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# Standardization of Wedge Grafting Technique in Guava (*Psidium guajava* L.) under Subtropical Conditions of Himachal Pradesh

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## ABSTRACT

The present investigation was carried out in the fruit nursery, Department of Fruit Science, College of Horticulture and Forestry, Neri, Hamirpur, Himachal Pradesh w.e.f., June, 2019–July, 2020. In the present investigation two factors viz., time of wedge grafting (mid-June, mid-July, mid-August, mid-September, mid-February and mid-March) and use of polycap (Graft union covered with polycap or without polycap) were studied to standardize the ideal time for wedge grafting with or without the use of polycap under protected conditions. Wedge grafting is being used as a rapid and successful technique for year-round production of guava plants, even in harsh climatic conditions and coving the graft union with polycap has also been used for obtaining higher success due to the development of a congenial microclimate in the graft's region. The results thus obtained showed that wedge grafting performed in guava during mid-February covered with polycap resulted in maximum graft-take (84.44%) and survival percent (80.31%). Whereas, wedge grafting executed during mid-July and covered with polycap resulted in maximum bud sprout (71.11%), minimum time for bud sprouting (10.67 days) and first leaf emergence (14.24 days). Wedge grafts performed in mid-July, covered with polycap also induced a notable increase in plant growth attributes in guava plants viz., production of number of leaves and sprout length at 30, 45, 60, 75 and 90 days after grafting.

**KEYWORDS:** Guava, growth, graft-take, polycap, wedge grafting

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***Data Availability Statement:*** Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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## 1. INTRODUCTION

Guava (*Psidium guajava* L.) is one of the most wonderful fruit crop grown both in tropical and sub-tropical regions of the world. It is recognized as "Poor man's apple" owing to cheaper cost and nutritionally richer than apple (Dhaliwal and Singla, 2002). Guava belongs to the family myrtaceae, which has more than 80 genera and 3,000 species, distributed in the tropics and subtropics, especially in America, Asia and Australia. It is native to tropical America extending from Mexico to Peru and was introduced in India by the Portuguese in 17$^{th}$ century (Menzel, 1985). Guava cultivation has been extended to varied agro-climatic regions owing to its wider adaptability. It is efficiently grown up to an altitude of 1500 m above mean sea level. However, temperature ranges between 20–30°C, well distributed rainfall ranges from 1000 to 2000 mm throughout the year, soils with good drainage, high levels of organic matter and ideal pH ranges between 5 to 7 (Yadava, 1996). Guava has gained popularity all over world due to its nutritional importance and health benefits. It is a rich source of vitamins C, A, $B_2$ (riboflavin) and minerals like calcium, potassium, phosphorous and iron (Singh et al., 2005; Rai et al., 2010).

In the recent times, guava has witnessed a commendable growth in its cultivation across the country. With respect to area, production and productivity in India, it is approximately to be 0.265 m ha, 4.054 m t and 15.29 t ha$^{-1}$, respectively (Anonymous, 2019). Guava has a great range of adaptability and gives high economic returns per year which reassures the farmers to take up guava cultivation on a commercial scale. There is an immense scope for bringing valuable additional area under guava crop in India. The primary requirement for planting an orchard is the initial planting material, which is a major factor in determining both quality and quantity of fruits (Singh et al., 2011). Lack of quality planting material and subsequent poor-quality seedlings, negatively affects the guava production and productivity (Singh et al., 2007; Singh and Bajpai, 2003). Inappropriate selection of scion wood from non-reliable sources and diseased mother plant also contribute towards production of poor-quality planting material.

