# STUDIES ON THE IMPROVEMENT OF NEW GRAFTING METHODS IN GUAVA

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Some factors affecting the sprouting success and growth of guava grafts were studied. The veneer and T-grafting were used on different dates during spring and summer seasons with scion wood having two, three and four buds. Summer grafting was found more successful (82%) than spring one (47%). The scion wood with four buds gave better success than those having two or three buds in both the seasons and in both grafting methods. In spring grafting mid-February while in summer early August were more suitable times for this work. Bud sprouting was also found to be positively correlated with callus formation in the region of graft union.

## INTRODUCTION

Inarching, aeriel layering, budding, grafting and cuttings are the various methods used for vegetative propagation of guava in various countries. In our country none of the above methods are practised in commercial nurseries and seed propagation is the only common method in vogue. Hence experiments were conducted to work out a simple, cheap and efficient methods of asexual propagation the results of which are reported in the special Number of Zarii Digest Vol 3 (1) of 1968. The present investigetions were carried out to study the role of some contributing factors in improving the performance of these methods under our conditions.

The results of various investigators for guava propagation by grafting are briefly reviewed here. Propagation of guava by veneer and side grafting failed completely (Ahmad, 1966) in Pakistan while Smith (1953) in Florida found that veneer and side grafting are successful on young plants of guava. With regard to inarching, Ahmad (1966) at Lyallpur got 72-80 per cent success in inarching done in spring and autumn season respectively. Also in India it is the most common method for vegetative propagation of guava

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(Gandhi, 1957). For time of grafting Tamburo *et. al* (1956) preferred autumn grafting using veneer, cleft and bark grafting methods while Singh (1960) found July to November as optimum time for side grafting.

Hartmann and Kester (1958) have reported that temperature has a pronounced effect on the production of callus tissue. Between 40-90°F the rate of callus formation increases directly with the temperature. They also reported that spring buds will usually develop rapidly enough if growing conditions are favourable. Leopold (1955 and 1964) reported that activity of cambium growth is promoted by hormones and that the hormones from the buds move basipetally and exert their influence on rooting.

## MATERIALS AND METHODS

The experiment was carried out in the University Nursery during the year 1969 for which one year old guava seedlings were used.

The two methods of grafting tested were veneer and T-grafting (Fig. 1 and 2). In order to study the effect of number of scion buds on grafting success bud wood with two, three and four buds was used. In all treatments the terminal portion of the shoot that was prepared on the tree about a week before grafting was used. The bud wood was prepared by trimming off all the leaves leaving their short petioles intact.

The grafting was done on 15th February, 1st March and 16th March in spring and 15th July, 1st August and 16th August in summer season of the year 1969 with a view to determine the optimum time of grafting in each season.

In all 864 plants were grafted by the two methods during each season. The experiment was laid out by randomized block design with three replications. The data regarding success of sprouted grafts and total growth of the graft during the season were analysed according to Fisher's method of Analysis of Variance (1958).

The data comprised of percentage of the sprouted grafts, total growth of grafts during the season and the correlation between the bud activity and callus formation by rank correlation method $SR = 1 - \frac{6\,Ed^2}{n(n^2-1)}$ after Kurtz (1963).

## RESULTS AND DISCUSSION

*Percentage of Sprouted Grafts*

In spring 1969 the two methods veneer and T-grafting and time of grafting did not show differential effects (Table 1) However, the percentage success was found to be related to the number of buds carried by the scion wood at the time of grafting. The scion wood with 4 buds showed significantly higher percentage of sprouted grafts (57%) as compared to scion wood with 2 buds (40%) while graft wood with 3 buds occupied intermediate position (46%). All interactions between various primary factors were non-significant (Table 1).

In summer season of 1969 again both the methods were alike. The success of sprouted grafts was, however, much higher as compared to spring season (Table 2). Like spring grafting, in summer also the bud wood with 4 buds produced significantly higher percentage success (94.0%) than bud wood with 3(81%) and 2 (70.0%) buds Thus the grafting of both spring and summer seasons has clearly shown that the grafting success was directly related to the number of buds present on the scion wood.

In summer grafting, 1st August produced the highest success of 88 per cent followed by 83% success of 15th July. Grafting success in case of 16th August was the lowest (74%). All interactions between various factors were non-significant.

