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Success of guava (*Psidium guajava* L.) Grafts affected by rootstock height and scion stick length

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Abstract

The experiment entitled “Success of guava (*Psidium guajava* L.) Grafts affected by rootstock height and scion stick length” at Fruit Research Station, Lalbaug, Junagadh Agricultural University, Junagadh during March-2021 to July-2021. The experiment was laid out in Completely Randomized Design with factorial concept comprised of twenty treatment combinations and three repetitions. The first factor involves grafting height (15, 20, 25 and 30 cm) and second factor involves scion stick length (05, 7.5, 10, 12.5 and 15 cm) to study the effect of effect of rootstock height and scion stick length on success, growth and survival in guava grafts.

Maximum number of successful grafts (5.00, 5.80, 6.73 and 6.68), success rate (50.00, 58.00, 67.33 and 66.82%), minimum number of failure grafts (1.20, 2.21, 2.81 and 3.32) and mortality rate (12.03, 22.12, 28.09 and 33.18%) at 30, 60, 90 and 120 days interval, respectively, and survival percentage (66.82%) at 120 DAG were noted in H₄ (30 cm rootstock height). The result on the effect of scion stick length: maximum number of successful grafts (4.33, 5.58, 6.25 and 6.17), success rate (43.33, 55.83, 62.50 and 61.70%), minimum number of failure grafts (1.37, 2.46, 3.08 and 3.83) and least mortality rate (13.70, 24.68, 30.87 and 38.31%) at 30, 60, 90 and 120 days interval, respectively and maximum survival percentage (61.70%) at 120 DAG were noted in L₃ (10 cm scion stick length).

Better results for success and survival percentage were found in the grafts prepared on 30 cm height of rootstock. As far as scion stick length is concern better results were recorded in the grafts prepared using 10 cm scion stick length for success and survival. Hence, for getting more success with least mortality and the highest survival percentage, the wedge grafts should be prepared during the last week of March to the first week of April using 30 cm rootstock height and 10 cm scion stick length in guava.

Keywords: Guava, wedge grafting, rootstock height, scion stick length

Introduction

Guava (*Psidium guajava* L.) is the member of Myrtaceae family and is one of the most common fruit in India (Govaerts *et al.*, 2008) [4]. It is well distributed in the tropical and subtropical regions of the world, especially in South America, Asia and Australia. The common guava is diploid (2n=22), but natural and artificial triploid (2n=33) and aneuploid exists (Menzel, 1985) [14]. Triploids generally produce seedless fruits (Jaiswal and Amin, 1992) [8]. The genus *Psidium* has about 150 shrubs and *Psidium guajava* is well known and grown worldwide (Paull and Bittenbender, 2006) [23]. It is commonly known as “Apple of tropics” and “Poor man's apple” having high vitamin A and B and being exceptionally rich in vitamin C (Rai *et al.*, 2010) [25]. The fruit is also a good source of pectin, calcium and phosphorus. Guava plants have been propagated through seeds for a long time. A seed propagated plant exhibits a great variation due to inevitable heterozygosity. Moreover, they come into bearing much later than vegetatively propagated plants. Though guava is propagated through budding (Gupta and Mehrotra, 1985; Kaundal *et al.*, 1987) [6, 10], air-layering (Singh and Singh, 1970; Sharma *et al.*, 1978; Manna *et al.*, 2004) [29, 30, 13], stooling (Rathore, 1984; Pathak and Saroj, 1988) [27, 21] and inarching (Mukherjee and Majumdar, 1983) [15], these are still not commercially viable due to varying rate of success, absence of tap root system and cumbersome process. A technique of rapid multiplication method wedge grafting has a tremendous potential for multiplying guava plants in a short span.

The success of grafting and its survival play an important role in orcharding. Though, work on this method of grafting was carried out, the information regarding the height of rootstock and length of scion stick at the time of grafting and subsequent effect is very meager. Rootstock height plays a most important role as from which height the grafting operation can be done for maximum success and its subsequent growth.

Grafting at too low height can create the problem of rot disease at the point of union of the sapling after plantation. Scion stick length also play most important role in success and growth of grafted plant. The longer scion have more food materials reserved that enhanced early bud break and leaf opening and thereby, resulting maximum growth of the plant. The output of this research work will help nurserymen to make their nursery more economical by producing more numbers of good quality grafts.

