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Comprehensive Study of Compatibility and Performance of Grafted Brinjal

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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

In this report, we have studied graft compatibility of five scion cultivar Pusa Shyamala, Pusa hybrid - 6, Pusa Kranti, Mahy 80 and Gopi 75 when grafted onto Kavach and CO2. As per data two scion, Mahy 80 and Gopi 75 when grafted on Kavach and CO2 showed maximum graft success from 82 to 88%. Moreover, in field experiment was having six treatments i.e. Mahy 80 grafted on Kavach, Mahy 80 when grafted on CO2, Gopi 75 grafted on Kavach, Gopi 75 grafted on CO2, Mahy 80 (non-grafted), Gopi 75 (non-grafted) with five replications. Among all treatments graft combination of Mahy 80 onto Kavach significantly enhanced plant height of 33.13, 56.84 and 78.07 cm at 30, 60

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and 90 DAT respectively. Similarly, Mahy 80 onto Kavach reported maximum number of branches per plant, average fruit weight (153.14 g), fruit yield per plant (1.50 kg plant-1), fruit yield per hectare (41.75 t ha-1) while earliness in terms of days to first harvest (67.24 days) and maximum number of fruits per plant (13.13) was reported in Gopi 75 grafted onto Kavach. Therefore, we claim that for Mewar region scion Mahy 80 onto Kavach rootstock will be suitable grafted seedling of brinjal.

Keywords: Brinjal; grafting; growth; rootstock; scion.

1. INTRODUCTION

Brinjal (*Solanum melongena* L.), being a member of the family Solanaceae with India or Indo-China origin, is the fifth most economically important solanaceous crop in the world after potato, tomato, pepper and tobacco, with a production of 58.68 lakh metric tons in the 19.63 lakh ha area of the world during 2021–22 [1,2]. It is widely grown in India with varied shape, size, and colour and it is a rich source of Ca, P, Fe and vitamins.

There are already high-yielding cultivars available, but global climate change affects production, and there is a need to provide resistance against biotic and abiotic stress to these cultivars. Moreover, the introduction of resistant genes in a new variety or hybrid is a difficult and time-consuming procedure. To overcome this, vegetable grafting emerged as an acceptable alternative to this laborious and time-consuming classical breeding program [3,4,5,6]. In the late 1950s, brinjal grafting was initiated by grafting onto wild solanum rootstock [3]. Grafting enhance growth, yield and quality of many vegetables due to vigorous root system and adaptive nature of rootstock that efficiently enhance the nutrient and water uptake [7]. It provides the resistance to biotic and abiotic stresses such as soil borne pathogen, salinity, alkalinity, drought, flooding, high temperature and heavy metals [8,9,10,11]. Due to this, it is also treated as viable alternative of chemical control and reduced the dependency on chemical residue and it is safer for environment [12,13].

Taking these points into consideration, the present experiment was designed to assess the compatibility of different brinjal varieties grafted on wild rootstock (brinjal) and compared growth, yield and quality parameters.

2. MATERIALS AND METHODS

The present investigation was conducted during February to June 2024 at Horticulture farm, Department of Horticulture, Rajasthan College of Agriculture, Udaipur which is situated at 24˚35' N latitude 74˚42' E longitude at 585.17 meters above the mean sea level. The seeds of rootstocks and scions were purchased from Vivek Traders, Udaipur. As depicted in Fig. 1, to raise the seedlings seeds were first soaked in water for one night and then planted in portrays (540 mm x 280 mm) filled with sterilized cocopeat, perlite and vermiculite (3:1:1). In order to ensure synchronized growth, the rootstock seeds were sown four weeks ahead of the scion seeds. The rootstock comprised of 55-60 days of growth having 3-4 leaves while scion, with 20-25 days old seedling growth, were on two leaves stage. During grafting stem diameter should be 2.33 mm measured with the help of vernier. The most commonly grafting method employed was cleft grafting done during evening hours. In present investigation two cultivated hybrids viz., Mahy-80 and Gopi-75 were grafted onto the two rootstocks Kavach and CO2 while for control non grafted seedlings of Mahy-80, and Gopi-75 were used. The grafted seedlings were transferred to plastic boxes and kept in dark, water should be sprayed daily with spray bottle to maintain the relative humidity upto 95% for 5 – 6 days which allows the graft union to heal. After successful healing, grafted plants exposed to sunlight for half an hour and exposure time gradually increased for 3-4 days. Then the healed grafts were transferred to normal nursery and further healing for a week under shade. Before transplanting the grafts were gradually exposed to direct sunlight for three to four days before transplanting. In experiment I, 100 grafts of each graft combination were used to check compatibility and graft success, evaluation of this experiment was laid out in CRD (completely randomized design) with 5 replications in which graft combination of Mahy 80 onto Kavach, Gopi 75 onto Kavach, Mahy 80 onto CO2 and Gopi 75 onto CO2 were found compatible (Table 1).