Since area under the crop is expanding throughout the year. Therefore, successful and rapid multiplication technique is required to meet the huge demand of guava planting material round the year. Different propagation methods *viz.*, budding (Gupta and Mehrotra, 1985; Kaundal et al., 1987, Kumar et al., 2007), Wedge grafting (Gurjar et al., 2012), air layering (Sharma et al., 1978; Rathore, 1984; Manna et al., 2004, Rymbai and Reddy, 2010, Singh and Singh, 2016;), stooling (Pathak and Saroj, 1988) and cuttings (Rahman et al., 2003) have been tried by various workers throughout country. These methods are still not commercially viable due to varying rates of success, owing to absence of tap root system, production of limited numbers of plants, expensive, time consuming, season bound, labour intensive and involving difficult process for multiplication i.e., layering and stooling methods.

Different workers across the country reported a great potential for multiplying guava plants through wedge grafting throughout the year either in protected or open field conditions (Gotur et al., 2017, Kumar et al., 2007). They found wedge grafting as a rapid and successful technique for year-round production, even in harsh climatic conditions i.e., extreme cold and advocated to cover the scion stick with polycap for higher success due to the development of a congenial microclimate in the graft's region. While choosing a particular technique for propagation of guava, the time and method of operation must be taken into consideration. Success rate of a particular method, which may be high at one place, may vary at other place due to environmental factors (Gautam et al., 2010; Beer et al., 2013) such as temperature and relative humidity etc. Keeping in view of all these factors, the investigation was carried out to find the appropriate time of grafting and growing conditions for wedge grafting in guava to meet out the ever-increasing demand of planting material.

## 2. MATERIALS AND METHODS

The present research experiment was laid out in Completely Randomized Design (Factorial) with three replications and twelve treatment combinations at the fruit nursery of College of Horticulture and Forestry, Neri, Hamirpur, Himachal Pradesh, India w.e.f., June, 2019 to July, 2020. The present research involves wedge grafting performed on guava seedling rootstocks raised in polythene bags and kept under protected conditions. The wedge grafting (Plate 1) was performed at six different times during mid-June ($T_1$), mid-July ($T_2$), mid-August ($T_3$), mid-September ($T_4$), mid-February ($T_5$) and mid-March ($T_6$) with use of polycap conditions i.e., with polycap ($P_1$) and without polycap ($P_2$). One-year-old papery round brown corky or previous season round scion shoots of pencil thickness with 3 to 4 healthy buds were taken for grafting and debladed ¾$^{th}$ on mother plant itself, for seven days prior to detaching. At the same time, the apical growing portion of selected scion shoot was also beheaded. Six to eight-month old guava seedling rootstocks of 0.75 to 1.00 cm thickness were selected for grafting. The top of the seedling rootstock was cut off with sharp, clean and sterilized knife at 15–18 cm height from soil surface. The stem was split vertically down in the centre to a point 3.5–4.0 cm below the cut surface with help of grafting knife. Scion wood was collected from mother plant after seven days of hardening. Scion wood at the basal portion was cut from both side into


Plate 1: Wedge grafting in guava

a tapering wedge shape approximately 3.5–4.0 cm long. The tapered end was inserted into the split stem of the seedling rootstock. The rootstock and scion were wrapped tightly along with the zone of contact with long polythene strips. The polythene wrapping was removed after complete graft union formation to avoid stem girdling. The observations on different attributes viz., graft take (%), time taken for bud spouting (days), sprout per cent (%), time taken to first leaf emergence (days), Sprout length (cm), number of leaves per sprout and graft survival were recorded during the period of investigation.

## 3. RESULTS AND DISCUSSION

### *3.1. Effect of grafting time and use of polycap on performance of wedge grafting*

The major bottleneck in the expansion of guava cultivation is the non-availability of quality planting material and superior quality rootstocks, affecting production and productivity of guava. Standardization of grafting time and suitable environmental conditions are the need of the hour for successful production of planting material. It has been observed that wedge grafting is being used as most suitable method for easier propagation across the whole country. Owing to the suitability of wedge grafting for rapid multiplication and other advantages, the present studies were undertaken to standardize the suitable time of wedge grafting and environmental conditions.