Material and Method

The experiment entitled “Effect of rootstock height and scion stick length on success, growth and survival of wedge grafting in guava (*Psidium guajava* L.) at Fruit Research Station, Lalbaug, Junagadh Agricultural University, Junagadh during March-2021 to July-2021. The experiment was laid out in Completely Randomized Design with factorial concept comprised of twenty treatment combinations and three repetitions. The first factor involves grafting height (15, 20, 25 and 30 cm) and second factor involves scion stick length (05, 7.5, 10, 12.5 and 15 cm) to study the effect of effect of rootstock height and scion stick length on success, growth and survival in guava grafts. About 6 to 8 months old seedling rootstocks of guava variety Lucknow-49 raised in poly bag at the Fruit Research Station, Lalbaug were used for the grafting. Among these seedlings healthy, vigorous, disease and pest free and homogeneous in size and growth (pencil thickness) were selected for the experiment. Then selected rootstocks were headed back at the time of grafting at different height *i.e.* 15, 20, 25 and 30 cm from the base of stock for propagation purpose as per treatments. The scion wood was obtained from young trees having healthy bud sticks. For this purpose 3- 4 month old scion wood of guava cultivar Anjirio with apical growing portion was selected. The scion wood of pencil thickness with 3 to 4 buds was defoliated about 7-8 days prior to grafting. Apical portion of scion wood was also beheaded at the time of defoliation.

These defoliated scion sticks were collected and stored in moist cloth bag with care until grafting. The healthy scion sticks were taken for further procedure and length of scion stick was 05, 7.50, 10, 12.50 and 15 cm. The cut was made according to the length during the time of grafting. The wedge grafting was done on last week of March to first week of April during morning hours at Fruit Research Station, Lalbaug, JAU, Junagadh. In this method, “V” vertical cut of 3 cm length was given onto beheaded guava seedling rootstock so as to fit the wedge shape scion. Then the scion of comparative thickness was made like wedge by giving slanting cut of 3 cm length on opposite sides with the help of grafting knife. The wedge shaped scion stick was inserted into the “V” shaped slit of the stock. The graft union should be as close as possible to ensure that the cambium layers of stock and scion were in perfect contact with each other. Then the graft union was tied tightly with the polythene strip. The grafted plants were kept under net house condition. The polythene wrapping was removed after complete graft union formation to avoid stem girdling.

Results and Discussion

Effect of rootstock height on number of successful graft and success rate at 30, 60, 90 and 120 DAG was observed significant. Maximum number of successful graft (5.00, 5.80, 6.73 and 6.68) and success rate (50.00, 58.00, 67.33 and

66.82%) at 30, 60, 90 and 120 days interval, respectively was observed in H₄ (30 cm rootstock height) which was at par with H₃ (25 cm rootstock height) at 90 DAG. While minimum number of successful graft (2.78, 5.07 and 5.27), success rate (27.80, 50.67 and 52.67%) at 30, 60 and 90 DAG, respectively and minimum number of successful graft (5.19) and success rate (51.88%) at 120 DAG observed in H₁ (15 cm rootstock height) and H₂ (20 cm rootstock height), respectively. Success on more rootstock height might be due to more food reserve material and higher cambial activity of rootstock and scion. Moreover, early callus formation occurred mainly from the rootstock with cells produced in definite rows. These results are in accordance with Patil *et al.* (1993) [22], Kumar *et al.* (2006) [12], Nalage *et al.* (2010a) [16], Richhariya (2012) [28] and Yadav *et al.* (2019) [34] in mango. Effect of rootstock height on number of failure graft and mortality rate at 30, 60, 90 and 120 DAG was observed significant. Minimum number of failure graft (1.20, 2.21, 2.81 and 3.32) and mortality rate (12.03, 22.12, 28.09 and 33.18%) at 30, 60, 90 and 120 days interval, respectively was observed in H₄ (30 cm rootstock height) which was at par with H₃ at 30 and 90 DAG. While maximum number of failure graft (1.99, 3.00 and 3.93), mortality rate (19.87, 29.96 and 39.25%) at 30, 60 and 90 DAG, respectively and maximum number of failure grafts (4.81) and maximum mortality rate (48.12 %) at 120 DAG observed in H₁ (15 cm rootstock height) and H₂ (20 cm rootstock height), respectively. It might be due to higher rootstock height have well established and strong root system as compared to lower rootstock height which had tender rootstock. The tender rootstock might have more chance to failure which might not tolerate the change in climatic parameters. Also grafting at too low height might create the problem of rot disease at the point of union of the sapling, which might infected due to direct contact of water. The present findings are similar to Prajapati (2008) [24] in jackfruit, Nalage *et al.* (2010a) [16] in mango and Parthiba *et al.* (2020a) [19].

