Original Research Article

Effect of different rootstocks and scions compatibility study on *Rosa* sp

ABSTRACT

An investigation entitled, “Effect of different rootstocks and scion compatibility study on *Rosa* sp.’’ was conducted to study the graft compatability and growth performance of grafted rose plants and the experiment was conducted in Vegetable Research Station, Tamil Nadu Agricultural University, Palur, Cuddalore district, Tamil Nadu during the year 2022. It was carried out using completely randomized design (CRD) with fifteen treatments (T1- Andhra red rose + Dog rose, T2-Andhra red rose + Button rose, T3-Andhra red rose + Ebb tide rose, T4- Andhra red rose +Fairy rose, T5- Andhra red rose + Edward rose, T6- Edward rose+ Dog rose, T7-Edward rose + Button rose, T8-Edward rose+ Ebb tide rose, T9-Edward rose + Fairy rose, T10-Edward rose+ Edward rose, T11-Damask rose + Dog rose, T12-Damask rose + Button rose, T13-Damask rose + Ebb tide rose, T14-Damask rose+ Fairy rose, T15-Damask rose+ Edward rose) and two replications. The results indicated a significant difference between the different treatment combination for graft union, success percentage, survival percentage, plant height (cm), leaf length (cm), leaf width (cm), days taken for leaf initiation. The experiment data revealed that the maximum graft success (90) and graft survival percentage (80), length of leaves (3.9 cm) and plant height (67.6) was recorded in the treatments T7 (Edward rose + Button rose). It can be concluded that the combination of rootstock as Edward rose and scion as Button rose is said to be most compatible and can be recommended for commercial cultivation.

Keywords*:* Grafting, Graft union, Graft compatability, *Rosa species,* Rootstock, Scion.

INTRODUCTION

Rose is the most well-known flower and is appropriately referred to as the "Queen of flowers". The rose is the most well-known flower in the world due to its extensive history, cultural significance, symbolism, beauty, colour, fragrance, and overall beautiful form. Rose occupies first position in international flower trade Gajraj *et al.,* (2022) [1]. The word Rose is derived from the word Eros which comes from Greek god for love. It represents love, companionship, sincerity, romance, grace and spirituality (Hummer and Jenick, 2009) [2]. Extensive farming practises developed by the Egyptians, Chinese, Greeks, and Romans 5000 years ago. Missionaries introduced Chinese roses to Europe in the fifteenth century. There are thousands of cultivars, more than 200 species, and roughly 150 species that have been identified under the genus Rosa. It was difficult to describe when rose cultivation first started in India. Roses are woody perennials that come in an array of sizes. They are very diverse in their growth habits, flower forms, colours, and flowering times. Rose plants have prickle-covered, erect, clinging, and trailing stems. There are several species of rose plants, some of which are deciduous and some of which are evergreen. Roses, popular as cut flowers, pot plants, and garden shrubs, are the most economically significant group of ornamental horticultural plants (Roberts, Debener, & Gudin, 2003) [3]. Due to its long history of cultivation and popularity, vast amounts of information exist on its breeding, cultivation, propagation, and rootstock selection. Roses are conventionally propagated by cuttings, budding, grafting, and layering. The easiest way to increase the ideal rose types would be through cuttings and budding.

Grafting is a method of rose propagation in which a small piece of one rose gets fused onto another. Garner (2013) [4] provides a comprehensive list of traditional grafting methods. The quick and simple method of growing roses is grafting. The scion is the upper part, and the rootstock or stock, is the lower part, A technique when a rose bud-eye or cutting is grafted onto a rootstock from a different variety. This is typically done because the host plant is more disease-resistant or

