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# Effect of nitrogen and plant growth regulators on seed yield per plant and seed quality parameters in brinjal (*Solanum melongena* L.)

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**Abstract:** The present investigation on effect of nitrogen [$N_0$ (Control), $N_1$ (50 kg N/ha), $N_2$ (100 kg N/ha), and $N_3$ (150 kg N/ ha)] and plant growth regulators [$G_0$ (Control), $G_1$ (50 ppm $GA_3$), $G_2$ (50 ppm NAA) and $G_3$ (500 ppm Cycocel)] on seed yield per plant and seed quality parameters in brinjal (*Solanum melongena* L.) cv. GJB 3 was carried out at the Instructional Farm, Department of Agronomy, Junagadh Agricultural University, Junagadh during *kharif* 2015-16. The experiment was laid out in field as per randomized block design (Factorial) with three replications. The seed harvested from 16 different treatments combinations replicated thrice from the field were analyzed in the laboratory following completely randomized design (factorial) for various seed quality parameters. Application of nitrogen @ 150 kg N/ha recorded significantly ($P<0.05$) highest seed yield per plant, shoot fresh weight, root dry weight, shoot dry weight and vigour index – 2 (mass), while application of 100 kg N/ha resulted in significantly ($P<0.05$) highest germination percentage, root length, shoot length, root fresh weight and vigour index – 1 (length). Application of $GA_3$ at 50 ppm recorded significantly the highest seed yield per plant, germination percentage, root length, shoot length, root fresh weight, shoot fresh weight, root dry weight, shoot dry weight, vigour index – 1 (length) and vigour index – 2 (mass). Among the 16 different treatment combinations, nitrogen @ 150 kg/ha and $GA_3$ 50 ppm noted the maximum seed yield per plant, shoot dry weight and vigour index – 2 (mass), while significantly the maximum germination percentage, root length, shoot length, root fresh weight, shoot fresh weight and vigour index – 1 (length) were registered in treatment combination nitrogen 100 kg N/ha and $GA_3$ @ 50 ppm. Therefore, it is advised that application of 100-150 kg of N/ha as a nitrogenous fertilizer and spray $GA_3$ @ 50 ppm ($G_1$) at 45 days after transplanting helps in increasing the seed yield per plant and seed quality parameters in brinjal seed production.

**Keywords:** Brinjal, Nitrogen, Plant growth regulators, Seed yield, Quality parameters

## INTRODUCTION

Brinjal (*Solanum melongena* L., 2n = 2x = 24) is a widely adaptive and highly productive most popular vegetable crop of tropical and subtropical regions of the world including India. After potato, it ranks second highest consumed vegetable in India, along with tomato and onion. India ranks second in production of brinjal (27.55%) after okra (73% of world production) in the world (Vanitha *et al.,* 2013). In India, during 2014-15, brinjal occupies an area of above 6.80 lakh hectares with production of 12.71 million tones with a productivity of 18.7 MT/ha (Anonymous, 2015). In Gujarat, during 2014-15, it is cultivated in 0.76 lakh hectares giving a production of 14.77 lakh tones with a productivity of 19.4 MT/ha (Anonymous, 2015).

Nitrogen is considered as one of the essential major nutrients required by the plants for their growth, development and yield. Nitrogen deficiency generally results in stunted growth and chlorotic leaves caused by poor assimilate formation that leads to premature flowering and shortening of the growth cycle. The presence of N in excess promotes development of the above ground organs with abundant dark green (high chlorophyll) tissues of soft consistency and relatively poor root growth. The productivity of eggplant is highly responsive to N fertilization. Pal *et al.* (2002) reported that eggplant fruit yield increased with increase in N up to 187.5 kg N/ha. Sat and Saimbhi (2003) observed that increasing the nitrogen significantly delayed flowering of eggplant and increased the number of days taken to fruit setting of eggplant. Plant growth regulators like promoters, inhibitors or retardants play a key role in controlling internal mechanisms of plant by interacting with key metabolic processes such as, nucleic acid metabolism and protein synthesis. Use of plant growth regulators (PGRs) might be a useful alternative to increase crop production. Recently, there has been global realization of the important role of PGR's in increasing crop yield. Gibberellic acid is one of those growth regulators that have positive effect on plant growth through the effect on cell division and elongation (Batlang *et al*., 2006).