### *3.2. Graft take (%)*

The results indicated that time of wedge grafting and use of polycap exhibit a significant influence on graft-take (Table 1). The wedge grafting performed during mid-February and graft union covered with polycap exhibited maximum graft-take (84.44%) followed by wedge grafting executed in mid-March (78.89%) with use of polycap. Whereas, minimum graft-take (39.99%) was observed in plants which were wedge grafted during mid-June without polycap. The higher graft take during early spring might be due to the optimum temperature with minimum variation in humidity and ideal scion portion. These factors might have played an important role in early establishment of contact of cambium layer of rootstock and scion resulting in easy callus formation and initiation of subsequent growth under favorable environmental conditions. The new callus tissue developing from the cambial region is made up of thin walled, turgid cells which are more prone to desiccation if left uncovered with polycap (Hartman et al., 1997). Use

Table 1: Effect of time of wedge grafting and use of polycap on graft take (%), time taken for bud sprouting (days), sprout percent (%), time taken for first leaf emergence (days) and graft survival (%)

| Time of wedge grafting | Graft-take (%) | | | Time taken for bud sprouting (days) | | | Sprout per cent (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean |
| $T_1$ (Mid-June) | 61.11 | 39.99 | 50.55 | 13.46 | 16.38 | 14.92 | 48.88 | 34.44 | 41.66 |
| $T_2$ (Mid-July) | 65.55 | 48.88 | 57.22 | 10.67 | 12.93 | 11.80 | 71.11 | 41.00 | 56.05 |
| $T_3$ (Mid-August) | 67.77 | 51.22 | 59.50 | 11.87 | 16.48 | 14.18 | 61.11 | 38.88 | 50.00 |
| $T_4$ (Mid-September) | 68.88 | 54.44 | 61.66 | 12.32 | 17.89 | 15.11 | 54.44 | 36.66 | 45.55 |
| $T_5$ (Mid-February) | 84.44 | 58.89 | 71.66 | 15.65 | 23.60 | 19.63 | 51.11 | 28.89 | 40.00 |
| $T_6$ (Mid-March) | 78.89 | 57.77 | 68.33 | 14.63 | 18.70 | 16.66 | 53.33 | 31.11 | 42.22 |
| Mean | 71.11 | 51.87 | | 13.10 | 17.66 | | 56.66 | 35.16 | |
| CD ($p$=0.05) (SEm±) | | | | | | | | | |
| Time of grafting (T) | 3.39 (350.6) | | | 1.65 (41.1) | | | 4.64 (223.5) | | |
| Use of polycap (P) | 1.96 (3331.9) | | | 0.95 (187.4) | | | 2.68 (4160) | | |
| T×P | 4.80 (25.1) | | | 2.34 (6.2) | | | 6.56 (41.8) | | |

Table 1: Continue...

| Time of wedge grafting | Time taken to first leaf emergence (days) | | | Graft survival (%) | | |
|---|---|---|---|---|---|---|
| | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean |
| $T_1$ (Mid-June) | 15.46 | 18.94 | 17.20 | 69.91 | 55.96 | 62.94 |
| $T_2$ (Mid-July) | 14.24 | 16.05 | 15.14 | 73.30 | 67.31 | 70.31 |
| $T_3$ (Mid-August) | 15.33 | 18.84 | 17.08 | 74.72 | 63.51 | 69.12 |
| $T_4$ (Mid-September) | 16.65 | 19.40 | 18.03 | 72.72 | 66.74 | 69.73 |
| $T_5$ (Mid-February) | 20.28 | 26.67 | 23.47 | 80.31 | 69.58 | 74.95 |
| $T_6$ (Mid-March) | 17.13 | 24.08 | 20.61 | 74.96 | 57.12 | 66.04 |
| Mean | 16.51 | 20.66 | | 74.32 | 63.37 | |
| CD ($p$=0.05) (SEm±) | | | | | | |
| Time of grafting (T) | 1.54 (53.1) | | | 3.07 (99.6) | | |
| Use of polycap (P) | 0.89 (154.8) | | | 1.78 (1079.2) | | |
| T×P | 2.17 (6.33) | | | 4.35 (6.5) | | |