the rose on which the graft is made is stronger and can withstand more stress. Grafting has been extensively utilised to explore signal transduction pathways, flowering regulation, and substance transport within plant tissues. Grafting can also be used to create rose bushes with flowers of more than one colour. To generate stronger plants that can withstand winter, two rose plants should be grafted (connected together). Rose plant responses to various grafting methods. Presently, several grafting techniques, such as side, cleft, notch, wedge, and splice grafting, are practised in horticultural crops. When compared to producing rooted cuttings, this form of propagation is easy and cost-effective. For grafting, it's crucial to choose the right rootstock and scion. A better success rate is likely to be achieved with healthy rootstock growth and proper grafting techniques. The most important aspect in determining the success and establishment of grafts is thought to be the timing of vegetative propagation. A scion or bud eye has been grafted onto the stem and root system known as the "rootstock." Understock and rootstock are two different terms for the same thing. A rose rootstock can affect the scion's growth and development in a variety of ways. The most crucial factors include climatic variables, disease resistance, plant longevity, compatibility, vigour, productivity, and flower quality (Edwards, 1955) [5]. Other factors include adaptation to specific pH values and soil drainage conditions. Commonly used rootstocks in roses are *Rosa bourboniana*, *Rosa multiflora,* and *Rosa indica*. Due to its widespread availability, the rose has been a part of people's daily lives through its decorative applications in parks, gardens, and homes, its presence on the most solemn occasions of life, and its usage in nutrition, perfumes, natural medicine, literature, art, architecture, and a variety of other fields (Selaru, 1998) [6]. One of the most well-known genera of ornamental plants, Rosa sp., has consistently been marketable and in great demand over the years (Nybom and Werlemark 2017) [7].

MATERIAL AND METHODS

The research was carried out in Vegetable Research Station, Tamil Nadu Agricultural University, Palur, Cuddalore district, Tamil Nadu during the year 2022. The Experiments were conducted to study the graft compatability and the growth performance of grafted rose plants. using 3 different rootstocks with 5 different scions was laid out in Completely Randomized Design (CRD) and a total of 15 treatments combinations are T1- Andhra red rose + Dog rose, T2-Andhra red rose + Button rose, T3-Andhra red rose + Ebb tide rose, T4- Andhra red rose +Fairy rose, T5- Andhra red rose + Edward rose, T6- Edward rose+ Dog rose, T7-Edward rose + Button rose, T8-Edward rose+ Ebb tide rose, T9-Edward rose + Fairy rose, T10-Edward rose+ Edward rose, T11-Damask rose + Dog rose, T12-Damask rose + Button rose, T13-Damask rose + Ebb tide rose, T14-Damask rose+ Fairy rose, T15-Damask rose+ Edward rose consisting of 2 replications per combination with 5 plants in each replication calculating 150 plants grafted.

collection of rootstocks

Rootstocks are one of the crucial components in the propagation of roses through grafting techniques, as they impart essential characteristics such as disease resistance, vigour, and adaptability to various soil conditions. About 30-60 cm long semi-hard-wood rooted cuttings of pencil thickness were selected for the study. Selected rootstocks are free from pest and disease. 4 to 5month old healthy rootstocks were collected from the private nursery located in Coimbatore.

collection of scions

For a successful graft and the development of a strong rose plant, choosing the appropriate scion is crucial variety. For this study, the healthy scion materials were collected from the private nursery in Agalakotta, Krishnagiri, Tamil Nadu.

Grafting techniques

The three grafting methods were used in the study viz., cleft, wedge, and bark grafting. For grafting, the rootstocks and scions of various thickness were selected. Rootstock was beheaded at the top, and a slit of 2.5 cm was made at the centre of the bark for inserting the scion. The scion was taken at a length of 6-7 cm by using a sharp, sterilized grafting knife. A slant cut was given at the base of the scion and it was inserted into the slit of the rootstock. After inserting the scions into the rootstock, it was tightly wrapped by using graft tape. Then it was covered with polythene cover until the emergence of sprout of buds. After grafting, the plants were kept in a mist chamber under ambient condition. It took 10 to 12 days for the graft union. After the emergence of new shoots from the scion, the polythene cover was removed and then it is transferred to green house.

Statistical analysis

The observations on days taken for graft union, success percentage, survival percentage, plant height (cm), leaf length (cm), leaf width (cm), days taken for leaf initiation, days taken for flower bud initiation were recorded. Collected data was subjected to statistical analysis by using AGRES software and Microsoft spreadsheet.