Keeping this in view, the effect of nitrogen and plant growth regulators on seed yield and seed quality pa-

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rameters of brinjal cv. GJB 3 was studied.

## MATERIALS AND METHODS

The present investigation on effect of nitrogen [$N_0$ (Control), $N_1$ (50 kg N/ha), $N_2$ (100 kg N/ha), and $N_3$ (150 kg N/ ha)] and plant growth regulators [$G_0$ (Control), $G_1$ (50 ppm $GA_3$), $G_2$ (50 ppm NAA) and $G_3$ (500 ppm Cycocel)] on seed yield per plant and seed quality parameters in brinjal (*Solanum melongena* L.) cv. GJB 3 was carried out at the Instructional Farm, Department of Agronomy, Junagadh Agricultural University, Junagadh during *kharif* 2015-16. The experiment was laid out in field as per randomized block design (Factorial) with three replications. The seed harvested from 16 different treatments combinations replicated thrice from the field were analyzed in the laboratory following completely randomized design (factorial) for various seed quality parameters viz., germination percentage, root length (cm), shoot length (cm), root fresh weight (g), shoot fresh weight (g), root dry weight (mg), shoot dry weight (mg), Vigour Index I and Vigour Index II. The data were analyzed following the statistical analysis of Completely Randomized Design (Factorial) as per the method suggested by Cochran and Cox (1957).

## RESULTS AND DISSCUSION

In the present study analysis of variance for seed yield per plant and seed quality parameters revealed that different nitrogen and plant growth regulator treatments manifested significant differences ($P<0.05$) for seed yield per plant and all the seed parameters studied. Mean squares due to interaction effects of nitrogen and plant growth regulators were found significant ($P<0.05$) seed yield per plant and all the seed parameters studied except shoot length.

**Seed yield per plant:** The results indicated that various levels of nitrogen, plant growth regulators and its interaction manifested significant effect on seed yield per plant (Table 2). Application of nitrogen 150 kg/ha ($N_3$) resulted in significantly the highest seed yield per plant (18.71 g) over control $N_0$ (10.48 g), 50 kg N/ha ($N_1$) (13.60 g) and 100 kg N/ha ($N_2$) (17.18 g). Arya *et al.* (1999) observed the highest seed yield (181.8 kg/ ha) with 100 kg N/ha in tomato. Application of $GA_3$ @ 50 ppm ($G_1$) produced significantly the highest seed yield per plant (18.16 g) over control ($G_0$) (10.86 g) as well as NAA 50 ppm ($G_2$) (15.74 g) and CCC ($G_3$) (15.21 g). Patil *et al.* (2008) reported that $GA_3$ @ 50 ppm recorded significantly more seed yield per plant in brinjal hybrid seed production. Natesh *et al*. (2005) reported that $GA_3$ at 100 ppm sprayed at flowering stage recorded higher seed yield followed by $GA_3$ 50 ppm and NAA 20 ppm. The treatment combination of nitrogen @ 150 kg/ha and $GA_3$ @ 50 ppm ($N_3G_1$) produced significantly the highest seed yield per plant (21.53 g) and it was remained at par with treatment combination $N_2G_1$ with 20.90g seed yield per plant. Significantly the lowest seed yield per plant (6.81 g) was noted in treatment combination control ($N_0G_0$).