of polycap reduces the rate of transpiration and increased humidity around graft joint, which protects the tissues from desiccation (Nimbalkar et al., 2011). Kukshal et al. (2017), Gotur et al. (2017), Joshi et al. (2014), Singh et al., (2011), Visen et al., (2010), Syamal et al. (2012) and Jadia et al. (2015) observed maximum graft take (%) with wedge grafting, when performed in the first fortnight of February.

*3.3. Time taken for bud sprouting (days)*

The data pertaining to the effect of time of wedge grafting and use of polycap on time taken for bud sprouting are presented in Table 1 and found to exhibit significant influence. The wedge grafting performed in mid-July and covered with polycap took minimum time (10.67 days) for bud sprouting, which was statistically at par with wedge grafting done in mid-August (11.87 days), mid-September (12.32 days) covered with polycap and wedge grafted plants without polycap in mid-July (12.93 days). While, maximum time (23.60 days) taken for bud sprouting was observed when wedge grafting was performed in mid-February without polycap.

*3.4. Sprout percent (%)*

It is inferred from the data presented in Table 1 that time of wedge grafting had a significant influence on the sprout per cent. The maximum sprout per cent (71.11%) was found

when wedge grafting was done in mid-July and covered with polycap followed by wedge grafting done in mid-August (61.11%) and graft union covered with polycap. However, minimum sprout per cent (28.89%) was observed when wedge grafting was done in mid-February without polycap, which was statistically at par with wedge grafting done in mid-March (31.11%) and mid-June (34.44%) without polycap.

*3.5. Time taken for first leaf emergence (days)*

The data recorded on the wedge grafting performed at different periods exhibited a significant effect on the time taken to first leaf emergence and are presented in Table 1. The wedge grafting performed in mid-July and covered with polycap took minimum time (14.24 days) to first leaf emergence, which was found to be statistically influenced with wedge grafting performed in mid-August (15.33 days), mid-June (15.46 days) covered with polycap and mid-July (16.05 days) without polycap. However, maximum time (26.67 days) to first leaf emergence was observed when wedge grafting was done in mid-February without polycap.

Early bud sprouting, higher sprout percent and lesser time for first leaf emergence may be due to higher cell sap movement, meristematic activity and higher relative humidity & temperature. Singh et al. (2007) suggested that relative humidity is an important factor in early sprouting of grafted plants, which promotes early sprouting and leads to earliest first leaf emergence. Similarly, a healthy, vigorous and robust rootstock raised under polyhouse condition would lead to better graft union and good sprouting percentage (Gotur et al., 2017).

These results are in conformity with Mulla et al. (2011**)** in jamun, Dixit et al. (2019), Bhatt et al. (2013) and Kumar et al. (2017) in guava and Singh and Singh (2007) in tamarind.

*3.6. Graft survival (%)*

The results pertaining to the effect of wedge grafting on graft survival is depicted in Table 1. It is evident that graft survival was significantly influenced by time of grafting and use of polycap. The maximum graft survival (80.31%) was observed when wedge grafting was performed in mid-February and covered with polycap followed by mid-March (74.96%). However, minimum graft survival (55.96%) was observed, when wedge grafting was done in mid-June and without polycap, which was statistically at par with plants grafted mid-March (57.12%).

The development of cambial tissues between stock and scion encouraged the better establishment of the grafts and resulted in increased graft survival in guava. After initial success of grafts, some grafts were failed to survive due to poor graft union. In addition, since the parenchyma cells comprising the callus tissues are thin walled and tender, after removing polycap they have no maintenance of temperature and relative humidity and did not support the graft to grow (Hartmann et al., 1997). Polycap also helped in high survivability of the grafts by providing initial nourishment and protection against desiccation during sprout initiation. Similar results were reported by Jadia et al. (2015) and Syamal et al. (2012) in guava, Ghojage et al. (2011) in jamun and Verma et al. (2012**)** in grape.