RESULTS AND DISCUSSION

Days for graft union

The data recorded on days to graft union was detailed in Table 1. The results were significantly varied among the different treatment combinations. Among all the treatment combination the minimum days (12) to graft union was observed in treatment T7- Edward rose + Button rose on par with T15-Damask rose + Edward rose (12.5) days. The maximum days (23.55) to graft union was recorded in treatment T6- Edward rose + Dog rose. The establishment of vascular connections, achieved through cell division occurring at the point where the scion and rootstock are joined resulted in successful grafting. The similar result was observed in bitter gourd were reported by Tamilselvi and Pugalendhi in 2017 [8].

Graft success percentage (%)

The data recorded on graft success percentage significantly varied among the treatment combinations was showed in table 1. Among the rootstock and scion compatibility, the highest graft success percentage (90) was recorded in treatment T7- Edward rose + Button rose on par with T15- Damask rose + Edward rose (80) percentage and minimum graft success (10) was recorded in T14- Damask rose + fairy rose followed by treatment T1- Andhra red rose + Ebb tide (20). The most successful grafting depends on good climatic conditions that exist after the grafting period and rapid sap circulation inside the rootstock and graft. These circumstances may have aided healing and sparked early callus development, allowing cambium and vascular tissues to link continuously. According to Chandel *et al.,* in 1998 [9], this then made it easier for new branches to sprout and ultimately enhanced the likelihood that the plant would survive.

Graft survival percentage (%)

The data recorded on survival percentage significantly varied among the treatment combinations was furnished in table 1. Among the rootstock and scion compatability, the maximum survival percentage was found in treatment T7- Edward rose + Button rose (80) on par with T15- Damask rose + Edward rose (70) while minimum percentage (30) was found in the treatment T8-Edward rose + Ebb tide rose. Some treatment showed delay in compatability due to presence of few biochemical alterations during the graft union, as has been defined in cherry and peach-plum combinations (Treutter & Feuchut, 1991[10]; Salesses & Bonnet, 1992) [11].

Days to leaf initiation

The data related to number of days for leaf initiation significantly varied among the treatment combinations was given in table 2. Among all the treatment the earliest leaf initiation (15 days) was observed in treatment T7- Edward rose + Button rose on par with the treatment T15-Damask rose + Edward rose (15.5 days) and the maximum leaf initiation days (28 days) was observed in the treatment T6- Edward rose + Dog rose. Increase in number of leaves might be due to the active growth of both rootstock and scion followed by favourable climatic conditions for the cambial activity and in turn favouring growth of grafts (Uchoi *et al*., 2012) [12].

Length of leaves (cm)

Length of leaves at 20, 35 and 50 days after grafting (DAG) were detailed in Table. At 20 days after grafting, all the treatments showed significant effect on leaf length. Among different treatments, the maximum length of leaves (1.4 cm) was observed in Treatment T7- Edward rose + Button rose on par with the treatment T15- Damak rose + Edward rose (1.35 cm) and the minimum length of leaves (0.5 cm) was recorded in treatment T5- Andhra red rose + Edward rose.

At 35 days after grafting (DAG), all the treatments showed significant effect on leaf length. The maximum length of leaves (3.75 cm) was observed in Treatment T7- Edward rose + Button rose followed by the treatment T15- Damak rose + Edward rose (3.3 cm) and the minimum length of leaves (2.5 cm) was recorded in treatment T2- Andhra red rose + Button rose.

The length of leaves at 60 days after grafting (DAG) were found to be significantly varied among different treatment combination. Among different treatment combination, the maximum length of leaves (4.35 cm) was recorded in the treatment T7- Edward rose + Button rose followed by the treatment T15- Damak rose + Edward rose (3.9 cm) and the minimum length of leaves (3.1 cm) was observed in the treatment T2- Andhra red rose + Button rose.

Inequality in leaf length may reflect a fundamental structural aspect of a leaf population which is maintained at a relatively constant level regardless of plant density (Berntson et al., 1991) [13]

Width of leaves (cm)

Width of leaves at 20, 35 and 50 days after grafting (DAG) were presented in Table 2. At 20 days after grafting, all the treatments showed significant effect on leaf width. Among different treatments, the maximum width of leaves (0.8 cm) was observed in Treatment T7- Edward rose + Button rose and the minimum width of leaves (0.2 cm) was recorded in treatment T14- Damask rose + Fairy rose.