**Germination percentage:** The results indicated that different levels of nitrogen exerted significant effect ($P<0.05$) on germination percentage. Significantly the maximum germination in per cent was recorded in treatment nitrogen @ 100 kg/ha ($N_2$) (96.75 %) over control as well as other levels of nitrogen (Table 1). Significantly the minimum germination percentage was recorded in nitrogen @ 50 kg/ha ($N_1$) (93.00 %). Payero and Bhangoo (1990) reported that final germination per cent was unaffected by any of the N treatments (14 to 70 kg/ha) in chilli. An examination of data showed that different plant growth regulators exerted significant influence on germination percentage. The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest germination percentage (96.17 %) and it was remained at par with NAA 50 ppm ($G_2$) (95.00 %). Significantly the lowest germination percentage (92.83 %) was reported in treatment CCC 500 ppm ($G_3$). The results are in line with the findings of Patil *et al.* (2008), who reported that $GA_3$ 50 ppm recorded significantly ($P<0.05$) more germination (75.52%) in brinjal as compared to NAA 40 ppm and control. Similar findings were also reported by Rajendran (2000) while using the concentrations 10, 20, 30 and 40 ppm of NAA, and Sultana *et al.* (2006) while using the concentrations 10 and 50 ppm of NAA in chilli. The interaction effect of nitrogen and plant growth regulators was significant for germination percentage. The treatment combination nitrogen @ 100 kg/ha and $GA_3$ @ 50 ppm ($N_2G_1$) produced significantly the highest germination percentage (98.33 %) and it was remained at par with treatment combinations $N_2G_0$, $N_2G_2$, $N_1G_1$, $N_3G_1$ and $N_0G_3$ with germination of 98.00, 97.67, 96.67, 95.67 and 95.33 per cent, respectively. Significantly the minimum germination percentage was noted in $N_3G_3$ treatment combination (92.33 %).

**Root length:** The results indicated that different levels of nitrogen exerted significant effect ($P<0.05$) on root length. Significantly the maximum root length was recorded in treatment nitrogen @ 100 kg/ha ($N_2$) (7.32 cm) over control ($N_0$) (4.25 cm), 150 kg N/ha ($N_3$) (6.71 cm) and 50 kg N/ha ($N_2$) (6.97 cm) (Table 1). An examination of data (Table 1) showed that different levels of plant growth regulators exerted significant effect on root length. The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest root length (6.97 cm) over control ($G_0$) (5.16 cm), NAA 50 ppm ($G_2$) (6.51 cm) and CCC 500 ppm ($G_3$) (6.59 cm). The results are in agreement with Patil *et al.* (2008), who reported that $GA_3$ 50 ppm recorded significantly more root length (7.81 cm) in brinjal as compared to NAA 40 ppm and control. The interaction effect of nitrogen and plant growth regulators was significant for root length (Table 1). The treatment combination nitrogen 100 kg/ha and $GA_3$ 50 ppm ($N_2G_1$) produced significantly the maximum root length (8.13 cm) and it was remained at par with treatment combinations $N_1G_1$ (7.83 cm), $N_2G_3$ (7.74 cm) and $N_3G_1$ (7.67 cm). Significantly the minimum root length was noted in control ($N_0G_0$) (3.75 cm).

**Shoot length:** The results presented in Table 1 reveled that different levels of nitrogen had significant influence on shoot length. Application of nitrogen 100 kg/ha ($N_2$) resulted in significantly the highest shoot length (11.68 cm) over control ($N_0$) (9.45 cm) and it was remained at par with treatment $N_1$ (50 kg N/ha) and $N_3$ (150 kg N/ha) with a shoot length of 11.61 cm and 11.50 cm, respectively. An examination of data (Table 1) showed that different plant growth regulators exerted significant effect on shoot length. The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest shoot length (11.56 cm) and found at par with treatment CCC 500 ppm ($G_3$). Significantly the lowest shoot length (10.31 cm) was reported in treatment control ($G_0$). The results are in agreement with Patil *et al.* (2008), who reported that $GA_3$ 50 ppm recorded significantly more shoot length (6.86 cm) in brinjal as compared to NAA 40 ppm and control. The interaction effect of nitrogen and plant growth regulators was non-significant for shoot length (Table 1). The treatment combination nitrogen 100 kg/ha and $GA_3$ 50 ppm ($N_2G_1$) produced the maximum shoot length (12.34 cm) followed by treatment combinations $N_1G_1$ (12.10 cm), $N_3G_3$ (11.93 cm) and $N_1G_2$ (11.93 cm). The minimum shoot length was noted in control ($N_0G_0$) (8.68 cm).

