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RESPONSE OF TOMATO GRAFTED ON BRINJAL ROOTSTOCK FOR GROWTH AND YIELD COMPONENTS.

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ABSTRACT

The present investigation was undertaken during *Rabi*-2019-20 with an objective to study the compatibility of different tomato varieties grafted on brinjal rootstock and to study the growth, yield parameters of different tomato varieties grafted on brinjal rootstock. The experimental material consisted of two rootstocks and three scions in a Randomized Block Design (RBD) having nine treatment and three replications. Brinjal rootstocks that were used are *Solanum torvum* and RHRB-06; scions that were Phule Raja, Phule Kesari and NS 501 of tomato hybrids and varieties. Maximum success rate was observed in Phule Raja grafted on *Solanum torvum* (89.96 %). Among all the treatments Phule Raja grafted on *Solanum torvum* recorded significantly highest plant height (123.80 cm), maximum number of branches (5.37), maximum number of fruits per plant (34.06), fruit weight (79.30 g), equatorial diameter (5.16 cm), fruit yield/plant (2.70 kg), fruit yield/plot (86.47 kg) and yield/ hectare (66.72 t/ha). It can be concluded that tomato scion 'Phule Raja' was found highly compatible with brinjal rootstock '*Solanum torvum*'.

Keywords: Grafting, rootstock, scion, growth, yield of tomato, *Solanum torvum*

Introduction

Tomato (*Solanum lycopersicum* L.), is solanaceous fruit vegetable It is commonly consumed globally. Globally tomato is cultivated over 5.03 million hectares with a production of 180.77 MT and productivity of 35.93 tonnes per hectare. (Anon.2019-20a). In India, it is an important vegetable crop with a production of 190.07 lakh tonnes and productivity of 24.33 tonnes per hectare (Anon.2019-20b). After China, India is the world's second-largest tomato grower.

Abiotic and biotic stresses are severe restrictions in tomato production. For dealing with these biotic and abiotic stresses chemical methods are used on a big scale. But chemicals may have detrimental effects not only on the consumer's health but also on the farmer himself (Sen *et al*., 2018). Hence, there is urgent need to develop an alternate approach to overcome these problems. One alternative approach is grafting. Grafting is a process in which the shoot portions of two separate plants of the same or different species are physically linked together and then grown as one plant. Grafting of commercial cultivars (scions) on selected tolerant rootstocks could be advantageous method for producing tomatoat suboptimal conditions (Krumbein, 2013).

Vegetable grafting has emerged as a potential and viable alternative to traditional breeding strategies for developing resistance to biotic and abiotic stressors, which are somewhat slow (Bahadur *et al*., 2015). It allows some genetic variants of specific species to be transferred, phenotype of scion is influenced by rootstock characteristics. The main advantage of grafted plant is the root system, which is stronger and more efficient in uptake of water and nutrients which indirectly improves yield. (Edelstein *et al*., 2017; Savvas *et al*., 2010; Schwarz *et al*., 2010). The genetic potential of various rootstocks in vegetable crops have

proven to be a better alternative to chemical sterilant to combating many soil borne diseases. Higher physiological activities like lipoxygenase activity, antioxidant content, membrane selectivity, osmotic adjustment, development of adventitious roots and arenchymatous tissuesin plants grafted on prospective rootstock provide broad insight into the mechanism of stress response and grafting is being advocated as a way to offset the negative effects of climate change on vegetable crop output and quality.

Compatibility is higher in intraspecific rootstock/ scion grafting than with interspecific grafting (Black *et al*., 2003). Intraspecific grafting is a good alternative toincrease resistance to various environmental stresses such as flood, drought, cold, heat and biotic stresses such as disease, insect and nematode. When environmental forces exceed intraspecific grafting, it can provide excellent benefits, whereas interspecific grafting can help to increase rootstock variability.

Material and Methods

Experimental Site

The field experiment was conducted at Tomato Improvement Scheme, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri. Dist.- Ahmednagar. State- Maharashtra, India 413 722 during year 2019-20 in Rabi season.

Treatments

The experiment was laid out in the Randomized Block Design (RBD) with three replications. There was total nine treatments of the experiment, as mentioned in Table 2. Two rootstocks such as *Solanum torvum*, RHRB-06 and three scion such as Phule Raja, Phule Kesari and NS-501 hybrids and varieties were used.

Seeds of both rootstock as well as scion were sown in protrays containing sterilized cocopeat to avoid the problem of uneven germination. The rootstock seeds were planted four weeks before the scion seeds.