*3.7. Sprout length*

The data recorded on the effect of time of wedge grafting and use of polycap on sprout length at 30, 45, 60, 75 and 90 days after grafting are presented in Table 2.

Table 2: Effect of time of wedge grafting and use of polycap on sprout length at 30, 45, 60, 75 and 90 days after grafting

| Time of wedge grafting | At 30 days after grafting | | | At 45 days after grafting | | | At 60 days after grafting | | |
|---|---|---|---|---|---|---|---|---|---|
| | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean |
| $T_1$ (Mid-June) | 1.46 | 1.18 | 1.32 | 2.93 | 2.38 | 2.66 | 4.89 | 4.43 | 4.66 |
| $T_2$ (Mid-July) | 2.49 | 2.21 | 2.35 | 3.93 | 3.30 | 3.61 | 6.00 | 4.85 | 5.42 |
| $T_3$ (Mid-August) | 2.37 | 2.00 | 2.19 | 3.39 | 2.99 | 3.19 | 4.60 | 4.37 | 4.49 |
| $T_4$ (Mid-September) | 1.28 | 0.97 | 1.12 | 2.06 | 1.78 | 1.92 | 3.48 | 3.01 | 3.25 |
| $T_5$ (Mid-February) | 0.96 | 0.81 | 0.88 | 1.64 | 1.51 | 1.57 | 2.98 | 2.76 | 2.87 |
| $T_6$ (Mid-March) | 1.04 | 0.94 | 0.99 | 2.08 | 1.99 | 2.03 | 3.77 | 3.08 | 3.42 |
| Mean | 1.60 | 1.35 | | 2.67 | 2.32 | | 4.28 | 3.75 | |
| CD ($p$=0.05) (SEm±) | | | | | | | | | |
| Time of grafting (T) | | 0.34 (2.39) | | | 0.32 (3.79) | | | 0.38 (5.86) | |
| Use of polycap (P) | | 0.20 (0.56) | | | 0.18 (1.08) | | | 0.22 (2.65) | |
| T×P | | NS (0.081) | | | NS (0.073) | | | NS (0.18) | |

Table 2: Continue...

| Time of wedge grafting | At 75 days after grafting | | | At 90 days after grafting | | |
|---|---|---|---|---|---|---|
| | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean |
| $T_1$ (Mid-June) | 6.32 | 6.18 | 6.25 | 7.55 | 7.43 | 7.49 |
| $T_2$ (Mid-July) | 8.02 | 6.10 | 7.06 | 9.13 | 7.17 | 8.15 |
| $T_3$ (Mid-August) | 6.75 | 6.32 | 6.54 | 7.87 | 7.34 | 7.61 |
| $T_4$ (Mid-September) | 4.96 | 4.32 | 4.64 | 6.17 | 5.43 | 5.80 |
| $T_5$ (Mid-February) | 4.48 | 4.07 | 4.27 | 5.86 | 5.32 | 5.59 |
| $T_6$ (Mid-March) | 5.16 | 4.84 | 5.00 | 6.14 | 5.99 | 6.07 |
| Mean | 5.95 | 5.31 | | 7.12 | 6.45 | |
| CD ($p$=0.05) (SEm±) | | | | | | |
| Time of grafting (T) | | 0.73 (7.77) | | | 0.63(7.14) | |
| Use of polycap (P) | | 0.42 (3.71) | | | 0.36 (4.08) | |
| T×P | | NS (0.63) | | | NS (0.69) | |

*3.7.1. Sprout length at 30, 45, 60, 75 and 90 days after grafting*

The time of wedge grafting showed a significant effect on sprout length at 30, 45, 60, 75 and 90 days after grafting. The wedge grafting performed during mid-July ($T_2$) resulted in maximum sprout length (2.35 cm, 3.61 cm, 5.42 cm, 7.06 cm and 8.15 cm), while minimum sprout length (0.88, 1.57, 2.87, 4.27 and 5.59 cm) was observed in plants which were grafted in mid-February ($T_5$) at 30, 45, 60, 75 and 90 days after grafting, respectively.