The graft success (%) was recorded on 5, 10 and 15 days after grafting based on wilting of the grafts and drying of healing region. The died plants were discarded and percentage of remaining successful graft was calculated by following formula:

$$\text{Graft Success \%} = \frac{No.\ of\ grafts\ survived}{Total\ no.\ of\ grafts\ applied} \times 100$$

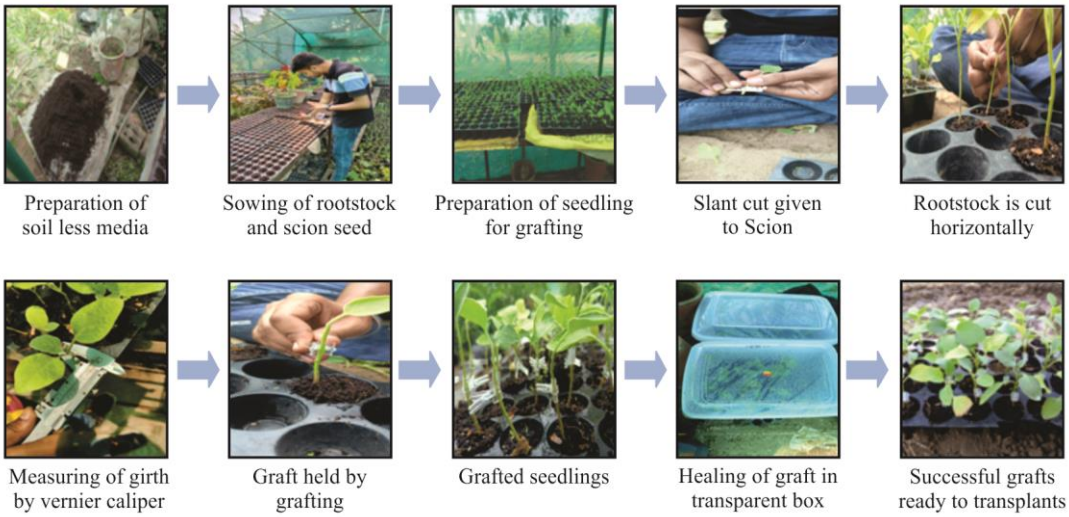

Fig. 1. Procedure of grafting

Table 1. Assessment of graft compatibility of brinjal variety grafted on brinjal rootstock

Treatments	Total number of grafts applied (DAG)	Graft Success (%)	Status of compatibility
Pusa Shyamala on Kavach	100	0	NC
Pusa hybrid - 6 on Kavach	100	0	NC
Gopi 75 on Kavach	100	81.8	C
Pusa Kranti on Kavach	100	0	NC
Mahy 80 on Kavach	100	83.56	C
Pusa Shyamala on CO2	100	0	NC
Pusa hybrid - 6 on CO2	100	0	NC
Gopi 75 on CO2	100	87.2	C
Pusa kranti on CO2	100	0	NC
Mahy 80 on CO2	100	86.14	C

**C – Compatible; NC – Non Compatible*

The present investigation was arranged in six treatments consisting of grafted plants, both the cultivars and their non- grafted (control) was laid out in RBD with 5 replications accommodating 12 plants in each plot (2.4m × 1.8m) with spacing (60cm × 60cm). Therefore, experiment was planted on April 2024. The recommended dose of fertilizer at the rate of 150:100:150 (NPK kg ha^{-1}) was applied to the crop. Half a dose of nitrogen and full doses of phosphorus and potash fertilizers were applied at the time of transplanting as a basal dose and other half dose of nitrogen was top dressed in a single dose after 30 days of transplanting. Irrigation was given at an interval of 4 to 5 days depending on soil moisture and climatic conditions. Earthing up was done 30 days after transplanting. Plant protection measures were taken regularly to protect crop from pest and disease infection.

