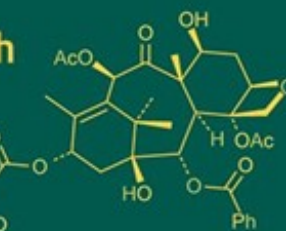
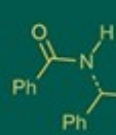


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Compatibility of bitter gourd grafts on various cucurbitaceous rootstocks during the summer of 2026

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ABSTRACT

The study was conducted for graft compatibility between bitter gourd commercial hybrid scions (S_1 , S_2 and S_3) grafted on Bottle gourd (*Pusa Navin* & *Samrat*), Pumpkin (*Arka Chandan* & *Arka Suryamukhi*) and Sponge gourd (*Phule Komal* & *Phule Prajakta*) rootstocks at AICRP on vegetable crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri during summer 2026. Graft compatibility was determined by evaluating the number of days taken to reach grafting stage, girth of scion and rootstock at time of grafting, days taken for graft healing, percent of grafting success and days required for transplanting. There were non-significant differences have been observed in the parameters of scions and rootstocks except days taken for germination of rootstocks. In the parameters of grafted plants. Among the rootstocks *Arka Chandan* (8.34), in the scions, S_2 (8.53) and in the interaction, S_2 grafted on *Arka Chandan* recorded the minimum days (7.97) for graft healing. In the rootstocks, *Samrat* (90.53%) and among the scion, S_3 (90.08%) and in the interaction S_2 grafted on *Samrat* (97.23%) recorded maximum percentage of graft success. The *Phule Komal* recorded minimum days (25.92) among the rootstocks and in the scions, the S_2 (26.04) and in the interaction S_2 grafted on *Phule Komal* recorded significantly minimum day (25.29) to attain transplanting.

Keywords: Graft compatibility, Bitter gourd, Bottle gourd, Pumpkin, Sponge gourd

Introduction

Bitter gourd (*Momordica charantia* L.) is a popular warm season vegetable belonging to the family Cucurbitaceae and chromosome number is $2n = 2x = 22$. It is cultivated throughout the country for its immature fruits which are used as vegetable.

The bitter gourd crop cultivated over an area of 1981.77 thousand ha in India with annual production of 147.33 thousand MT and the productivity is 12 t/ha of varieties and 25 t/ha of hybrids (Annon. 2024).

When cucurbit crops are cultivated under abiotic stress conditions such as low temperature, excessive moisture, drought, and low light, their growth and productivity often decline, and their susceptibility to diseases increases. Due to climate change and the growing global population, the demand for sustainable and nutritious vegetable production is increasing significantly. Conventional intensive farming practices that rely heavily on fertilizers, pesticides, and irrigation can have adverse effects on soil health, water quality, and the environment. Consequently, there is an increasing emphasis on sustainable practices that reduce the use of chemical inputs and promote soil health. Vegetable grafting, which involves joining a rootstock and a scion, is a promising technique for enhancing crops' ability to withstand environmental stresses and for increasing productivity (Dabhade *et al.*, 2026) [1].

Compatibility is higher in intraspecific rootstock and scion grafting than with interspecific grafting (Black *et al.*, 2003) [2].

Against the backdrop of a lack of information regarding the benefits of grafting onto various rootstocks and the compatibility between the scion and the rootstock, this experiment was designed to evaluate the grafting compatibility of bitter gourd with various cucurbitaceous rootstocks.

Material and Methods**Experiment site**

The research trial was conducted at All India Co-ordinated Research Project on vegetable crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri during summer 2026.

Experiment material

The experimental materials consisted of six rootstocks of cucurbitaceous crops which were Bottle gourd (*Pusa Navin* & *Samrat*), Pumpkin (*Arka Chandan* & *Arka Suryamukhi*) and Sponge gourd (*Phule Komal* & *Phule Prajakta*) and three commercial hybrids of bitter gourd as scions, indicated as S_1 , S_2 and S_3 . Seeds of

scions were sown three days before rootstock seeds in sterilized coco-peat-filled pro-trays.

Procedure of single cotyledon grafting in bitter gourd

The grafting was performed under the shade net house allowing only 25% sunlight and relatively low temperature near about 24 to 27 °C with high humidity (60 to 70%) than the outside environment. Rootstock seedlings were grafted at the cotyledon to first true-leaf stage, while scions were used at the true leaf stage. An oblique cut at approximately 35-45° was made on both rootstock and scion's hypocotyl, ensuring a close match in cut length and stem diameter. The scion was carefully attached onto the rootstock and secured with a grafting clip to maintain firm contact and facilitate graft union formation and support with the thin bamboo stick. Grafting was performed during the morning and evening hours, and the grafted seedlings were maintained under transparent polythene moist chambers to promote successful healing and establishment.

A) Rootstock and scion parameters

Days taken for germination: The observation was recorded at every-day by visual observation and date on which seedling emerged was noted, average days taken for germination were calculated.