Irrespective of time of grafting, use of polycap also showed significant influence on the sprout length at 30, 45, 60, 75 and 90 days after grafting. The wedge grafted plants covered with polycap showed maximum sprout length (1.60, 2.67, 4.28, 5.95 and 7.12 cm), whereas minimum sprout length (1.35, 2.32, 3.75, 5.31 and 6.45 cm) was observed in wedge grafted plants without polycap, at 30, 45, 60, 75 and 90 days after grafting, respectively. The interaction between time of wedge grafting and use of polycap had non-significant effect on sprout length at 30, 45, 60, 75 and 90 days after grafting.

Grafted plants covered with polycap showed better growth as compared to uncapped grafts. It might be due to earliness in sprouting and leaf emergence caused by congenial environment conditions inside the polycap and resulted in the fast growth of grafts. A congenial environment inside the polyhouse was also maintained which might provide the favourable temperature and higher relative humidity to the grafts. The favourable environmental conditions might hasten the process of photosynthesis resulted in higher availability of food material to the plants which supported to continue flushing of grafts. Similar findings were also reported by Kumar et al. (2017) in guava.

*3.8. Number of leaves*

The results pertaining to the effect of time of wedge grafting and use of polycap on number of leaves at 30, 45, 60, 75 and 90 days after grafting are presented in Table 3.

*3.8.1. Number of leaves at 30, 45, 60, 75 and 90 days after grafting*

Irrespective of use of polycap, the time of wedge grafting exhibited a significant influence on production of number of leaves emerged at 30, 45, 60, 75 and 90 days after grafting. The maximum number of leaves (2.99, 3.88, 4.27, 6.16 and 8.74) were formed when wedge grafting was performed in mid-July ($T_2$) while, minimum number of leaves (1.85, 2.39, 3.03, 5.41 and 6.60) were formed when wedge grafting performed in mid-March ($T_5$) at 30, 45, 60, 75 and 90 days after grafting, respectively.

The use of polycap also exhibited a significant effect on number of leaves at 30, 45, 60, 75 and 90 days after wedge grafting. Maximum number of leaves (2.73, 3.57, 4.10, 5.78 and 7.78) were formed in wedge grafted plants covered with polycap, whereas minimum number of leaves (2.17, 2.98, 3.44, 5.16 and 6.76) were found in plants not covered with polycap at 30, 45, 60, 75 and 90 days after grafting, respectively.

The interaction between time of wedge grafting and use of polycap attained a non-significant effect on the number of leaves at 30, 45, 60, 75 and 90 days after grafting.

The formation of maximum number of leaves in July might be due to favourable climatic conditions prevailed during that period as well as higher food reserve in plants leading to early sprouting of scions that supported growth of the grafts at higher rate and resulting in production of higher number of leaves on the grafts. The findings are in consonance with those of Gosh et al. (2010) in sapota and Ghojage et al. (2011) in jamun.