Effect of different rootstock height was significant on survival percentage (%) of grafting at 120 DAG. Among different rootstock height, the highest survival (66.82%) at 120 DAG was noted in H₄ (30 cm rootstock height). Whereas, lowest survival (55.60%) was recorded in H₁ (15 cm rootstock height) at 120 DAG. The higher per cent survival with more grafting height could be a result of higher cambial activity in the hard-wood root-stocks, as compared to soft-wood root-stocks. Likewise, 15 cm height of rootstock is tender, thin skinned and easy to damage by some mechanical force, hence they required more time for establishment, and this might be responsible for lower survival percentage of graft. Higher survival percentages at higher root-stock height were recorded in mango by Kumar *et al.* (2006) [12], Nalage *et al.* (2010a) [16] Jagannath *et al.* (2012) [7], Karna and Varu (2018) [9], Yadav *et al.* (2019) [34]. The results are also in agreement with the findings of Prajapati (2010) [24] in jackfruit.

Effect of scion stick length on number of successful graft and success rate at 30, 60, 90 and 120 DAG was observed significant. Maximum number of successful graft (4.33, 5.58, 6.25 and 6.17) and success rate (43.33, 55.83, 62.50 and 61.70) at 30, 60, 90 and 120 DAG, respectively which was at par with L₄ at 30 DAG, L₁ and L₄ at 60 DAG, L₁, L₂ and L₄ at 90 DAG and L₁ at 120 DAG. While minimum number of successful graft (3.83), success rate (38.33 %) in L₂ at 30 DAG and, minimum number of successful grafts (5.17, 5.67 and 5.85), success rate (51.66, 56.66 and 58.50 %) at 30, 60,

90 and 120 DAG in L₅ (15 cm scion length). The highest number of successful grafts and percentage of success as observed with 10 cm scion length as compared to the other scion stick length might have resulted for a faster graft take might be due to more rapid formation of callus and vascular continuity. Similar kind of observations were noted by the earlier work of Thokchom and Singh (2018) [32] in Trifoliate orange, Gunjate *et al.* (1980) [5] in Jackfruit. Alam *et al.* (2006) [1] also reported highest success (76.67 %) in mango cv. Langra, Chakrabarty and Sadhu (1983) [2], Nalage *et al.* (2010b) [17], Tadda *et al.* (2018) [31] in mango and Ram and Bist (1982) [26] when 10 cm long scion was used.

Effect of scion stick length on number of failure graft and mortality rate at 30, 60, 90 and 120 DAG was observed significant. Minimum number of failure graft (1.37, 2.46, 3.08 and 3.83) and mortality rate (13.70, 24.68, 30.87 and 38.31) at 30, 60, 90 and 120 DAG, respectively was observed in L₃ (10 cm scion length) which was at par with L₄ at 30 and 90 DAG with L₁ and L₄ at 60 DAG and with L₁ at 120 DAG. While maximum number of failure graft (1.48, 2.81, 3.43 and 4.15) and mortality rate (14.83, 28.14, 34.33 and 41.50 %) at 30,

60, 90 and 120 DAG in L₅ (15 cm scion length). Production of new xylem and phloem thus permits the vascular connection between the scion and rootstock. The enlarging leaf surfaces on the scion shoots has little or no water to offset that loss by transpiration and the scion quickly become desiccated faster and died which thus caused low survival. Prajapati (2010) [24], Desai and Desai (1989) [3] in jackfruit and Nalage *et al.* (2010b) [17] in mango. Effect of different scion stick length significantly influenced on survival percentage (%) at 120 DAG. The highest survival (61.70%) was recorded in L₃ (10 cm scion length) at 120 DAG. Whereas, the lowest survival (58.50%) was recorded in L₅ (15 cm scion length) at 120 DAG. Production of new xylem and phloem thus permits the vascular connection between the scion and rootstock. The enlarging leaf surfaces on the scion shoots has little or no water to compensation that loss by transpiration and the scion quickly become desiccated and die and thus causing low survival. Prajapati (2010) [24], Desai and Desai (1989) [3] in jackfruit, Nalage *et al.* (2010b) [17], Parasana *et al.* (2013) [18] in mango, Parthiba *et al.* (2020b) [20] and Turi *et al.* (2021) [33] in guava.