Days taken to reach grafting stage: Seedlings were randomly selected and evaluated based on stem diameter, leaf number and time required to attain the appropriate grafting stage.

Stem diameter at time of grafting: The stem diameter of both scions and rootstocks was measured at the time of grafting using a digital Vernier Calliper.

B) Observations of grafted plants

Days taken for graft healing: Grafted seedlings were randomly selected and examined after five days of grafting by removing the grafting clips. The average number of days required for complete healing of the graft union was recorded.

Graft success (%): Grafting success was assessed 15 days after grafting (DAG). The percentage of successful grafts was calculated as:

$$\text{Graft success (\%)} = \frac{\text{Number of successful grafts}}{\text{Total number of plants grafted}} \times 100$$

Days required for transplanting: The number of days from grafting to transplanting was recorded for each treatment, and the mean duration required for transplanting was calculated.

Statistical analysis

The data obtained during the experiment were analysed as per the statistical methods prescribed by Panse and Sukhatme (1995) to obtain valid conclusions. The treatments were compared using the critical difference at a 5% level of significance.

Results and Discussion

Rootstock and scion parameters

Days taken for germination, Days taken to reach grafting stage and Stem diameter at grafting time in bitter gourd.

The mean data about days taken to germination, days taken to reach the grafting stage, and diameter of scion and rootstock in bitter gourd are depicted in Table 1.

Statistically non-significant differences have been observed in these parameters of scions and rootstocks except days taken for germination of rootstocks, that noted significant result.

For days taken for germination, about 10 days has been taken by scions and 8 days by rootstocks excepts Samrat and Phule Prajakta, these took 9 days and from those variations also noted in the days taken to reach grafting stage *i.e.*, 10 to 13 days in both scions and rootstocks.

Cucurbits (vine crops) are warm-climate crops, and seed germination is a crucial factor in their cultivation. Seed germination depends on temperature, moisture, gases etc. The most suitable temperature for seed germination and growth is 20-25 °C. The seed germination is af-

fected above 30 °C, due to this increase the average time required for germination as well as hard/ thick seed coat and high oil content are the major problems associated with delayed seed germination.

The stem girth of scions and rootstocks was about 2.26 to 2.75 mm at the time of grafting. The diameter of the rootstock and the scion at the collar region is a crucial factor for the success of the graft and the formation of the union, this is because this diameter ultimately determines the health, growth, and survival capacity of the grafted plants in the field. The finding is consistent with Yetisir *et al.* (2003) [3], Tamilselvi *et al.* (2017) [4], Balaji (2021) [5], Shirisha *et al.* (2022) [6], Choudhary *et al.* (2025) [7] and Dabhade *et al.* (2026) [1].

B. Observations of grafted plants

The observation of grafted plants was recorded after grafting and before the transplanting.

Days taken for graft healing

The mean data about the effect of bitter gourd scion grafted on different rootstocks on days taken to graft healing is presented in Table 2.

The mean value of rootstock observed significant differences and non-significant result observed in the scions and interaction for days taken for graft healing in summer season.

Among the rootstocks Arka Chandan recorded significantly minimum days (8.34) which were at par with Arka Suryamukhi and Samrat. In the scions, the S₂ (8.53) also recorded minimum days for graft healing. In the interaction, S₂ grafted on Arka Chandan recorded the minimum days (7.97). Whereas, maximum days has been observed in S₃ grafted on Phule Prajakta (9.05) for graft healing.

The duration needed for graft healing varies based on the developmental stage of the rootstock and scion, as well as the prevailing atmospheric conditions. According to findings the formation of graft union beings with a number of events such as multiplication and proliferation of the callus from the scion and rootstock, formation of a callus bridge, vascular separation and production of the xylem and phloem (Hartman *et al.*, 2011) [8], Balaji (2021) [5], Shirisha *et al.* (2022) [6], Dolas *et al.* (2023) [9] Choudhary *et al.* (2025) [7] and Dabhade *et al.* (2026) [1] also reported similar results.

Graft Success (%)

The mean data about the effect of bottle gourd scion varieties grafted on different rootstocks on days taken to graft success (%) is presented in Table 3.

The significant differences have been observed in the graft success of bitter gourd grafted onto different rootstocks.

In summer 2026, among the all rootstocks Samrat (90.53%) and among the scion, S₃ (90.08%) recorded maximum percentage of graft success. While, about interaction the S₂ grafted on Samrat (97.23%) followed by S₃ grafted on Phule Prajakta. Unlike, S₁ grafted on Samrat recorded minimum percentage (85.27%) of graft success.

The success of grafting depends on several factors; these include the graft union, graft compatibility, and the combination of the scion and rootstock (Kawaguchi *et al.*, 2008) [10], Factors such as the age of the plant, post-grafting care, the size of the scion and rootstock, cultivation conditions, the grafting method, differences in tissue and structure, physiological and biochemical properties, the growth stages of the rootstock and scion, phytohormones, and the environment play a significant role (Davis *et al.*, 2008) [11]. The success of the grafting process also depends on weather conditions, and variations are observed across different regions within the same season. This seasonal impact is primarily due to the influence of temperature and humidity during that period (Tamilselvi *et al.*, 2015) [12]. The current observations correspond with Balaji (2021) [5], Shirisha *et al.* (2022) [6], Dolas *et al.* (2023) [9], Choudhary *et al.* (2025) [7] and Dabhade *et al.* (2026) [1].