At 35 days after grafting (DAG), all the treatments showed significant effect on leaf width. The maximum width of leaves (1.8 cm) was observed in Treatment T7-Edward rose + Button rose followed by the treatment T15- Damak rose + Edward rose (1.55 cm) and the minimum width of leaves (0.95 cm) was recorded in treatment T2 - Andhra red rose + Button rose.

At 50 days after grafting (DAG), all the treatments showed significant effect on leaf width. The maximum width of leaves (2.3 cm) was observed in Treatment T7-Edward rose + Button rose followed by the treatment T15- Damak rose + Edward rose (2.05 cm) and the minimum width of leaves (1.45 cm) was recorded in treatment T2 - Andhra red rose + Button rose.

Days to flower initiation

The data related to number of days for flower initiation significantly varied among the treatment combinations was given in table 2. Among all the treatment the earliest flower bud initiation (31.5days) was observed in treatment T7- Edward rose +

Button rose followed by the treatment T15 (33days) and the maximum flower bud initiation days (40.5days) was observed in the treatment T8- Edward rose + Ebb tide rose. If a plant has adequate carbohydrates in it since its vegetative growth, it has a tendency to enter the reproductive phase early. Initiation of flower buds is also influenced by environmental conditions. These observations are in agreement with Kute et al., (2022) [14] and Patil et al., (2022) [15].

Plant height(cm)

Plant height 30 and 45 (DAG) days after grafting were observed in table 2. The data related to plant height was significantly varied among the different treatment combinations. At 45 DAG the highest plant height (67.6 cm) was recorded in the treatment T7- Edward rose + Button rose and the lowest height at 45 DAG (24.75cm) was recorded in treatment T12- Damask rose + Button rose. Considerable increase in plant height was noticed in most of the grafted plants that is related to the fact that grafted plants are more vigorous than non-grafted plants (Khah,2012) [16]. Hence, a higher quantity of shoots and leaves initiated the photosynthesis process, leading to the storage of energy. Concurrently, the presence of sufficient moisture and nutrients in the growth medium led to increased sprouting, subsequently enhancing various morphological aspects such as plant height, circumference, and leaf count. This result agrees with the findings of lee (1994) [17] and Ioannou *et al*., (2002) [18].

Table 1. Effect of different rootstock and scion combinations on days taken for graft union, graft success % & graft survival%

Treatment combination	Days for graft union	Graft success% 20 DAG	Graft survival % 30 DAG
T1-Andhra red rose + Dog rose	22	20	0
T2-Andhra red rose + Button rose	14.5	50	40
T3-Andhra red rose + Ebb tide rose	23.5	30	0
T4-Andhra red rose + Fairy rose	0	0	0
T5-Andhra red rose + Edward rose	19.5	60	40
T6-Edward rose + Dog rose	23.55	40	0
T7-Edward rose + Button rose	12	90	80
T8-Edward rose + Ebb tide rose	23	50	30
T9-Edward rose + Fairy rose	0	0	0
T10-Edward rose + Edward rose	14.5	50	50
T11-Damask rose + Dog rose	23	40	0
T12-Damask rose + Button rose	13	70	60
T13-Damask rose + Ebb tide rose	21.5	30	0
T14-Damask rose + Fairy rose	17.5	10	0
T15-Damask rose +Edward rose	12.5	80	70
Mean	16.00	41.33	24.66
SE(d)	0.955	12.649	9.660
CD (0.5)	2.037	26.961	20.592
Significant	0.00**	0.00 **	0.00 **

Table 2. Effect of different rootstock and scion combinations on days for leaf initiation, days for flower bud initiation, leaf length(cm), leaf width(cm), plant height (cm)