**Root fresh weight:** The results (Table 1) indicated that different levels of nitrogen exerted significant effect on root fresh weight. Significantly the maximum root fresh weight was recorded in treatment nitrogen $N_2$ (100 kg/ha) (0.87 g) over control ($N_0$) (0.43 g) as well

**Table 1.** Effect of nitrogen and plant growth regulators on seed yield per plant and seed quality parameters in brinjal.

| Treatment | Seed yield per plant (g) | Germination % | Root length (cm) | Shoot length (cm) | Root fresh weight (g) |
|---|---|---|---|---|---|
| **Nitrogen** | | | | | |
| $N_0$= Control | 10.48 | 94.33 | 4.25 | 9.45 | 0.43 |
| $N_1$= 50 kg N/ha | 13.60 | 93.00 | 6.71 | 11.61 | 0.72 |
| $N_2$=100 kg N/ha | 17.18 | 96.75 | 7.32 | 11.68 | 0.87 |
| $N_3$=150 kg N/ ha | 18.71 | 93.58 | 6.96 | 11.50 | 0.80 |
| Mean | 14.99 | 94.92 | 6.31 | 11.06 | 0.71 |
| S.Em.± | 0.34 | 0.53 | 0.08 | 0.11 | 0.01 |
| C.D. at 5 % | 0.99 | 1.53 | 0.23 | 0.32 | 0.02 |
| **Plant growth regulators** | | | | | |
| $G_0$= Control | 10.86 | 93.67 | 5.16 | 10.31 | 0.55 |
| $G_1$= 50 ppm $GA_3$ | 18.16 | 96.17 | 6.97 | 11.56 | 0.83 |
| $G_2$= 50 ppm NAA | 15.74 | 95.00 | 6.51 | 11.07 | 0.68 |
| $G_3$= 500 ppm Cycocel | 15.21 | 92.83 | 6.59 | 11.30 | 0.76 |
| Mean | 14.99 | 94.92 | 6.31 | 11.06 | 0.71 |
| S.Em.± | 0.34 | 0.53 | 0.08 | 0.11 | 0.01 |
| C.D. at 5 % | 0.99 | 1.53 | 0.23 | 0.32 | 0.02 |
| **Nitrogen x plant growth regulators** | | | | | |
| $N_0$ x $G_0$ | 6.81 | 94.00 | 3.75 | 8.68 | 0.38 |
| $N_0$ x $G_1$ | 12.91 | 94.00 | 4.26 | 10.01 | 0.43 |
| $N_0$ x $G_2$ | 11.23 | 94.00 | 4.46 | 9.08 | 0.34 |
| $N_0$ x $G_3$ | 10.96 | 95.33 | 4.52 | 10.05 | 0.57 |
| $N_1$ x $G_0$ | 7.83 | 90.00 | 5.00 | 10.60 | 0.51 |
| $N_1$ x $G_1$ | 17.30 | 96.67 | 7.83 | 12.10 | 0.99 |
| $N_1$ x $G_2$ | 14.86 | 94.67 | 7.30 | 11.93 | 0.67 |
| $N_1$ x $G_3$ | 14.39 | 90.67 | 6.69 | 11.83 | 0.72 |
| $N_2$ x $G_0$ | 12.16 | 98.00 | 6.15 | 11.28 | 0.66 |
| $N_2$ x $G_1$ | 20.90 | 98.33 | 8.13 | 12.34 | 1.01 |
| $N_2$ x $G_2$ | 18.20 | 97.67 | 7.27 | 11.68 | 0.85 |
| $N_2$ x $G_3$ | 17.47 | 93.00 | 7.74 | 11.41 | 0.95 |
| $N_3$ x $G_0$ | 16.63 | 92.67 | 5.76 | 10.70 | 0.65 |
| $N_3$ x $G_1$ | 21.53 | 95.67 | 7.67 | 11.78 | 0.89 |
| $N_3$ x $G_2$ | 18.66 | 93.67 | 6.99 | 11.58 | 0.85 |
| $N_3$ x $G_3$ | 18.03 | 92.33 | 7.42 | 11.93 | 0.82 |
| Mean | 14.99 | 94.92 | 6.31 | 11.06 | 0.71 |
| S.Em.± | 0.69 | 1.06 | 0.16 | 0.22 | 0.01 |
| C.D. at 5 % | 1.98 | 3.06 | 0.46 | NS | 0.03 |
| C.V. % | 7.91 | 1.95 | 4.41 | 3.45 | 2.81 |