Table 3: Effect of time of wedge grafting and use of polycap on number of leaves at 30, 45, 60, 75 and 90 days after grafting

| Time of wedge grafting | At 30 days after grafting | | | At 45 days after grafting | | | At 60 days after grafting | | |
|---|---|---|---|---|---|---|---|---|---|
| | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean |
| $T_1$ (Mid-June) | 2.95 | 2.42 | 2.68 | 3.57 | 3.27 | 3.42 | 3.93 | 3.59 | 3.76 |
| $T_2$ (Mid-July) | 3.36 | 2.61 | 2.99 | 4.46 | 3.30 | 3.88 | 4.80 | 3.75 | 4.27 |
| $T_3$ (Mid-August) | 2.46 | 1.99 | 2.23 | 3.85 | 3.05 | 3.45 | 4.40 | 3.55 | 3.98 |
| $T_4$ (Mid-September) | 3.33 | 2.42 | 2.87 | 4.16 | 3.44 | 3.80 | 4.69 | 3.78 | 4.24 |
| $T_5$ (Mid-February) | 2.37 | 1.81 | 2.09 | 2.97 | 2.47 | 2.72 | 3.51 | 3.15 | 3.33 |
| $T_6$ (Mid-March) | 1.94 | 1.77 | 1.85 | 2.42 | 2.36 | 2.39 | 3.27 | 2.79 | 3.03 |
| Mean | 2.73 | 2.17 | | 3.57 | 2.98 | | 4.10 | 3.44 | |
| CD ($p$=0.05) (SEm±) | | | | | | | | | |
| Time of grafting (T) | 0.38 (1.27) | | | 0.39 (2.15) | | | 0.32 (1.51) | | |
| Use of polycap (P) | 0.22 (2.85) | | | 0.23 (3.14) | | | 0.18 (3.96) | | |
| T×P | NS (0.09) | | | NS (0.23) | | | NS (0.14) | | |

Table 3: Continue...

| Time of wedge grafting | Time taken to first leaf emergence (days) | | | Graft survival (%) | | |
|---|---|---|---|---|---|---|
| | With polycap ($P_1$) | Without polycap ($P_2$) | Mean | With polycap ($P_1$) | Without polycap ($P_2$) | Mean |
| $T_1$ (Mid-June) | 4.89 | 4.64 | 4.76 | 6.88 | 6.69 | 6.78 |
| $T_2$ (Mid-July) | 6.59 | 5.74 | 6.16 | 9.87 | 7.61 | 8.74 |
| $T_3$ (Mid-August) | 6.25 | 5.17 | 5.71 | 8.94 | 7.23 | 8.09 |
| $T_4$ (Mid-September) | 5.79 | 4.87 | 5.33 | 7.11 | 6.41 | 6.76 |
| $T_5$ (Mid-February) | 5.70 | 5.12 | 5.41 | 7.01 | 6.29 | 6.65 |
| $T_6$ (Mid-March) | 5.43 | 5.39 | 5.41 | 6.89 | 6.31 | 6.60 |
| Mean | 5.78 | 5.16 | | 7.78 | 6.76 | |
| CD ($p$=0.05) (SEm±) | | | | | | |
| Time of grafting (T) | 0.60 (1.28) | | | 1.08 (4.99) | | |
| Use of polycap (P) | 0.35 (3.45) | | | 0.62 (9.50) | | |
| T×P | NS (0.25) | | | NS (0.93) | | |

The development of cambial tissues between stock and scion encouraged the better establishment of the grafts in guava, results in increased graft survival. After initial success of grafts, some grafts were failed to survive due to poor graft union formation. In addition, since the parenchyma cells comprising the callus tissues are thin walled and tender, after removing polycap they have no maintenance of temperature and relative humidity and did not support the graft to grow (Hartmann et al., 1997). Polycap also helped in high survivability of the grafts by providing initial nourishment and protection against desiccation during sprout initiation. Similar results were reported by Jadia et al. (2015) and Syamal et al. (2012) in guava, Ghojage et al. (2011) in jamun and Verma et al. (2012) in grape.

## 4. CONCLUSION

Wedge grafting performed during mid-February and covered with polycap resulted maximum graft-take (84.44%) and graft survival (80.31%) under protected environment. However, wedge grafting performed during mid-July recorded better vegetative growth among different parameters viz., early bud sprouting, first leaf emergence, sprout length and number of leaves.

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