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# Effect of scion precuring and time of grafting on softwood grafting in sapota (*Manilkara acharas* (mill) Fosberg) cv. Kalipatti

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**Abstract**
An experiment entitled effect of scion precuring and time of grafting on softwood grafting in sapota (*Manilkara acharas* (Mill) Fosberg) cv. Kalipatti conducted in the green house nursery at Horticulture Research Farm, B. A. College of Agriculture, AAU, Anand, Gujarat during July to November, 2021. The treatment comprised four levels of scion precuring period (P) *viz*., $P_1$- 0 days, $P_2$- 10 days, $P_3$- 15 days and $P_4$- 20 days with four levels of grafting time (S) *viz*., $S_1$- 3rd week of July, $S_2$- 5th week of July, $S_3$- 2nd week of August and $S_4$- 4th week of August. The experiment was laid out in Completely Randomized Design with factorial concept (FCRD) with 16 number treatments and repeated thrice. It could be concluded that, scion of cv. Kalipatti grafted on khirni rootstock with 20 days scion precured prior to grafting and during 4th week of August proved to be the best for minimum number of days to sprouting of graft, maximum number of bud sprout, leaves per graft as well as maximum length of scion (cm), scion girth (mm), internodal length (cm) and survival percentage.

**Keywords:** Sapota, softwood grafting, scion precuring, time of grafting

## Introduction
Sapota (*Manilkara acharas* (Mill.) Fosberg) (Synonym: *Acharas zapota* L.) is an evergreen, tropical fruit belong to family Sapotaceae. Chromosome number of sapota is 2n=26. It is locally known as Chickoo while internationally known as Sapodilla plum, Zapota and Nose berry (Parle and Preeti, 2015) [10]. Origin of sapota is Tropical America and now widely cultivated in Mexico, Central America and throughout Tropics. Vegetative propagation of sapota using air layering and stem cutting have some disadvantages like root are not easily form in air layering and produce adventitious root through cutting. Plants are raised through cutting or air layering produce poor quality root which are weaker than the tap root system. Budding method are suitable to costal region of India where climate is moist and heavy rainfall. Now a days, high density planting (HDP) system in fruit crop popular among the farmers which require erect and stout plants of uniform canopy. It is only possible through grafting instead of air layering, cutting and budding method of sapota propagation. Hence it has to be propagated by grafting. Khirni (*Manilkara hexandra*) is indigenous, tropical tree belong to family Sapotaceae and extensively used as most suitable root stock.
Weather condition also play a prominent role on success of grafting, influencing graft-scion success and growth of grafted plant (Iqbal *et al.*, 2004) [5]. A controlled environment condition showing congenial for faster healing and callus formation results in better success and survival of grafts (Chander, 2016) [1]. Keeping the importance of precuring of scion prior to grafting and time of grafting, the present research carried out. The output of this research work will help nurseryman to make their nursery more economical by producing a greater number of good quality graft.

## Material and Methods
The experiment was conducted in the green house nursery at Horticulture Research Farm, B. A. College of Agriculture, AAU, Anand, Gujarat during July to November, 2021. The first factor involves scion precuring period (P) and second factor involve grafting time (S).

### Treatment details
**Factor A:** Scion precuring period (P)
0 days ($P_1$)

10 days ($P_2$)
15 days ($P_{3)}$.
20 days ($P_4$)

**Factor B:** GRAFTING TIME (S)
3rd week of July ($S_1$)
5th week of July ($S_2$)
2nd week of August ($S_3$)
4th week of August ($S_4$)

**Preparation of rootstock**
On the day of grafting, selected rootstock seedling brought from the nursery beds and kept in nursery shade for grafting. On the rootstocks leaves were removed using sharp grafting knife. Above the 15 cm selected rootstock was headed back where softwood portion was present on the rootstock and terminal portion was removed by using secateur. With the help of grafting knife 3-5 cm deep vertical straight cut was made on the centre of the beheaded rootstock. Care was taken that gum or latex on the cut surface was not spread. By using grafting knife this vertical split was splatted to insert scion stick.

**Preparation of scion**
A same thickness of rootstock, scion was selected among the collected scions. Excess portion of scion at bottom was reduced to conventional length by cutting scion using secateur to expose fresh tissue. V- wedge slant cut was made in both side of lower part of scion stick and similarly same length of vertical cut of rootstock. Care was taken that the cut surface not damaged by touching with the fingers. The scion stick is then inserted in the cleft of the rootstock and tied with polythene strip.