Treatment wise, seedlings of various age were raised carefully. Drenching treatment applied whenever necessary for proper growth of seedlings. Splice grafting method was carried out when scion and rootstock seedling attained their respective height and girth. Grafting was done after 60 days of sowing of seeds of rootstock and 25 days of sowing of seeds of the scion. 1.6 mm silicon grafting clips were used for grafting. Grafted plants were placed in healing chamber to ensure high grafting success. They were kept in healing chambers with a relative humidity 85-90% and 28-32°C temperature for ten to twelve days to allow graft union.

The grafted seedlings were transplanted in the main plot 20 days after grafting, where each unit plot contained 32 seedlings with maintaining 90 × 45 cm spacing. Various intercultural operations such as irrigation, gap filling, weeding, staking, and plant protection measures were done when necessary for better growth of the plants.

Graft success observations was recorded at 7th, 14th and 21th days after grafting. It was calculated by number of plants alive to the total number of plants grafted multiplied by hundred and expressed in percentage. Five plants from each plot were selected for taking observations on growth and yield parameters. In growth parameters, plant height and number of branches were recorded at the time of last harvest. To obtain 50% flowering data, date on which 50% of the plants in the net plot showed the flowering was noted from the date of transplanting.

Data pertaining to the yield parameters *viz.* average fruit weight (g), number of fruits/ plant, polar diameter (cm), equatorial diameter (cm), pericarp thickness (cm), yield/plant (Kg), yield/ plot (Kg), Yield/ ha (t) were recorded.

Result and Discussion

Graft Success

The results revealed (Table-1) that there was considerable variation between the grafting success and it was in the range of 83.65 % to 89.96 %. Highest grafting success (89.96%) was observed in Phule Raja grafted on *Solanum torvum* (T1) which was at par with treatment (T3) NS 501 grafted on *Solanum torvum* (88.17 %), treatment (T5) Phule Kesari grafted on RHRB-06 (87.21%) and treatment NS 501 grafted on RHRB-06 (T6) (85.85 %). The minimum grafting success (83.65 %) was noted in Phule Raja grafted on RHRB-06 (T4) (Table 1). This might be due to better graft union and favorable conditions provided in the healing chamber. The above results are in similar with Rashid *et al.*(2004), Nkansanh *et al.* (2013) and Soe *et al*. (2018).

Growth Parameters

The results (Table-2) revealed that at harvest, Phule Raja grafted on *Solanum torvum* (T1) treatment gave the highest (123.80 cm) plant height among all the treatments which were at par with Phule Raja grafted on RHRB-06 (T4) (115.00 cm), whereas the lowest plant height (75.33 cm) was recorded in self rooted (non-grafted) Phule Kesari (T8). The above findings are consistent with results reported by Soe *et*

al. (2018) and Hossain *et al*. (2019). At harvest, Phule Raja grafted on *Solanum torvum* (T1) recorded the highest branches per plant (5.37), whereas the lowest branches per plant (4.20) were observed in self rooted Phule Kesari plants (T8) (Table 2). It could be owing to strong and deep root system of rootstock which is able to absorb nutrients, minerals and water efficiently causes vigorous growth of plant.

NS 501 grafted on RHRB-06 (T6) took the lowest number of days (25.33) for 50 per cent flowering as well as for first harvest (71.00), whereas highest number of days for 50 per cent flowering and first harvest were recorded in self-rooted (non- grafted) Phule Kesari (T8) (29.33) and (74.00) respectively (Table 2). The above results are in similar with results of Nkansanh *et al*. (2013), Kumar *et al*. (2016). Nkansanh *et al*. (2013) reported that grafted tomatoes require minimum number of days for 50% flowering and first harvesting than non- grafted plants.

Yeild Parameters

The results revealed that (Table-2) among all the treatments, Phule Raja grafted on *Solanum torvum* (T1) recorded maximum fruits per plant (34.06) and produced fruits with higher weight (79.30g) whereas minimum number of fruits per plant (27.73) and lowest weight of fruit was observed in self rooted Phule Kesari plants (T8) (73.03 g). The above results are in accordance with Nkansanh *et al*. (2013) and Soe *et al*. (2018). Nkansanh *et al*. (2013) reported that number of fruits per plant was greater on grafted plants and lowest on non-grafted plants. Soe *et al*. (2018) recorded that highest fruit weight was observed in the grafted tomato onto eggplant rootstock.