Days to attain transplanting

The mean data about the effect of bottle gourd scion varieties grafted on different rootstocks for days required for transplanting is presented in Table 4.

Regarding days to attain transplanting the result showed significant differences in summer season of 2026.

The Phule Komal recorded significantly minimum days (25.92) among the rootstocks and in the scions, the S₂ recorded significantly minimum days (26.04). Whereas, in the interaction S₂ grafted on Phule Komal recorded significantly minimum day (25.29) and maximum days has been recorded in S₃ grafted on A. Suryamukhi (27.23) days to attain transplanting.

The grafted plants ready for transplanting is depend upon the time period required for graft healing, proper functional state of the rootstock

and scion, time required for joining of vascular bundles, maintenance of the grafted plants as well as skill of the grafting person, weather condition at the time of grafting, temperature, light, relative humidity, nutrients available in soil media and quantity of water supply to grafted plants in the grafting chamber. Similar observations were reported by Balaji (2021) [5], Shirisha *et al.* (2022) [6], Dolas *et al.* (2023) [9], Choudhary *et al.* (2025) [7] and Dabhade *et al.* (2026) [1].

Table 1. Days taken for germination, Days taken to reach grafting stage and Stem diameter at grafting time in bitter gourd.

Crop Name	Scions & Rootstocks	Days taken for germination	Days taken to reach grafting Stage	Girth of scions and rootstocks at grafting time
Bitter gourd	S ₁	10.67	13.76	2.75
	S ₂	10.63	13.61	2.34
	S ₃	10.33	13.64	2.48
	S.Em (+)	0.35	0.48	0.11
	CD (5%)	NS	NS	NS
Bottle gourd	Pusa Navin	8.33	10.28	2.27
	Samrat	9.33	10.61	2.48
Pumpkin	A. Chandan	8.33	11.11	2.56
	A. Suryamukhi	8.00	10.64	2.83
Sponge Gourd	Phule Komal	8.33	10.71	2.36
	Phule Prajakta	9.10	10.87	2.26
	S.Em (+)	0.29	0.29	0.15
	CD (5%)	0.89	NS	NS

Table 2. Effect of grafting on days taken for graft healing in bitter gourd

Rootstocks	Pusa Navin	Samrat	Arka Chandan	Arka Suryamukhi	Phule Komal	Phule Prajakta	Mean
Scions							
S ₁	8.84	8.50	8.40	8.54	9.03	8.58	8.65
S ₂	8.81	8.54	7.97	8.60	8.65	8.60	8.53
S ₃	8.57	8.57	8.67	8.36	8.72	9.05	8.66
Mean	8.74	8.54	8.34	8.50	8.80	8.74	
	S		R		S x R		
S.Em (+)	0.08		0.11		0.18		
CD (5%)	NS		0.31		NS		

Table 3. Effect grafting on graft success (%) in bitter gourd

Rootstocks	Pusa Navin	Samrat	Arka Chandan	Arka Suryamukhi	Phule Komal	Phule Prajakta	Mean
Scions							
S ₁	88.73	85.27	85.60	89.03	91.70	86.03	87.73
S ₂	85.50	97.23	92.90	89.97	87.80	86.53	89.99
S ₃	88.07	89.10	93.03	86.07	89.40	94.80	90.08
Mean	87.43	90.53	90.51	88.36	89.63	89.12	
	S		R		S x R		
S.Em (+)	0.28		0.40		0.69		
CD (5%)	0.81		1.14		1.98		

Table 4. Effect grafting on days to attain transplanting in bitter gourd

Rootstocks	Pusa Navin	Samrat	Arka Chandan	Arka Suryamukhi	Phule Komal	Phule Prajakta	Mean
Scions							
S ₁	27.08	27.10	26.41	27.12	25.35	25.43	26.41
S ₂	26.91	25.41	26.18	27.10	25.29	25.35	26.04
S ₃	27.16	27.02	26.08	27.23	27.14	27.12	26.96
Mean	27.05	26.51	26.22	27.15	25.92	25.96	
	S		R		S x R		

(continued on next page)

Rootstocks	Pusa Navin	Samrat	Arka Chandan	Arka Suryamukhi	Phule Komal	Phule Prajakta	Mean
Scions							
S.Em (+)	0.08		0.11		0.18		
CD (5%)	0.22		0.31		0.53		

Conclusion

The study concluded that, bottle gourd, pumpkin and sponge gourd were highly compatible with the commercial hybrids of bitter gourd S₁, S₂ and S₃. It was observed that, the pumpkin took less time for graft healing, bottle gourd rootstocks had highest graft success percentage and sponge gourd took minimum number of days for transplanting.

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