Table 1: Effect of rootstock height and scion stick length on number of successful grafts and success rate of guava grafts

Treatments	Number of successful grafts				Success rate (%)			
	30 Days	60 Days	90 Days	120 Days	30 Days	60 Days	90 Days	120 Days
Rootstock height								
H ₁	2.78	5.07	5.27	5.56	27.80	50.67	52.67	55.60
H ₂	4.27	5.13	5.60	5.19	42.67	51.33	56.00	51.88
H ₃	4.07	5.53	6.47	6.43	40.67	55.33	64.67	64.33
H ₄	5.00	5.80	6.73	6.68	50.00	58.00	67.33	66.82
S.Em.±	0.08	0.09	0.12	0.07	0.82	0.88	1.20	0.66
C.D. at 5 %	0.23	0.25	0.34	0.19	2.34	2.52	3.44	1.90
Scion stick length								
L ₁	4.00	5.42	5.92	5.96	40.00	54.17	59.17	59.60
L ₂	3.83	5.25	6.08	5.95	38.33	52.50	60.83	59.50
L ₃	4.33	5.58	6.25	6.17	43.33	55.83	62.50	61.70
L ₄	4.08	5.50	6.17	5.90	40.83	55.00	61.67	59.00
L ₅	3.89	5.17	5.67	5.85	38.92	51.67	56.67	58.50
S.Em.±	0.09	0.10	0.13	0.07	0.92	0.99	1.34	0.74
C.D. at 5 %	0.26	0.28	0.38	0.21	2.62	2.82	3.84	2.12
Interaction (H x L)								
S.Em.±	0.18	0.20	0.27	0.15	1.83	1.97	2.69	1.48
C.D. at 5 %	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of rootstock height and scion stick length on number of failure grafts, mortality rate and survival per cent of guava grafts

Treatments	Number of failure grafts				Mortality rate (%)				Survival (%)
	30 Days	60 Days	90 Days	120 Days	30 Days	60 Days	90 Days	120 Days	
Rootstock height									
H ₁	1.99	3.00	3.93	4.44	19.87	29.96	39.25	44.40	55.60
H ₂	1.32	2.68	3.51	4.81	13.16	26.84	35.13	48.12	51.88
H ₃	1.25	2.61	2.96	3.57	12.51	26.13	29.60	35.67	64.33
H ₄	1.20	2.21	2.81	3.32	12.03	22.12	28.09	33.18	66.82
S.Em.±	0.02	0.05	0.07	0.07	0.24	0.51	0.67	0.66	0.66
C.D. at 5 %	0.07	0.15	0.19	0.19	0.68	1.46	1.92	1.90	1.90
Scion stick length									
L ₁	1.46	2.61	3.33	5.96	14.56	26.08	33.33	40.40	59.60
L ₂	1.46	2.74	3.35	5.95	14.60	27.40	33.50	40.50	59.50
L ₃	1.37	2.47	3.09	6.17	13.70	24.68	30.87	38.31	61.70
L ₄	1.43	2.50	3.41	5.90	14.29	25.00	33.07	41.00	59.00
L ₅	1.48	2.81	3.43	5.85	14.83	28.14	34.33	41.50	58.50
S.Em.±	0.03	0.06	0.08	0.07	0.26	0.57	0.75	0.74	0.74
C.D. at 5 %	0.08	0.16	0.21	0.21	0.76	1.63	2.15	2.12	2.12
Interaction (H x L)									
S.Em.±	0.05	0.11	0.15	0.15	0.53	1.14	1.50	1.48	1.48
C.D. at 5 %	NS	NS	NS	NS	NS	NS	NS	NS	NS



Conclusion

On the basis of the results obtained from the present investigation, it can be concluded that better results success rate and survival percentage with minimum mortality were found in the grafts prepared on 30 cm height of rootstock. As far as scion stick length is concern better results were recorded in the grafts prepared using 10 cm scion stick length for success and survival. Hence, for getting more success with least mortality and the highest survival percentage, the wedge grafts should be prepared during the last week of March to the first week of April using 30 cm rootstock height and 10 cm scion stick length in guava.

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