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# Impact of Grafting and different Levels of Spacing and nitrogenous fertilizers on Earliness Parameters of Brinjal (*Solanum melongena* L.)

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**ABSTRACT: The impact of grafting and different levels of spacing and nitrogenous fertilizers on earliness parameters of brinjal was studied for two years at coastal Odisha climatic conditions for two seasons. The experiment was laid out in double split plot design having grafting (rootstock *Solanum torvum*) and without grafting as main treatments, different spacing levels (90 × 60 cm$^2$, 90 × 75 cm$^2$ and 90 × 90 cm$^2$) as sub treatments and different nitrogen fertilizer levels (90kg N/ha, 135kg N/ha, 180 kg N/ha and 225 kg N/ha) as sub-sub treatments. The observation for different earliness parameters like days to first flowering, days to 50 % flowering and days to first fruit harvest were recorded. The experimental results showed that the grafted brinjal plants showed earlier flowering and fruiting tendencies than the non grafted brinjal plants.**

**Keywords:** Days to first flowering, Days to 50 % flowering, Days to first fruit harvest, Grafted brinjal, Spacing, Nitrogen fertilizer level.

## INTRODUCTION

The adoption of vegetable grafting is based on the principle that use of rootstocks can enhance plant vigour through vigorous attainment of soil nutrients, avoidance of soil pathogens and tolerance to low soil temperatures, salinity, and wet-soil conditions (Frank *et al*., 2010). The most common rootstocks of eggplant are wild related species such as *Solanum torvum*, *S. integrifolium* and *S. sisymbrifolium*. Amongst them, rootstock *S. torvum* was reported by several authors to be resistant to *Verticillium* and bacterial wilts and root-knot nematodes. (Saiful *et al*., 2002; Curuk *et al*., 2005; King *et al*., 2008).

Plant spacing is an important agronomic attribute since it is believed to have effects on light interception for photosynthesis which is the energy manufacturing medium using green parts of the plant. Also it affects the photosphere and rhizosphere exploitation by the plants especially when spacing is inadequate and the plants suffer by clustering together. Optimum plant spacing gives the right plant density which is the number of plants allowed on a given unit of land for optimum yield (Ibeawuchi *et al*., 2008).

Apart from plant spacing, plant nutrition plays an important role for enhancing yield and quality of brinjal. However, according to Ruiz *et al*. (1997); Colla *et al.* (2006); Arao *et al*. (2008) available information on nutrition for grafted plants is not sufficient for commercial cultivation. Efficient use of fertilizer and water is highly critical to sustain agricultural production. Thus, there is wide scope to increase productivity by integrated management of nutrient, water, space and disease pest menance and also by doing grafting in brinjal on wild rootstock. The optimum plant population per hectare is also very important for obtaining higher yields in brinjal, which can be achieved by adopting different spacings between the rows and plants. The balanced application of major nutrients such as nitrogen, phosphorus and potassium is also important for maximization of yields in brinjal. Grafted brinjal produces fruits for longer time and need balanced and sufficient supply of nutrients for higher yield and better quality. Brinjal crop also responds well to fertilization and spacing. Therefore, it is necessary to investigate optimum dose of fertilizers and optimum spacing for higher yields in grafted brinjal. Therefore, researchers are eager to develop the standard production technologies and efficient management systems in order to optimise the productivity of grafted plants (Lee and Oda 2003).

## MATERIALS AND METHODS

The experiment was conducted for two years in Double split plot design in which the whole plot was divided to two main strips with three replications of each. Grafted brinjal hybrid VNR-212 on rootstock *Solanum torvum* was grown in one strips and on the other strip nongrafted VNR-212 hybrid seedlings were grown. Again each strip was divided into the sub lots with different spacings between plant to plant (*i.e.* 60 cm, 75

cm and 90 cm respectively) with row to row spacing remaining constant *i.e.* 90 cm. Again each subplot was divided into 4 sub sub plots based on applied Nitrogen fertilizers doses such as 50%, 75%, 100% and 125% of recommended nitrogen fertilizer doses. Three replications were used with twenty four treatment combinations. From the above factors, twenty four treatment combinations with three replications were obtained and adopted in the experiment at field level. The plants were spaced at 90 cm between the rows and within plant to plant it differed according to the treatments. The total number of plants per plot for 90 × 60 cm, 90 × 75 cm and 90 × 90 cm were 20, 16 & 12 respectively. The recommended package practices for growing brinjal crop were followed.

