productivity. Nitrogen has been demonstrated to promote growth and increase biomass output. According to Devi et al. (2002), adding 120 kg N ha^{-1} increased the girth, weight, and production of aubergine fruits.

Table 1: Effect of different levels of nitrogen on reproductive and yield characteristics of brinjal (*S. melongena*).

Treatments	No. of flower cluster plant-1	No. of flowers plant-1	No. of fruits plant-1	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)
T0	8.9	11.26	6.33	20.26	6.01	77.00
T1	7.24	13.01	6.51	21.32	5.76	80.11
T2	7.51	12.76	7.01	21.51	6.06	81.34
T3	10.04	14.01	7.26	22.04	6.51	84.68
T4	12.34	16.11	9.34	23.11	7.01	83.34
T5	12.26	17.06	10.02	25.04	8.11	98.06
CV (%)	6.71	6.81	6.16	4.25	6.48	2.84
SE (mean)	0.68	0.54	0.44	0.63	0.31	1.41
LSD (0.05)	**	**	**	**	*	**

**= highly significant; *= significant

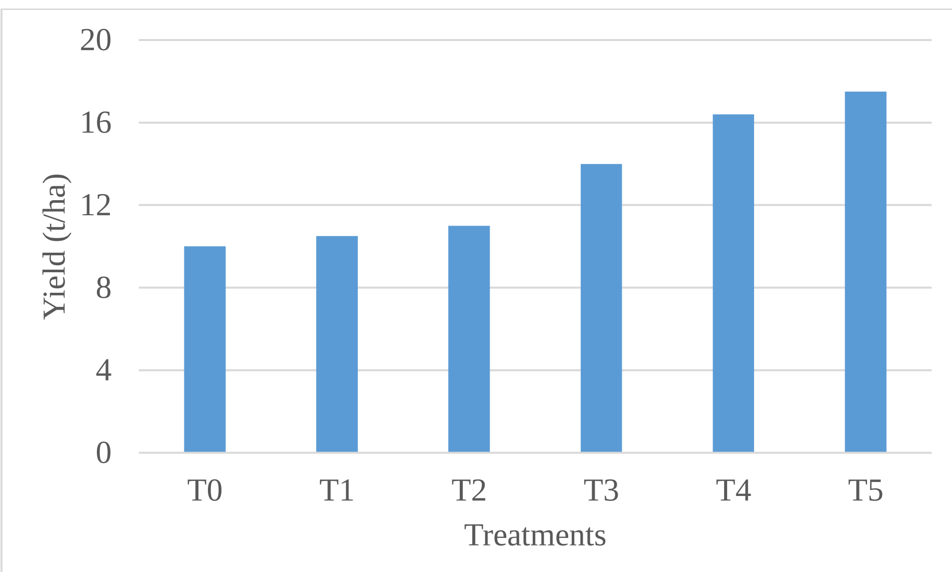

Figure 1: Effect of different levels of nitrogen on yield of brinjal (*S. melongena*).

Conclusion and recommendation

This study found that the fruit production and yield-contributing traits of the brinjal (*S. melongena*) had considerable favourable effect with the rising rates of urea. The application of 375 kg ha-1 urea resulted in the maximum fruit production of brinjal (*S. melongena*), whereas the control treatment produced the lowest yield. The findings of the current investigation so indicated that 375 kg ha-1 of urea had the optimum performance. However, recommendations for fertiliser in the future ought to be site-, location-, and variety-specific. The study's final finding was that further research in Pakistan's various agro-ecological zones and seasons is required before the application dosage is fully optimised.

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