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| Treatment | Shoot fresh weight (g) | Root dry weight (mg) | Shoot dry weight (mg) | Vigour Index- 1 (length) | Vigour Index- 2 (mass) |
|---|---|---|---|---|---|
| **Nitrogen** | | | | | |
| $N_0$= Control | 2.28 | 13.25 | 61.14 | 1292.50 | 7019.25 |
| $N_1$= 50 kg N/ha | 2.94 | 15.75 | 65.20 | 1708.14 | 7546.70 |
| $N_2$=100 kg N/ha | 3.44 | 16.08 | 71.20 | 1838.12 | 8441.36 |
| $N_3$=150 kg N/ ha | 3.44 | 16.75 | 74.61 | 1727.58 | 8552.79 |
| Mean | 3.03 | 15.46 | 68.04 | 1641.58 | 7890.02 |
| S.Em.± | 0.03 | 0.20 | 0.65 | 16.04 | 70.38 |
| C.D. at 5 % | 0.09 | 0.56 | 1.87 | 46.20 | 202.73 |
| **Plant growth regulators** | | | | | |
| $G_0$= Control | 2.87 | 14.08 | 60.00 | 1451.28 | 6942.09 |
| $G_1$= 50 ppm $GA_3$ | 3.37 | 17.42 | 72.63 | 1785.27 | 8664.18 |
| $G_2$= 50 ppm NAA | 2.99 | 14.92 | 70.14 | 1671.19 | 8080.68 |
| $G_3$= 500 ppm Cycocel | 2.87 | 15.42 | 69.38 | 1658.60 | 7873.15 |
| Mean | 3.03 | 15.46 | 68.04 | 1641.58 | 7890.02 |
| S.Em.± | 0.03 | 0.20 | 0.65 | 16.04 | 70.38 |
| C.D. at 5 % | 0.09 | 0.56 | 1.87 | 46.20 | 202.73 |
| **Nitrogen x plant growth regulators** | | | | | |
| $N_0$ x $G_0$ | 2.16 | 13.33 | 50.59 | 1167.61 | 6009.00 |
| $N_0$ x $G_1$ | 2.40 | 16.00 | 65.60 | 1341.07 | 7670.71 |
| $N_0$ x $G_2$ | 2.39 | 9.67 | 63.16 | 1272.90 | 6845.34 |
| $N_0$ x $G_3$ | 2.18 | 14.00 | 65.21 | 1388.42 | 7551.95 |
| $N_1$ x $G_0$ | 2.93 | 13.00 | 58.82 | 1404.24 | 6459.96 |
| $N_1$ x $G_1$ | 3.53 | 19.67 | 69.56 | 1926.80 | 8624.37 |
| $N_1$ x $G_2$ | 2.85 | 17.33 | 69.85 | 1820.96 | 8253.29 |
| $N_1$ x $G_3$ | 2.45 | 13.00 | 62.55 | 1680.58 | 6849.18 |
| $N_2$ x $G_0$ | 3.18 | 15.00 | 63.45 | 1707.81 | 7688.43 |
| $N_2$ x $G_1$ | 3.78 | 17.00 | 76.14 | 2013.37 | 9158.39 |
| $N_2$ x $G_2$ | 3.38 | 16.33 | 71.05 | 1850.90 | 8534.58 |
| $N_2$ x $G_3$ | 3.41 | 16.00 | 74.16 | 1780.38 | 8384.02 |
| $N_3$ x $G_0$ | 3.20 | 15.00 | 67.14 | 1525.44 | 7610.96 |
| $N_3$ x $G_1$ | 3.78 | 17.00 | 79.20 | 1859.85 | 9203.23 |
| $N_3$ x $G_2$ | 3.35 | 16.33 | 76.47 | 1740.00 | 8689.51 |
| $N_3$ x $G_3$ | 3.43 | 18.67 | 75.61 | 1785.03 | 8707.45 |
| Mean | 3.03 | 15.46 | 68.04 | 1641.58 | 7890.02 |
| S.Em.± | 0.07 | 0.39 | 1.30 | 32.07 | 140.75 |
| C.D. at 5 % | 0.19 | 1.13 | 3.75 | 92.40 | 405.47 |
| C.V. % | 3.75 | 4.38 | 3.31 | 3.38 | 3.09 |