Treatment combination	Days for leaf initiation	Days for flower bud initiation	Leaf length (cm)			Leaf width (cm)			Plant height (cm)	
			20 DAG	35 DAG	50 DAG	20 DAG	35 DAG	50 DAG	30 DAG	45 DAG
T1	25	0	0	0	0	0	0	0	0	0
T2	17.5	37	1.1	2.5	3.1	0.35	0.95	1.45	41.5	47.5
T3	26.5	0	0	0	0	0	0	0	0	0
T4	0	0	0	0	0	0	0	0	0	0
T5	22.5	37.5	0.5	2.55	3.15	0.45	1.25	1.75	28	32.5
T6	28	0	0	0	0	0	0	0	0	0
T7	15	31.5	1.4	3.75	4.35	0.8	1.8	2.3	60.75	67.6
T8	26	40.5	0	2.7	3.3	0	1.2	1.7	49	52.5
T9	0	0	0	0	0	0	0	0	0	0
T10	17.5	35.5	0.9	2.95	3.05	0.45	1.3	1.8	31	53.5
T11	26.5	0	0	0	0	0	0	0	0	0
T12	16.5	36.5	1.25	2.6	3.2	0.55	1.35	1.85	20.5	24.75
T13	25.5	0	0	0	0	0	0	0	0	0
T14	20.5	0	0.55	0	0	0.2	0	0	0	0
T15	15.5	33.5	1.35	3.3	3.9	0.55	1.55	2.05	36	41
Mean	18.83	16.8	0.47	1.35	1.60	0.22	0.62	0.86	17.78	21.29
SE(d)	0.983	1.000	0.125	0.174	0.060	0.054	0.063	0.063	1.036	1.169
CD (0.5)	2.095	2.131	0.266	0.371	0.129	0.116	0.134	0.135	2.210	2.492
Significant	0.00 **	0.00 **	0.00**	0.00 **	0.00 **	0.00 **	0.00 **	0.00 **	0.00 **	0.00 **