The growth parameters like plant height (cm) and number of branches per plant at 30, 60, 90 and 120 DAT, number of days taken for 50% flowering was recorded when 50% plant population flowered after days of transplanting and days to first harvest were recorded by counting date of transplanting to date of first harvesting done from the five selected tagged plants. For yield attributes, five fruits were selected from five tagged plant in each replication and mean was worked out for fruit diameter (cm), average fruit weight (g), number of fruits per plant and fruit yield per plant (kg $plant^{-1}$) and yield per hectare (t ha^{-1}).

2.1 Statistical Analysis

The data pertaining to graft compatibility (Experiment I) was analyzed by using

Completely Randomized Design (CRD) and field experiment of compatible graft for growth, yield and quality (Experiment II) was analyzed by using Randomized Block Design (RBD) with five replications. The level of significance was noticed at p = 0.05 to determine the significant difference [14].

3. RESULTS AND DISCUSSION

3.1 Effect of Graft Compatibility of Rootstock on Scion

In present investigation graft success of scion on two rootstock Kavach and CO2 was carried out and on the basis of data (Table 2) revealed that significantly higher graft success (87.20%) was recorded in Gopi 75 grafted on CO2 and the lowest graft success of 81.80% was recorded in Gopi 75 grafted on Kavach. Grafting success depends on the union of the grafts (rootstock and scion) and its compatibility. Further, for better healing proper humidity should be maintained in transparent box, this could be the result of improved vascular tissue union at the graft union [4]. These findings are consistent with those of Arwiyanto et al [15], who found that the success rates for grafting were 85% and 95% for tomato and eggplant scions, respectively.

3.2 Effect of Grafting on Growth Parameters

Data presented in (Tables 3 and 4) stated that grafting in brinjal had significantly affected the growth parameters, plant height (cm) and no. of branches at different growth stages that was 30, 60, 90 and 120 DAT as compared to control (non-grafted scion Gopi 75 and Mahy 80 plants). Grafting of scion Mahy 80 grafted onto Kavach have highest plant height 33.13 cm, 56.84 cm, 78.07 cm and 92.12 cm at 30, 60, 90 and 120 DAT. Similarly, maximum no. of branches 4.73, 14.81 and 18.44 at 30, 90 and 120 DAT was recorded in Mahy 80 grafted onto Kavach but at 60 DAT, maximum number of branches (10.11) was recorded in Gopi 75 grafted onto CO2 (Table 4). Grafted plants are superior in terms of vegetative growth because their rootstocks have vigorous root system and it is more efficient in water and mineral uptake [12]. As per result Kavach rootstock have robust root system with good water and mineral uptake. This result supports the research findings of Lee and Ioannou [12,16], who observed that grafted plants exhibited greater height and vigor in comparison to self-rooted ones.

Table 2. Effect of graft combination on graft success (%) of brinjal

Treatments	Graft success (%)
Gopi 75 grafted on Kavach	81.8
Mahy 80 grafted on Kavach	83.56
Gopi 75 grafted on CO2	87.2
Mahy 80 grafted on CO2	86.14
SE(m)±	0.693
CD @ 5%	2.09

Table 3. Effect of rootstock and scion graft combination on plant height (cm) at different growth stages in brinjal

Treatments	30 DAT	60 DAT	90 DAT	120 DAT
Gopi 75 grafted on Kavach	29.98	54.89	75.9	86.54
Mahy 80 grafted on Kavach	33.13	56.84	78.07	92.12
Gopi 75 grafted on CO2	29.7	54.76	75.2	85.38
Mahy 80 grafted on CO2	29.84	56.31	77.11	89.25
Gopi 75 non grafted control	30.37	53.74	73.87	83.64
Mahy 80 non grafted control	31.17	54.3	74.56	85.18
SE(m)±	0.26	0.354	0.867	0.837
CD @ 5%	0.767	1.043	2.557	2.469

**DAT – Days after transplanting*

Table 4. Effect of rootstock and scion graft combination on number of branches per plant at different growth stages in brinjal