Phule Kesari grafted on *Solanum torvum* (T2) recorded maximum polar diameter (6.59 cm), whereas minimum polar diameter (5.44 cm) recorded in self rooted Phule Raja plants (T7). Mostly it is due to varietal character, as fruits of oval fruit variety had maximum polar diameter and fruits of round variety had minimum polar diameter. Phule Raja grafted on *Solanum torvum* (T1) recorded maximum equatorial diameter (5.16 cm), whereas self-rooted (non-grafted) Phule Kesari (T8) recorded minimum equatorial diameter (4.56 cm). Among all the treatments, Phule Kesari grafted on *Solanum torvum* (T2) recorded maximum pericarp thickness (0.63 cm), whereas self-rooted (non-grafted) NS 501 (T9) recorded minimum pericarp thickness (0.50 cm). T3 recorded maximum pericarp thickness due to its specific varietal character as it has thick pericarp fruits. The above results are in accordance with results reported by Negi (2016) who reported that rootstocks, grafting methods and scions affected pericarp thickness significantly.

Phule Raja grafted on *Solanum torvum* (T1) recorded highest yield per plant (2.70 kg), highest yield/ plot (86.47 Kg) and highest yield/ha (66.72 t) respectively. Lowest yield/ plant (2.01 Kg) recorded in self rooted (non-grafted) Phule Kesari plants. The above results are in accordance with results reported by Turhan *et al*. (2011), Ibrahim *et al*. (2014), Kumar *et al*. (2017) and Soe *et al.* (2018). The vigorous root system of rootstock is often capable of absorbing water and nutrients more efficiently than scion roots and serves as a good supplier of endogenous plant hormones and also enhanced accumulation of more food reserves to the sink.

Conclusion

It is concluded that Phule Raja grafted on *Solanum torvum* was found suitable for better growth and yield as it recorded maximum plant height, number of branches, average fruit weight, number of fruits/plant, yield/plant, yield/plot and yield/hectare. Considering the above points it can be concluded that 'Phule Raja' was found highly compatible with brinjal rootstock '*Solanum torvum*'. *Solanum torvum* is a vigorous rootstock having a good compatibility with the scion provides the best result in terms of growth and yield parameters.

Table 1: Effect of brinjal rootstock on tomato regarding graft success (%)

Tr. No	Treatment details	Graft Success (%)
T1	Phule Raja grafted on *Solanum torvum*	89.96
T2	Phule Kesari grafted on *Solanum torvum*	84.07
T3	NS 501 grafted on *Solanum torvum*	88.17
T4	Phule Raja grafted on RHRB-06	83.65
T5	Phule Kesari grafted on RHRB-06	87.21
T6	NS 501 grafted on RHRB-06	85.85
	S.E. (m) ±	1.42
	CD at 5%	4.28

Table 2: Effect of grafting on growth and yield parameters of tomato cultivars grafted on brinjal rootstock.

Tr. No.	Treatment details	Plant height (cm)	Number of branches	Days to 50% flowering	Days to first harvest	Number of fruits/plant	Average fruit weight (g)	Polar diameter (cm)	Equatorial diameter (cm)	Pericarp thickness (cm)	Yield /plant (kg)	Yield/ Plot (kg)	Yield/ ha (t)
T1	Phule Raja grafted on *Solanum torvum*	123.80	5.37	28.00	73.67	34.06	79.30	5.69	5.16	0.54	2.70	86.47	66.72
T2	Phule Kesari grafted on *Solanum torvum*	77.93	4.40	29.00	73.33	29.25	77.33	6.59	4.71	0.63	2.26	72.28	55.77
T3	NS 501 grafted on *Solanum torvum*	83.33	4.53	26.33	72.00	30.08	78.25	6.44	4.98	0.51	2.35	75.23	58.03
T4	Phule Raja grafted on RHRB-06	115.00	5.30	29.00	74.00	31.86	78.67	5.75	5.00	0.53	2.50	79.99	61.72
T5	Phule Kesari grafted on RHRB-06	76.67	4.33	28.33	73.67	26.24	75.41	6.56	4.57	0.62	2.03	63.24	48.80
T6	NS 501 grafted on RHRB-06	80.00	4.40	25.33	71.00	28.35	76.08	6.16	4.98	0.51	2.15	68.79	53.07
T7	Control (Phule Raja)	103.37	5.17	28.00	73.67	29.17	76.47	5.44	5.10	0.53	2.23	71.23	54.96
T8	Control (Phule Kesari)	75.33	4.20	29.33	74.00	27.73	73.03	6.34	4.56	0.62	2.01	64.61	49.84
T9	Control (NS 501)	78.53	4.40	26.00	72.00	28.23	74.14	6.13	4.83	0.50	2.09	66.75	52.01
	S.E. (m)±	2.95	0.21	0.47	0.62	0.32	0.40	0.22	0.13	0.09	0.03	0.99	0.79
	CD at 5%	8.87	0.63	1.41	1.87	0.96	1.21	0.68	0.39	0.27	0.09	2.97	2.37

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