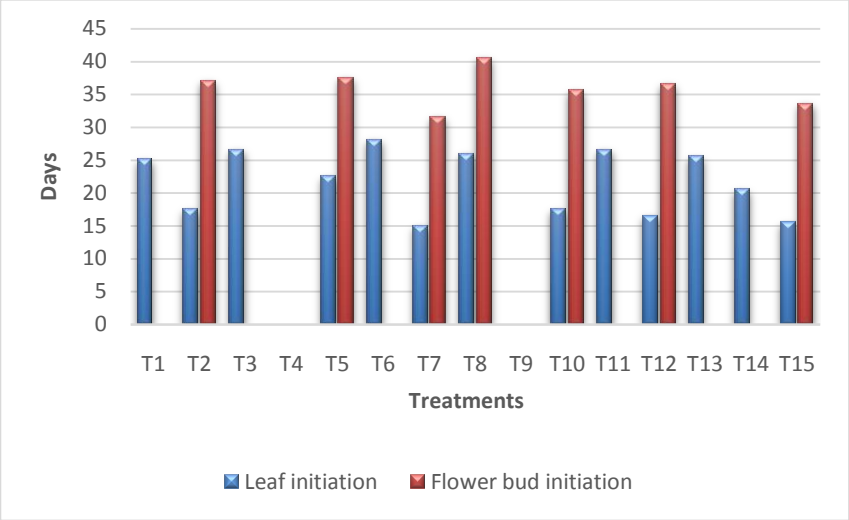

Figure 1: Days for leaf initiation and Flower bud initiation

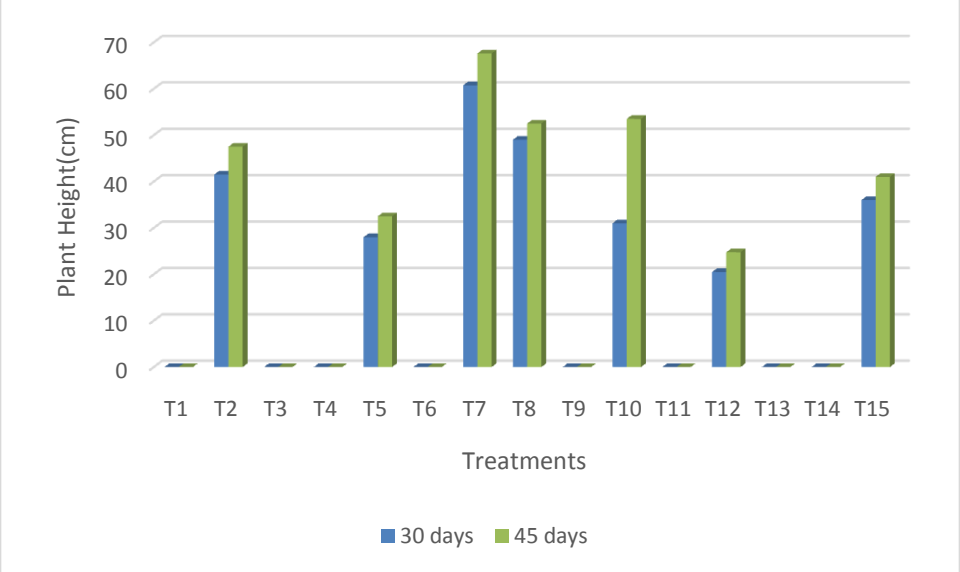

FIGURE 2: Plant height at different intervals

CONCLUSION

In this conclusion, the findings of the experiment stated that that the treatment T7-edward rose + button rose, exhibited superior performance when compared to other treatment combinations in terms of graft union and overall morphological parameters. Notably, this combination shows an earlier graft union, success percentages, and survival percentages, as well as leaf initiation, flower bud initiation, leaf length, leaf width, and plant height. Hence the combination of rootstock as Edward rose and scion as Button rose is said to be most compatible and can be recommended for commercial cultivation.

REFERENCES

Gajraj BK, Ahamed Z, Naik V. Protected Cultivation of Rose-A Potential Cut Flower.
Hummer KE, Janick J. Rosaceae: taxonomy, economic importance, genomics. Genetics and genomics of Rosaceae. 2009:1-7.
Roberts AV, Debener T, Gudin S. Encyclopedia of Rose Science. Vol. I-III.
Garner RJ. The grafter's handbook. Chelsea Green Publishing; 2013.

Edwards WS, Tapp JS. Chemically treated nylon tubes as arterial grafts. Surgery. 1955 Jul;38(1):61-70
selaru, E. Flori cultivate in gradina. Ed. Grand, Bucureşti, (1998).
Nybom H, Werlemark G. Realizing the potential of health-promoting rosehips from dogroses (Rosa sect. Caninae). Current Bioactive Compounds. 2017 Mar 1;13(1):3-17.
Tamilselvi NA, Pugalendhi L. Studies on effect of grafting technique on growth and yield of bitter gourd (Momordica Charantia L.).
Chandel JS, Negi KS, Jindal KK. Studies on vegetative propagation in kiwi (Actinidia deliciosa Chev.). Indian journal of Horticulture. 1998;55(1):52-4.
Treutter D, Feucht W. Accumulation of phenolic compounds above the graft union of cherry trees.
Salesses G, Dirlewanger E, Bonnet A, Lecouls AC, Esmenjaud D. Interspecific hybridization and rootstock breeding for peach. InIV International Peach Symposium 465 1997 Jun 22 (pp. 209-218).
Uchoi J, Raju B, Debnath A, Shira VD. Study on the performance of softwood grafting in jamun (Syzygium cumunii SKEEL). Asian Journal of Horticulture. 2012 Dec;7(2):340-2.
Berntson GM, Weiner J. Size structure of populations within populations: leaf number and size in crowded and uncrowded Impatiens pallida individuals. Oecologia. 1991 Jan; 85:327-31.
Kute RS, Bhagat AA, Idate GM, Badgujar CD. Open field evaluation of rose cultivars under Pune, Maharashtra conditions.
Patil HB, Chaurasia AK, Kumar S, Krishna B, Subramaniam VR, Sane AP, Sane PV. Synchronized flowering in pomegranate, following pruning, is associated with expression of the FLOWERING LOCUS T homolog, PgFT1. Physiologia Plantarum. 2022 Jan;174(1):e13620.
Petropoulos SA, Khah EM, Passam HC. Evaluation of rootstocks for watermelon grafting with reference to plant development, yield and fruit quality.
Lee JM. Cultivation of grafted vegetables I. Current status, grafting methods, and benefits. HortScience. 1994 Apr 1;29(4):235-9.
Ioannou N, Ioannou M, Hadjiparaskevas K. Evaluation of watermelon rootstocks for off-season production in heated greenhouses. InII Balkan Symposium on Vegetables and Potatoes 579 2000 Oct 11 (pp. 501-506).