as nitrogen application @ 150 kg/ha ($N_3$) (0.80 g) and 50 kg/ha ($N_1$) (0.72 g). An examination of data (Table 1) showed that different levels of plant growth regulators exerted significant effect on root fresh weight. The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest root fresh weight (0.83 g). Significantly the lowest root fresh weight (0.55 g) was reported in treatment control ($G_0$). The results are in agreement with the findings of Das and Prusty (1972) in brinjal for root fresh weight. The interaction effect of nitrogen and plant growth regulators was significant for root fresh weight (Table 1). The treatment combination nitrogen 100 kg/ha and $GA_3$ 50 ppm ($N_2G_1$) produced significantly the maximum root fresh weight (1.01 g) and it was remained par with treatment combination 50 kg N/ha and GA3 50 ppm ($N_1G_1$) (0.99 g). The treatment combination, $N_0G_2$ produced significantly the lowest root fresh weight (0.34 g).

**Shoot fresh weight:** The results (Table 1) indicated that different levels of nitrogen exerted significant effect on shoot fresh weight. Application of nitrogen 50 kg/ha ($N_1$) and nitrogen 150 kg/ha ($N_3$) resulted in significantly the maximum shoot fresh weight (3.44 g). The lowest shoot fresh weight was recorded under treatment control $N_0$ (2.28 g). An examination of data (Table 1) showed that different levels of plant growth regulators exerted significant effect on shoot fresh weight. The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest shoot fresh weight (3.37 g). Significantly the lowest shoot fresh weight (2.87 g) was reported in treatment control ($G_0$) and CCC 500 ppm ($G_3$). The results are in agreement with the findings of Das and Prusty (1972). The interaction effect of nitrogen and plant growth regulators was significant for shoot fresh weight (Table 1). The treatment combinations, nitrogen 100 kg/ha and $GA_3$ 50 ppm ($N_2G_1$) and nitrogen 150 kg/ha and $GA_3$

50 ppm ($N_3G_1$) produced significantly the maximum shoot fresh weight (3.78 g). The lowest shoot fresh weight (2.16 g) was reported in control $N_0G_0$.

**Root dry weight:** The results (Table 1) indicated that different levels of nitrogen exerted significant effect on root dry weight. Significantly the maximum root dry weight was recorded in treatment nitrogen $N_3$ (150 kg/ha) (16.75 mg) over control ($N_0$) (13.25 mg) as well as nitrogen application @ 50 kg/ha ($N_1$) (15.75 mg) and 100 kg/ha ($N_2$) (16.08 mg). An examination of data (Table 1) showed that different levels of plant growth regulators exerted significant effect on root dry weight. The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest root dry weight (17.42 mg). Significantly the lowest root dry weight (14.08 mg) was reported in treatment control ($G_0$). The results are in agreement with the findings of Das and Prusty (1972). Patil *et al.* (2008) also reported that $GA_3$ 50 ppm recorded significantly more seedling dry weight in brinjal as compared to NAA 40 ppm and control. The interaction effect of nitrogen and plant growth regulators was significant for root dry weight (Table 1). The treatment combination nitrogen 50 kg/ha and $GA_3$ 50 ppm ($N_1G_1$) produced significantly the maximum root dry weight (19.67 mg). The treatment combination, $N_0G_2$ produced significantly the lowest root dry weight (9.67 mg).

**Shoot dry weight:** The results (Table 1) indicated that different levels of nitrogen exerted significant effect on shoot dry weight. Application of nitrogen 150 kg/ha ($N_3$) resulted in significantly the maximum shoot dry weight (74.61 mg). The lowest shoot dry weight was recorded under treatment control $N_0$ (61.14 mg). An examination of data (Table 1) showed that different levels of plant growth regulators exerted significant effect on shoot dry weight. The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest shoot dry weight (72.63 mg) over control $G_0$ (60.00 mg) and well as $G_3$ (69.38 mg) and $G_2$ (70.14 mg). The results are in agreement with the findings of Das and Prusty (1972). Patil *et al.* (2008) also reported that $GA_3$ 50 ppm recorded significantly more seedling dry weight in brinjal as compared to NAA 40 ppm and control. The interaction effect of nitrogen and plant growth regulators was significant for shoot dry weight (Table 1). The treatment combination nitrogen 150 kg/ha and $GA_3$ 50 ppm ($N_3G_1$) produced significantly the maximum shoot dry weight (79.20 mg) and it was remained par with treatment combination $N_3G_2$ (76.47 mg), $N_2G_1$ (76.14 mg) and $N_3G_3$ (75.61 mg). The treatment combination $N_0G_0$ produced the lowest shoot dry weight (50.59 mg).

