International Journal of Plant & Soil Science

34(22): 1677-1683, 2022; Article no.IJPSS.91847
ISSN: 2320-7035

Impact of Grafting Techniques on Success Rate, Survival and Growth of Different Adenium (*Adenium obesum*) Scions under Prayagraj Agro-climatic Conditions

Kaustav Roy [a*ϕ] and Urfi Fatmi [a#]

[a] Department of Horticulture (Floriculture and Landscaping), SHUATS, Prayagraj, Uttar Pradesh - 211007, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i2231547

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/91847

Original Research Article

Received 03 July 2022
Accepted 08 September 2022
Published 14 September 2022

ABSTRACT

This work was carried out for 5 months from February, 2022 to June, 2022 in shadenet house, Department of Horticulture, SHUATS, Prayagraj. The experiment was designed according to a Factorial Completely Randomized Design (FCRD), using five different adenium hybrids and three different types of grafting techniques. The experiment was replicated three times. The different hybrids used in the experiment were Masai, Cream of My Body, Tangerine, Super Moon, Golden Jublee and grafting techniques were wedge, cleft, flat. The results obtained showed that the hybrid Golden Jublee with flat grafting was found superior in terms of days taken to 1st sprout, sprouting percentage, number of sprouts and survival percentage while hybrid Cream of My Body with flat grafting was found superior in terms of number of leaves, shoot length and stem girth. Therefore, Golden Jublee and Cream of My Body are suitable for propagation through flat grafting under agro-climatic conditions of Prayagraj.

Keywords: Adenium; wedge; cleft; flat; grafting.

[ϕ]M.Sc. Scholar;
[#]Assistant Professor;
**Corresponding author: E-mail: kaustavroy2458@gmail.com;*

1. INTRODUCTION

Adenium genus belongs to family Apocynaceae. Adenium commonly known as desert rose, winter rose, sabi star or kudu can be grouped in herbaceous, shrub and arboreal plants, with succulent stems and roots. *Adenium obesum* is a native of Africa but now a days it is cultivated in several parts of the world including India is a popular ornamental plant.This plant represents one of the richest sources of phytochemicals such as glycosides and possess great potential for pharmaceuticals and piscicultural applications. *Adenium obesum* is found in the sub-Saharan region of Africa, from Sudan to Kenya. In horticulture it was adopted to divide *adenium* genus into 11 species: *A. oleifolium, A. swazicum, A.boehmianum, A. multiflorum, A. obesum, A. somalense 'A. somalense, A. crispum, A. socotranum, A. arabicum* [1].

Adenium store water in their soft, swollen roots and stems to allow them to survive through periods of drought. Young plants have an inflated trunk, sometimes called the caudex. From this fattened caudex arise several slender but soft and succulent stems which are sparsely branched in youth. Even young plants 2-3 years old and 6-8 inches tall can put on a beautiful floral display, with the pink to red flowers arising from the tips of the stems. True *Adenium obesum* normally blooms in spring and summer continuously for many weeks. Improved cultivars bloom almost continuously if given proper care. In nature, adenium is quite variable but can form a small, thick-trunked tree or large shrub.

As a result of its wide range of flower color among cultivars, roots and drought tolerance, desert rose has been increasingly produced as flowering potted plants and as landscape plant in tropical and subtropical regions. As their size can be restricted and because of the its unusual shapes, they are becoming increasingly popular subjects for tropical and succulent bonsai [1,2]. Compact growth habit, thick trunk like structure with showy caudex, good branching and flowering with high level of divergence for flower colour makes adenium a desirable pot plant to display in balconies, in verandas as well as is excellent plant for xeriscaping and roof top gardens [3,4].

Propagation of desert rose can be done via seeds, cuttings and grafting. The first option is not reliable due to the low seed production, a result of pollination problems and possible sterile male and female flowers. The easiest method of propagation is cuttings, however the plants obtained through this method are not well accepted in the ornamental market, since they produce underground caudex and do not show the same exuberance of the plants propagated via seeds [5].

Adenium propagation through grafting has been outstanding for hybrids, mainly, due to the consumer market demands for new varieties, such as folded flowers and new colors. Thus, grafting allows to producing seedlings of these highly segregated materials on rootstocks produced by seeds, which presents a swollen caudex, characteristic of the *Adenium* genus. Seedlings aged from one year can already be used as rootstocks, since they have the caudex developed enough for grafting. Grafting on *Adenium* may be performed by the graft method or a method similar to the graft approach ('cork'). The grafting method may present a disadvantage, as uneven healing of the tissues in the graft region, while the 'cork' method presents uniform healing of this region, which becomes imperceptible after a few months of cultivation. The method consists of making a straight cut on the rootstock above the region where the caudex is most pronounced. The branch from the canopy variety to be grafted is cut into segments, similar to a small cork, with at least one vegetative bud. The union between the rootstock and the graft is by approaching grafts of the cut sides. To protect and better fix the graft, it is required to cover the area with plastic tape or other impermeable material. After the graft initiates the emission of shoots, the plastic shall be removed, in order not to harm the shoot growth [6].