Days to first flowering was recorded in five plants by observing the number of days required for first flower blooming from the date of transplanting. Days to 50 per cent flowering was recorded by observing the number of days required by 50 per cent of the plant population to flower from the date of transplanting. Similarly, days to first fruit harvest was recorded by observing the number of days required for first fruit harvest from the date of transplanting.

Average of readings from different plants were worked out for different parameters mentioned above and used for analysis of data.

## RESULTS

**Days to first flowering.** Data pertaining to days to first flowering are mentioned in Fig. 1. Among different grafting levels, as per pooled analysis, grafted brinjal hybrid VNR 212 plants on rootstock *Solanum torvum* were earlier to produce first flower (41.6 days) than nongrafted brinjal hybrid VNR 212 (43.8 days). With respect to different levels of spacings, no significant difference was found for days to first flowering. However, spacing of 90 cm × 90 cm took least days to first flowering (43.1 days) compared to other spacings. Among different levels of nitrogen fertilizer application, least days to first flowering (40.0 days) was recorded by application of 180 kg N/ha to brinjal closely followed by application of 135 kg/ha (41.5 days) as per pooled analysis. Application of 225 kg N/ha took the highest days to first flowering (47.1 days) in brinjal.

**Table 1: Effect of different spacing and nitrogen fertilizer levels in grafted and non grafted brinjal on earliness parameters (Pooled data over 2 years).**

| Characters | Days to first flowering | Days to 50 % flowering | Days to first fruit harvest |
|---|---|---|---|
| **Grafting** | | | |
| G0-Non grafted | 43.80 | 53.00 | 55.00 |
| G1-Grafted | 41.60 | 51.60 | 53.10 |
| SEm± | 0.57 | 0.64 | 0.61 |
| CD (0.05) | 2.22 | 2.53 | 2.39 |
| **Spacing levels** | | | |
| S1-90 × 60 cm | 41.30 | 51.50 | 53.30 |
| S2-90 × 75 cm | 42.70 | 52.20 | 53.20 |
| S3-90 × 90 cm | 43.10 | 52.90 | 55.60 |
| SEm± | 0.56 | 0.56 | 1.54 |
| CD (0.05) | 1.69 | 1.68 | 4.62 |
| **Nitrogen fertilizer doses** | | | |
| N1-90 kg N/ha | 44.30 | 54.00 | 57.20 |
| N2-135 kg N/ha | 41.50 | 53.00 | 54.50 |
| N3-180 kg N/ha | 40.00 | 51.50 | 51.50 |
| N4-225 kg N/ha | 47.10 | 53.40 | 52.90 |
| SEm± | 0.86 | 0.71 | 1.60 |
| CD (0.05) | 2.43 | 2.00 | 4.50 |

**Days to 50% flowering.** Data related to days to 50% flowering are illustrated in Fig. 1. Among different grafting levels, as per pooled analysis, grafted brinjal hybrid VNR 212 plants on rootstock *Solanum torvum* took lowest days to produce 50% flowering (51.5 days) compared to nongrafted brinjal hybrid VNR 212 (53.0 days). With respect to different levels of spacings, no significant difference was observed with respect to days to first flowering. However, spacing of 90 cm × 60 cm took least days to 50% flowering (51.5 days) compared to other spacings. Among different levels of nitrogen fertilizer application, least days to first flowering (51.5 days) was observed by application of 180 kg N/ha application to brinjal closely followed by application of 135 kg/ha (51.5 days) and 225 kg N/ha (53.4) as per pooled analysis. Application of 90 kg N/ha took the highest days to 50 % flowering (54.0 days) in brinjal.