**Vigour index -1 (length):** The results (Table 1) indicated that different levels of nitrogen exerted significant effect on vigour index – 1 (length). Significantly the maximum vigour index – 1 (length) was recorded in treatment nitrogen $N_2$ (100 kg/ha) (1838.12) over control ($N_0$) (1292.50) as well as nitrogen application @ 50 kg/ha ($N_1$) (1708.14) and 150 kg/ha ($N_3$) (1727.58). An examination of data (Table 1) showed that different levels of plant growth regulators exerted significant effect on vigour index – 1 (length). The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest vigour index – 1 (length) (1785.27) over control $G_0$ (1451.28) and well as $G_3$ (1658.60) and $G_2$ (1671.19). Patil *et al.* (2008) also reported that $GA_3$ 50 ppm recorded significantly more seedling vigour index in brinjal as compared to NAA 40 ppm and control. The interaction effect of nitrogen and plant growth regulators was significant for vigour index – 1 (length) (Table 1). The treatment combination nitrogen 100 kg/ha and $GA_3$ 50 ppm ($N_2G_1$) produced the maximum vigour index – 1 (length) (2013.37) and it was remained par with treatment combination $N_1G_1$ (1926.80). The treatment combination $N_0G_0$ produced the lowest vigour index – 1 (length) (1167.61).

**Vigour index - 2 (mass):** The results (Table 1) indicated that different levels of nitrogen exerted significant effect on vigour index – 2 (mass). Significantly the maximum vigour index – 2 (mass) was recorded in treatment nitrogen $N_3$ (150 kg/ha) (8552.79) over control ($N_0$) (7019.25) and nitrogen application @ 50 kg/ha ($N_1$) (7546.70). However, it was at par with application of 100 kg/ha ($N_3$) (8441.36). An examination of data (Table 1) showed that different levels of plant growth regulators exerted significant effect on vigour index – 2 (mass). The application of plant growth regulators $GA_3$ 50 ppm ($G_1$) recorded significantly the highest vigour index – 2 (mass) (8664.18) over control $G_0$ (6942.09) and well as $G_3$ (7873.15.19) and $G_2$ (8080.68). Patil *et al.* (2008) also reported that $GA_3$ 50 ppm recorded significantly more seedling vigour index in brinjal as compared to NAA 40 ppm and control. The interaction effect of nitrogen and plant growth regulators was significant for vigour index – 2 (mass) (Table 1). The treatment combination nitrogen 150 kg/ha and $GA_3$ 50 ppm ($N_3G_1$) produced the maximum vigour index – 2 (mass) (9203.23) and it was remained par with treatment combination $N_2G_1$ (9158.39). The treatment combination $N_0G_0$ produced the lowest vigour index – 2 (mass) (6009.00).

## Conclusion

From the results and discussion, it can be concluded that during the present study application of nitrogen 150 kg/ha and $GA_3$ @ 50 ppm was found best suited, as it has produced the maximum seed yield per plant in brinjal (*Soalnum melongena* L.) as well as shoot dry weight and vigour index – 2 (mass), while significantly ($P<0.05$) the maximum germination percentage, root length, shoot length, root fresh weight, shoot fresh weight and vigour index – 1 (length) were registered in treatment combination nitrogen 100 kg N/ha and $GA_3$

@ 50 ppm. Therefore, it is advised that application of 100-150 kg of N/ha as a nitrogenous fertilizer and spray $GA_3$ @ 50 ppm ($G_1$) at 45 days after transplanting helps in increasing the seed yield per plant and seed quality parameters in brinjal seed production.

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