The commercialization of adenium was carried out in different ways. Without being certain of the color and shape of the flowers due to the high genetic variability found in the species. Now-a-days, ornamental plants market has been organized and it is being possible to acquire plants in flower shops and supermarkets, such as traditional potted plants, with an affordable price. It is common to find flowering plants of two and three years, but it is also common to find older plants in some specialized florists, presenting the most developed and sculptural caudex. New hybrids are being evolved which need to be evaluated for their performance in different regions [6].

2. MATERIALS AND METHODS

The present investigation was carried out to study the "Impact of grafting techniques on

success rate, survival and growth of different adenium (*Adenium obesum*) scions under Prayagraj agro-climatic conditions". The experiment was carried out in shadenet, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj (UP), India during 2022 . Prayagraj is situated at an elevation of 78 meters above sea level at 25.87° North latitude and 81.15° East longitudes. This region has a sub-tropical climate prevailing in the South-East part of UP with both the extremes in temperature, i.e., the winter and the summer. In cold winters, the temperature sometimes is as low as 32°F from December – January and very hot summer with the temperature reaching up to 115°F in May and June (SHUATS, 2022). The experiment was conducted from February to June 2022.

The experimental material consisted of adenium rootstock of Nova Luna and five different hybrids of adenium viz., Masai (V_1), Cream of My Body (V_2), Tangerine (V_3), Super Moon (V_4), Golden Jublee (V_5). Grafting techniques were wedge (G_1), cleft (G_2) and flat (G_3). A total of fifteen treatments were tried in FCRD design and replicated thrice. The treatment details shown in the Chart 1.

All plants were selected for recording observation on sprouting, survival and growth parameters.

3. RESULTS AND DISCUSSION

3.1 Sprouting Parameters

3.1.1 Effect of grafting techniques on days taken to 1st sprout of different adenium hybrids

Among various adenium hybrids, significantly lesser number of days taken to 1st sprout (16.7) was observed in Golden Jublee and more number of days (19.7) was recorded Super Moon (Table 1). Among various grafting techniques, significantly lesser number of days taken to 1st sprout (17.5) was observed in cleft grafting and more number of days (19.2) was observed in wedge grafting (Table 2).

Among the interaction effect of hybrids and grafting techniques significantly lesser number of days taken to 1st sprout (14.6) was observed in Golden Jublee with cleft grafting and more number of days (22.6) was observed in Cream of My Body with wedge grafting (Table 3).

The above results might be due to the fact that congenial weather conditions like optimum temperature and high relative humidity helped in early sprouting and better graft success because of fast establishment of vascular tissue of rootstock and scion Syamal et al. [7].

3.1.2 Effect of grafting techniques on sprouting percentage of different adenium hybrids

Among various adenium hybrids, significantly higher sprouting percentage (59.3) was observed in Golden Jublee and lower sprouting percentage (22.1) was recorded in Masai & Cream of My Body (Table 1). Among various grafting techniques, significantly higher sprouting percentage (51) was observed in flat grafting and lower sprouting percentage (35.4) was observed in cleft grafting (Table 2).

Among the interaction effect of hybrids and grafting techniques, significantly higher sprouting percentage (89) was observed in Golden Jublee with flat grafting and lower sprouting percentage (11) was observed in Masai with flat grafting & Cream of My Body with flat grafting (Table 3).

Graft success can be increased by heating treatment and for this aim, covering the whole of the grafted plant is needed Ercan et al. [8]. As the heating treatment is better in flat grafting compare to other techniques, it showed better success rate.

Chart 1. A total of fifteen treatments details

T1	Masai x Wedge	T2	Masai x Cleft	T3	Masai x Flat
T4	Cream of My Body x Wedge	T5	Cream of My Body x Cleft	T6	Cream of My Body x Flat
T7	Tangerine x Wedge	T8	Tangerine x Cleft	T9	Tangerine x Flat
T10	Super Moon x Wedge	T11	Super Moon x Cleft	T12	Super Moon x Flat
T13	Golden Jublee x Wedge	T14	Golden Jublee x Cleft	T15	Golden Jublee x Flat