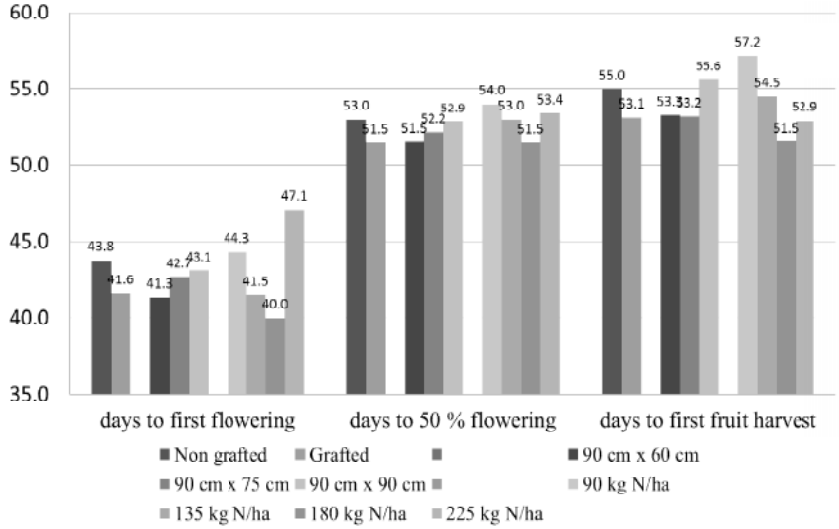


**Fig. 1.** Earliness characters in brinjal affected by grafting, spacing and nutrient management.

**Days to first fruiting.** Data related to days to first fruiting are illustrated in Fig. 1. Among different grafting levels, as per pooled analysis, grafted brinjal hybrid VNR 212 plants on rootstock *Solanum torvum* took lowest days to produce first fruiting (53.1 days) compared to nongrafted brinjal hybrid VNR 212 (55.0 days). With respect to different levels of spacings, no significant difference was observed with respect to days to first flowering. However, spacing of 90 cm × 60 cm took least days to 50% flowering (51.5 days) compared to other spacings. Among different levels of nitrogen fertilizer application, least days to first flowering (51.5 days) was observed by application of 180 kg N/ha application to brinjal closely followed by application of 135 kg/ha (51.5 days) and 225 kg N/ha (53.4) as per pooled analysis. Application of 90 kg N/ha took the highest days to 50 % flowering (54.0 days) in brinjal.

## DISCUSSIONS

As per the observations grafted plants produced flowering earlier than the non grafted plants. Gisbert *et al*. (2011) explained that when there is no constraint due to incompatibility and abiotic stress, grafted plants may develop faster, there by resulting in earliness of the grafted plant. There are reports on earliness in eggplant grafted on two *S. lycopersicum* hybrids (Khah *et al*., 2006) and melon plants grafted onto Cucurbita rootstocks (Fita *et al*., 2007). Khah (2011) reported a similar observation where grafted tomato fruit earlier than the non-grafted ones. Kumar *et al*. (2019) revealed that grafted plant showed earliness of more than 5 days in comparison to their non-grafted plant. With increase in nitrogen fertilizer doses the flowering got earlier but after 180 kg nitrogen fertilizer application per plant at 225 kg application again the flowering got delayed. It might be due to impact of good vegetative growth contributing to better and earlier flowering at initial stages but excessive vegetative growth at 225 kg nitrogen per hectare leading to delayed flowering. Similar results were obtained by Rajangam (1991); Assinapol *et al*. (2017).

Generally, in grafted plants, the formation of graft union between scion and rootstock is necessary for the translocation of food material from the root system to apical parts of the plant and leads to delayed flowering in grafted plants. In this study, greater earliness was observed in most non-grafted plants. Comparable effect of delayed flowering in grafted plants of eggplant and tomato was reported by Moncada *et al*. (2013); Musa *et al*. (2020). The concluding phenomenon is attributable to the stress experienced by these plants following the grafting operation Khah *et al*. (2006). However, in this study, contrasting results were obtained where grafted plants showed early flowering compared to the non-grafted plants. This phenomenon was related to the absence of graft incompatibility and environmental stress. Gisbert *et al*. (2011), explained that when there is no constraint due to incompatibility and abiotic stress, grafted plants may develop faster, thereby resulting in earliness of the grafted plant.

## CONCLUSION

The research trend as observed in this experiment showed that the grafted plants produce higher early yield compared to the non grafted brinjal plants, which will ultimately help in getting better price in market because of less competition from farmers that grow normal crop.

## FUTURE SCOPE

The eariness characters should be thoroughly studied along with the last harvest from grafted and non grafted plants which will show us facts regarding total harvest period which ultimately decides total yield. The earliness characters of grafted plants can also be studied under different abiotic stress condition for understanding the full potential of grafting in brinjal.

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