**Method of grafting**
Grafting carried out under shade nursery. V-wedge shaped scion stick is inserted in the splatted rootstock and tied with polythene strip. The graft joint was tied with white polythene strip of 2 cm wide, 30 cm long and thickness of 150 gauge, in order to provide proper contact of cambium cells and avoid desiccation of the graft union.

**Result and Discussion**
**Days to sprouting**
Minimum number of days (10.66) required for emergence of sprouting was noted in 20 days + 4th week of August ($P_4S_4$), which is at par with 15 days + 2nd week of August (12.06) ($P_3S_4$). It might be due to level of sucrose content and favourable environment condition somewhat equal and optimum amount. New parenchymatous cells proliferate in two to eight days from both the scion and rootstock. The similar kind of observation was recorded by Majeed *et al.* (2015) [8] in mango.
The minimum number of days (12.58) required for emergence of sprouting was recorded in 20 days ($P_4$) scion precured prior to grafting. The time taken for sprouting decreased significantly with increase in time gap between scion precuring (defoliation) and grafting. Early sprouting of grafted plant in 20 days scion precuring prior to grafting might be due to storage of material in precured scion stick which stimulating meristematic activity and increase auxin concentration in the scion stick before formation of union, which leads to early sprouting in graft of sapota. Same result was also obtained by Dhakar and Das (2017) [3] in litchi.
Number of days required for sprouting was influenced significantly by different time of grafting. Minimum number of days (13.63) required for sprouting was recorded in 4th week of August ($S_4$). It might be due to that sprouting is influenced by the climate condition prevailing during grafting period. Moderate temperature and high humidity during August month which triggered cell activity. The higher cell activity results in early sprouting of scion (Shinde *et al.*, 2011) [11]. Relative humidity is a key factor in bud sprouting and higher humidity leads to early bud sprouts in sapota. The similar kind of finding were recorded by Sonawane *et al.* (2012) [12] in carambola.

**Sprouting percentage at 30 DAG**
The interaction effect of scion precuring and time of grafting (P×S) was found non-significant on the sprouting percentage at 30 DAG.
The significantly highest sprouting percentage (76.53%) was reported in 20 days ($P_4$) scion precured prior to grafting at 30 DAG. It might be due to the fact that defoliation cause an immediate rise in sucrose content of phloem sap of shoot. This helps in movement of solutes towards the apex of the shoot and thereby resulting in initiation of higher meristematic activity at bud level. This condition helps in better sap flow and good callus formation due to stimulation of cambium division favouring better graft union (Maiti and Biswas, 1980). This result is also conformity with the finding of Dhakar and Das (2017) [3] in litchi.
Grafting on 4th week of August ($S_4$) showed significantly highest sprouting percentage (65.73%) at 30 DAG. The higher success of grafting may be attributed to the congenial weather condition (maximum & minimum temperature and relative humidity) which resulted increased cell activity leading to better union of scion and rootstock. These results are in agreement with the finding of Gotur *et al.* (2017) [4] in guava and Karna. (2018) [6] in mango.

**Leaf area ($cm^2$) at 60 and 90 DAG**
leaf area at 60 DAG (35.58) and 90 DAG (43.57) was observed in 20 days precuring + 4th week of August ($P_4S_4$). It was statistically at par with 20 days precuring + 2nd with of August ($P_4S_3$) at 90 DAG (43.31).
The significantly highest leaf area was recorded in 20 days ($P_4$) scion precured prior to grafting at 60 DAG (32.34 $cm^2$) and 90 DAG (42.06 $cm^2$). It might be due to as the number of leaves increase metabolic activity of cell is doubled which result in vigorous and healthy growth of grafts, in turn give rise to more photosynthesis which might have increased the leaf area at great extent. Similar result observed by Chavda *et. al.* (2018) [2] in jamun.
Among the different time, significantly maximum leaf area was found in 4th week of August ($S_4$) at 60 DAG (27.21 $cm^2$) and 90 DAG (39.67 $cm^2$). It might be due to combined effect of climate conditions and also highest number of leaves increase the growth. The greater number of leaves which increase more leaf area per graft. The better vegetative growth and leaf are during 4th week of August, which increase the rate of photosynthesis and leads to formation of more photosynthates that facilitate and improve the growth and leaf area of grafted plants.

**Survival percentage at 90 DAG**

Effect of scion precuring and time of grafting observed significant effect on survival percentage of grafts at 90 DAG. 20 days + 4th week of August ($P_4S_4$) was observed significantly maximum survival percentage of grafts at 90 DAG (73.83%). It was statistically at par with 20 days + 2nd week of August ($P_4S_3$) (72.01%). It might be due to precuring of scion prior to grafting and adequate temperature & relative humidity is beneficial in terms of more success rate as well as overall graft growth. Along with this, the curing of scion prior to grafting had improved the efficiency of growth parameters resulting in appropriate graft growth & success and giving a possibility of maintaining of vigour of the scion. The similar kind of findings were recorded by Umadevi *et al.* (2021) [14] in tamarind.