Table 1. Effects of different adenium varieties in terms of different parameters

Sl. No.	Variety details	Days taken to	Sprouting	Survival	Mortality	Shoot length	Stem girth
1	Masai	18.3	22.1	18.3	81.6	2	4.1
2	Cream of My Body	18.6	22.1	14.6	85.3	5.8	5.2
3	Tangerine	18.1	51.7	44.4	55.5	7.3	7.4
4	Super Moon	19.7	55.5	48.2	51.7	7.1	7.6
5	Golden Jublee	16.7	59.3	54.1	45.8	3.2	6.5
Factor A	F test	S	S	S	S	S	S
	CD at 5%	1.666	15.31	10.525	9.115	2.628	1.413
	SE(d)±	0.783	7.461	5.129	4.442	1.28	0.689

S – Significant

Table 2. Effects of grafting techniques in terms of different parameters

Sl. No.	Grafting details	Days taken to	Sprouting	Survival	Mortality	Shoot length	Stem girth
1	Wedge	19.2	40	35.4	64.5	3.7	5.2
2	Cleft	17.5	35.4	31	68.9	3.2	5.5
3	Flat	18.2	51	41.3	58.6	8.4	7.8
Factor B	F test	S	S	S	S	S	S
	CD at 5%	1.244	11.859	8.153	7.06	2.035	1.094
	SE(d)±	0.606	5.779	3.973	3.44	0.992	0.533

S – Significant

Table 3. Effect of grafting techniques on different adenium hybrids in terms of different parameters

Sl. No.	Treatment details	Days taken to 1st sprout	Sprouting percentage	Survival percentage	Mortality percentage	Shoot length (mm)	Stem girth (mm)
1	Masai x Wedge	17.3	33.3	22	78	1	3
2	Masai x Cleft	19.6	22	22	78	1	4
3	Masai x Flat	18	11	11	89	4	5.3
4	Cream of My Body x Wedge	22.6	33.3	22	78	1.3	3.3
5	Cream of My Body x Cleft	15.3	22	11	89	1.6	3.3
6	Cream of My Body x Flat	18	11	11	89	14.6	9
7	Tangerine x Wedge	17.6	22	22	78	6.3	6.3
8	Tangerine x Cleft	18.3	66.6	55.6	44.3	5.6	7.6
9	Tangerine x Flat	18.3	66.6	55.6	44.3	10	8.3
10	Super Moon x Wedge	22.3	55.6	55.6	44.3	8	9.3
11	Super Moon x Cleft	19.6	33.3	33.3	66.6	3.6	5
12	Super Moon x Flat	17.3	77.6	55.6	44.3	9.6	8.6
13	Golden Jublee x Wedge	16.3	55.6	55.6	44.3	2	4
14	Golden Jublee x Cleft	14.6	33.3	33.3	66.6	4	7.6
15	Golden Jublee x Flat	19.3	89	73.3	26.6	3.6	8
Factor A x B	F test	S	S	S	S	S	S
	CD at 5%	2.781	26.518	18.231	15.788	4.551	2.447
	SE(d)±	1.355	12.922	8.884	7.693	2.218	1.193

S – Significant

3.2 Survival Parameters

3.2.1 Effect of grafting techniques on survival percentage of different adenium hybrids

Among various adenium hybrids, significantly higher survival percentage (54.1) was observed in Golden Jublee and lower survival percentage (14.6) was recorded in Cream of My Body. Among various grafting techniques, significantly higher survival percentage (41.3) was observed in flat grafting and lower survival percentage (31) was observed in cleft grafting (Table 2).

Among the interaction effect of hybrids and grafting techniques, significantly higher survival percentage (73.3) was observed in Golden Jublee with flat grafting and lower survival percentage (11) was observed in Masai with flat grafting, Cream of My Body with cleft grafting and Cream of My Body with flat grafting (Table 3).

The final survival of graft is depending of interaction of time of grafting and source of scion suggested by Syamal et al. [7].

3.2.2 Effect of grafting techniques on mortality percentage of different adenium hybrids

Among various adenium hybrids, significantly higher mortality percentage (85.3) was observed in Cream of My Body and lower mortality percentage (45.8) was recorded in Golden Jublee (Table 1). Among various grafting techniques, significantly higher mortality percentage (68.9) was observed in cleft grafting and lower mortality percentage (58.6) was observed in flat grafting (Table 2).

Among the interaction effect of hybrids and grafting techniques, significantly higher mortality percentage (89) was observed in Masai with flat grafting, Cream of My Body with cleft grafting and lower mortality percentage (26.6) was observed in Golden Jublee with flat grafting (Table 3).

3.3 Growth Parameters

3.3.1 Effect of grafting techniques on shoot length (mm) of different adenium hybrids at 30 days after sprouting

Among various adenium hybrids, significantly longer shoot length (7.3) was observed in Tangerine and shorter shoot length (2) was recorded in Masai (Table 1). Among various grafting techniques, significantly longer shoot length (8.4) was observed in flat grafting and shorter shoot length (3.2) was observed in cleft grafting.