Treatments	30 DAT	60 DAT	90 DAT	120 DAT
Gopi 75 grafted on Kavach	3.52	8.57	13.97	16.68
Mahy 80 grafted on Kavach	4.73	9.74	14.81	18.44
Gopi 75 grafted on CO2	3.76	10.11	12.85	15.76
Mahy 80 grafted on CO2	4.18	9.27	13.14	16.18
Gopi 75 non grafted control	3.39	8.09	11.98	13.74
Mahy 80 non grafted control	3.2	8.63	12.21	13.81
SE(m)±	0.034	0.109	0.128	0.169
CD @ 5%	0.099	0.32	0.376	0.499

**DAT – Days after transplanting*

Table 5. Effect of rootstock and scion graft combination on days to 50 % flowering (DAT) and days to first harvest (DAT) in brinjal

Treatments	Days to 50% flowering	Days to first harvest
Gopi 75 grafted on Kavach	49.8	67.24
Mahy 80 grafted on Kavach	49.85	68.35
Gopi 75 grafted on CO2	49.87	68.26
Mahy 80 grafted on CO2	49.94	69.59
Gopi 75 non grafted (control)	50.07	71.15
Mahy 80 non grafted(control)	50.13	71.91
SE(m)±	0.605	0.611
CD @ 5%	NS	1.804

**DAT – Days after transplanting*

Table 6. Effect of grafting on yield parameters in brinjal

Treatments	Fruit diameter (cm)	Average fruit weight (g)	No. of fruits plant^{-1}	Fruit yield plant^{-1} (kg plant^{-1})	Fruit yield ha^{-1} (t ha^{-1})
Gopi 75 grafted on Kavach	4.12	107.54	13.13	1.41	39.23
Mahy 80 grafted on Kavach	5.89	153.14	9.81	1.5	41.75
Gopi 75 grafted on CO2	4.31	105.96	12.63	1.34	37.16
Mahy 80 grafted on CO2	6.08	150.29	9.15	1.38	38.2
Gopi 75 non grafted (control)	3.92	101.64	12.31	1.25	34.75
Mahy 80 non grafted (control)	5.81	143.31	8.77	1.26	34.92
SE(m)±	0.05	1.22	0.14	0.03	0.76
CD @ 5%	0.13	3.6	0.42	0.08	2.24

3.3 Effect of Grafting on 50 % Flowering and Days to First Harvest in Brinjal

The data presented in (Table 5), it was recorded that there is no significant difference were seen in days required for flowering and it ranges between 49-50 days while minimum days to first harvest was observed in Gopi 75 grafted on Kavach (67.24 days) as compared to Mahy 80 non grafted (71.91 days). As Gopi 75 is an early maturing hybrid, harvesting occurs earlier than other scion. According to Soe et al [17], grafted plants develop reproductively earlier and harvest earlier than non-grafted plants, making earliness an essential factor in commercial agriculture.

3.4 Effect of Grafting on Yield in Brinjal

In present investigation yield parameter (Table 6) of grafted brinjal parameters *viz.* fruit diameter (6.08 cm), average fruit weight (153.14 g), fruit yield per plant (1.50 kg plant^{-1}), fruit yield per hectare (41.75 t ha^{-1}) were recorded significantly higher in scion cv. Mahy 80 grafted onto Kavach as compared to non-grafted scion (control) and scion that grafted onto CO2. While higher number of fruits per plant was 12.63 recorded in Gopi 75 grafted onto CO2 because Gopi 75 is

elongate shaped cultivar and bears more fruits of less weight and diameter compare to cv. Mahy 80. Increased yield of brinjal is due to improved absorption of water and nutrients, vigorous and deep root system, which allows a good supply of endogenous hormones, improved nutritional status, increased assimilation of CO_2 and soil water [18,19,20,21] and results in increased number of fruits and fruit yield. Similar results in brinjal were found by Kumar et al [22], who reported that grafted "Surati Ravaiya Purple" (44.46 t ha^{-1}) had the highest yield followed by self rooted "Surati Ravaiya Purple" (31.67 t ha^{-1}) whereas the lowest yield (17.60 t ha^{-1}) was recorded in control self rooted “Surati Ravaiya Pink”.

4. CONCLUSION

The present investigation revealed that grafting Mahy 80 scion when grafted on Kavach rootstock significantly increased overall growth, crop duration and yield with graft success (83.56%) and therefore, using Kavach as rootstock would be a potential tool for achieving higher performance of brinjal even in biotic and abiotic stress.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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