The significantly maximum survival percentage (71.07%) was obtained in 20 days ($P_4$) scion precured prior to grafting at 90 DAG. It might be due to defoliated scion had more food material which visible as bud swelling. It causes rapid formation of callus tissue and early healing of graft union that allow translocation of vital chemical compounds between stock and scion leading to more chance of graft success and survivability. Similar result was recorded by Upadhya *et al.* (2014) [15] in mango and Tandel *et al.* (2020) [13] in mango.

The significantly maximum survival percentage (60.78%) was obtained in 4th week of August ($S_4$) at 90 DAG. It might be due to presence of enough carbohydrate and other food material in the scion collected during July- August season and the accumulated food material was mobilized for new growth which in turns high meristematic activity in scion. The similar kind of findings were recorded by Muniyappan *et al.* (2019[9] in jamun.

**Table 1:** Effect of scion precuring and time of grafting on days required for emergence of sprouting of sapota grafts and Sprouting percentage at 30 DAG

| Treatments | Days to sprouting | Sprouting percentage at 30 DAG |
|---|---|---|
| **Factor A: Scion precuring period (P)** | | |
| $P_1$- 0 days | 16.75 | 37.72 |
| $P_2$- 10 days | 15.45 | 54.43 |
| $P_3$- 15 days | 14.18 | 69.96 |
| $P_4$- 20 days | 12.58 | 76.53 |
| S.E m ± | 0.30 | 0.98 |
| **CD at 5%** | 0.84 | 2.83 |
| **Factor B: Grafting time (S)** | | |
| $S_1$ - 3rd week of July | 15.35 | 54.40 |
| $S_2$ - 5th week of July | 15.33 | 56.33 |
| $S_3$ - 2nd week of August | 14.65 | 62.15 |
| $S_4$ - 4th week of August | 13.63 | 65.73 |
| S.Em ± | 0.30 | 0.98 |
| CD at 5% | 0.84 | 2.83 |
| **Interaction (P×S)** | **Significant** | **Non-significant** |
| S.Em ± | 0.58 | |
| CD at 5% | 1.68 | |
| C. V.% | 6.86 | |

**Table 2:** Effect of scion precuring and time of grafting on leaf area of sapota at 60 & 90 DAG and survival percentage at 90 DAG

| Treatment | Leaf area ($cm^2$) | | Survival percentage |
|---|---|---|---|
| | 60DAG | 90DAG | 90 DAG |
| **Factor A: Scion precuring period (P)** | | | |
| $P_1$- 0 days | 17.78 | 33.65 | 46.90 |
| $P_2$- 10 days | 21.54 | 38.94 | 49.96 |
| $P_3$- 15 days | 27.22 | 40.42 | 67.47 |
| $P_4$- 20 days | 32.34 | 42.06 | 71.07 |
| **S.Em ±** | 0.30 | 0.35 | 0.65 |
| **CD at 5%** | 0.84 | 0.88 | 1.87 |
| **Factor B: Grafting time (S)** | | | |
| $S_1$ - 3rd week of July | 22.76 | 37.85 | 50.23 |
| $S_2$ - 5th week of July | 23.68 | 38.49 | 53.01 |
| $S_3$ - 2nd week of August | 25.81 | 39.04 | 56.36 |
| $S_4$ - 4th week of August | 27.21 | 39.67 | 60.78 |
| S.Em ± | 0.30 | 0.35 | 0.65 |
| CD at 5% | 0.84 | 0.88 | 1.87 |
| **Interaction (P× S)** | **Significant** | **Significant** | **Significant** |
| S.Em ± | 0.61 | 0.85 | 1.16 |
| CD at 5% | 1.75 | 1.90 | 3.35 |
| C. V.% | 4.28 | 2.74 | 3.66 |

## Conclusion

Based on the present investigation "Effect of scion precuring and time of grafting on softwood grafting of sapota (*Manilkara acharas* (Mill.) Fosberg) cv. Kalipatti", it could be concluded that, among 16 treatment combination, scion of cv. Kalipatti grafted on khirni rootstock with 20 days scion precured prior to grafting and during 4th week of August proved to be the best for minimum number of days to sprouting of graft, maximum number of bud sprout, leaves per graft as well as maximum length of scion (cm), scion girth (mm), internodal length (cm) and survival percentage.

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