Among the interaction effect of hybrids and grafting techniques, significantly longer shoot length (14.6) was observed in Cream of My Body with flat grafting and shorter shoot length (1) was observed in Masai with wedge grafting & Masai with cleft grafting (Table 3).

Reduction in auxin transport from aerial parts of grafted plants has been proposed to limit root growth and cytokinin production supplied for shoot growth Adhikari et al. [9]. Higher shoot length were achieved with thicker rootstock than thinner rootstock Simon et al. [10].

3.3.2 Effect of grafting techniques on stem girth (mm) of different adenium hybrids

Among various adenium hybrids, significantly broad stem girth (7.6) was observed in Super Moon and thinner stem girth (4.1) was recorded in Masai (Table 1). Among various grafting techniques, significantly broad stem girth (7.8) was observed in flat grafting and thinner stem girth (5.2) was observed in wedge grafting (Table 2).

Among the interaction effect of hybrids and grafting techniques, significantly broad stem girth (9.3) was observed in Super Moon with wedge grafting and thinner stem girth (3) was observed in Masai with wedge grafting (Table 3).

The late emerging seedlings showed higher increase in diameter after thinning. Higher stem girth were achieved with thicker rootstock than thinner rootstocks Simon et al. [10].

4. CONCLUSION

From the present investigation it was concluded that hybrid Golden Jublee (V_5) through flat grafting (G_3) was found superior in term of days taken to 1st sprout [11-13], sprouting percentage, number of sprouts and survival percentage and hybrid Cream of My Body (V_2) with flat grafting (G_3) was found superior in terms of number of leaves, shoot length and stem girth. Hence, hybrids Golden Jublee and Cream of My Body are suitable for propagation through flat grafting under Prayagraj agro-climatic conditions.

ACKNOWLEDGEMENT

The work was supported by Advisor Dr. Urfi Fatmi and all faculty members, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, (U.P.) India for providing field and assistance in conducting the Research Trail.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Dimmitt MG, Joseph G, Palzkill D. Adenium: Sculptural elegance, floral extravagance. Cactus and Succulent Journal. 2009;20(1):59-64.
2. Versiani MA, Ahmeda SK, Ikrama A, Alia ST, Yasmeena K, Faizib S. Chemical constituents and biological activities of *Adenium obesum*. Zurich Journal. 2014;11(6):171-180.
3. Chavan S, Singh A, Bhandari AJ and Patel BN. Management of potted adeniums. Floriculture Today. 2016;21(2):10-13.
4. Colombo RC, Favetta V, Melo TD, Faria RTD, Silva MA. Potting media, growth and build-up of nutrients in container-grown desert rose. Australian Journal of Crop Science. 2016;10(2):258-263.
5. Kanchanapoom K and Sunheem S. *In vitro* propagation of *Adenium obesum.* Notulae Botanicae Horticulturae Agrobotanici. 2010;38(3):209-213.
6. Colombo RC, Favetta V, Yamamoto LY, Alves GAC, Abati J, Takahashi LSA, Faria RTD. Biometric description of fruit and seeds, germination and imbibition pattern of desert rose. Journal of Seed Science. 2015;37(4):206-213.
7. Syamal MM, Katiyar R, Joshi M. Performance of wedge grafting in guava under different growing conditions. Indian Journal of Horticulture. 2012;69(3):424-427.
8. Ercan E, Serdar U., Akyuz B, Aydin E. Effect of different storing times on graft success in bench grafted walnut plants. International Journal of Agricultural and Natural Sciences. 2020;13(1):1-9.
9. Adhikari PB, Xu Q, Notaguchi M. Compatible graft establishment in fruit trees and its potential markers. Multidiscplinary Digital Publishing Institute. 2022;12(8):1981-1996.
10. Simon AM, Akinnifesi FK, Sileshi GW, Ajayi OO. Rootstock growth and development for increased graft success of mango (*Mangifera indica*) in the nursery. African journal of Biotechnology. 2010;9(9):1317-1324.
11. Chaste DB, Kedar DP. Propagation of hibiscus through cutting and grafting. International Journal of Current Microbiology and Applied Sciences. 2021;10(3):1850-1853.
12. Brown SH. *Adenium obesum*- A report. Institute of Food and Agricultural Science. 2012;20(2):10-14.
13. Singh A, Bhandari AJ, Chavan S, Patel NB, Patel AI, Patel BN. Evaluation of *Adenium obesum* for potted ornamentals under soilless growing system. International Journal of Current Microbiology and Applied Sciences. 2017; 6(12):2141-2146.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/91847