The two methods of grafting used in the present studies have shown similar performance in the same season. However, the success in both the

TABLE 1 *Percentage of sprouted grafts during spring 1969.*

| | Number of Buds on Scion Wood | | | | | | | | | Means for methods. | F. Ratio. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 buds | | | 3 buds | | | 4 buds | | | | |
| Dates : | 15th | 1st | 16th | 15th | 1st. | 16th | 15th | 1st. | 16th | | |
| Method of grafting | Feb. | Mar. | Mar | Feb. | Mar. | Mar, | Feb. | Mar. | Ma. | | |
| Veneer-grafting. | 24 | 38 | 76 | 43 | 24 | 48 | 52 | 57 | 57 | 47 | N.S. |
| T-grafting | 33 | 29 | 38 | 57 | 48 | 52 | 62 | 52 | 62 | 48 | * |
| Means for No. of buds | | 40 | | | 45 | | | 57 | | | |
| Means for dates : | 15th Feb | | | 1st Mar. | | | 16th Mar. | | | | |
| | | 45 | | | 41 | | | 57 | | | N.S. |

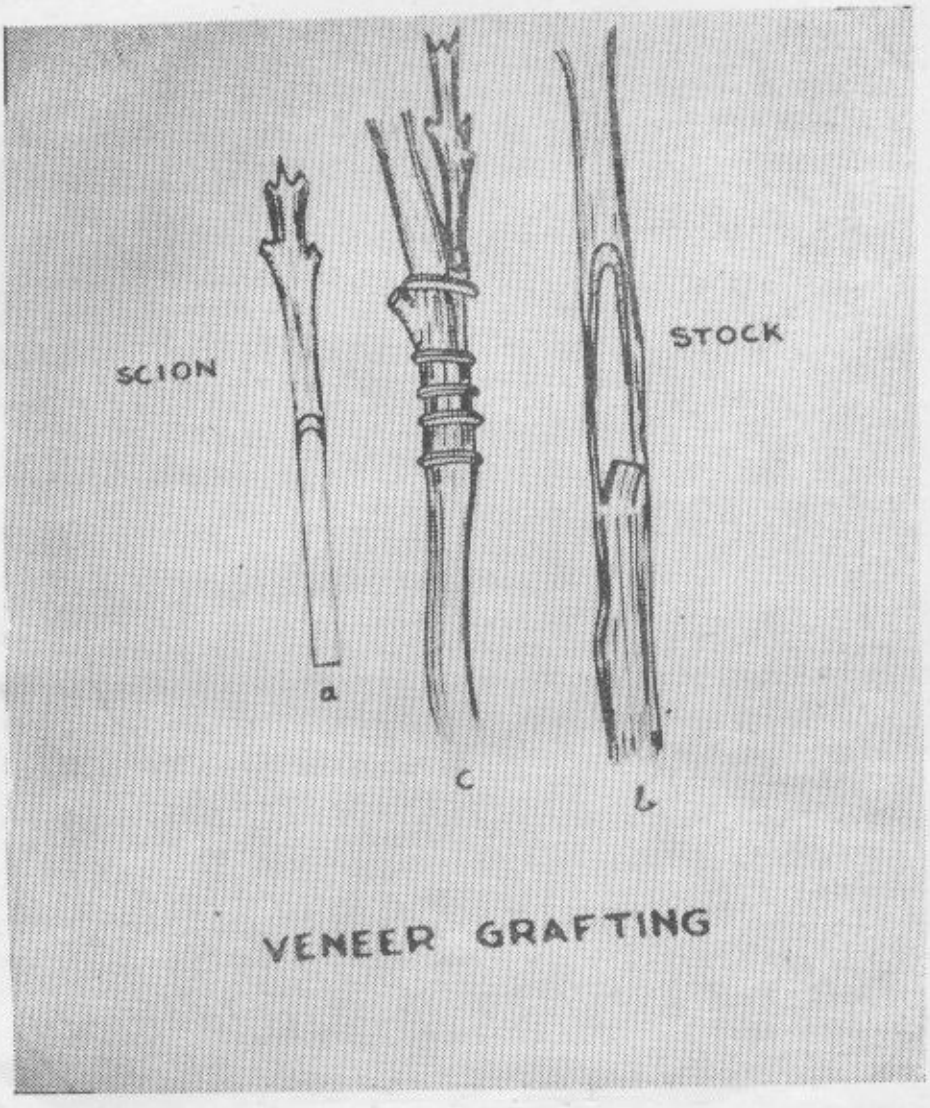


Fig. 1. Veneer grafting method

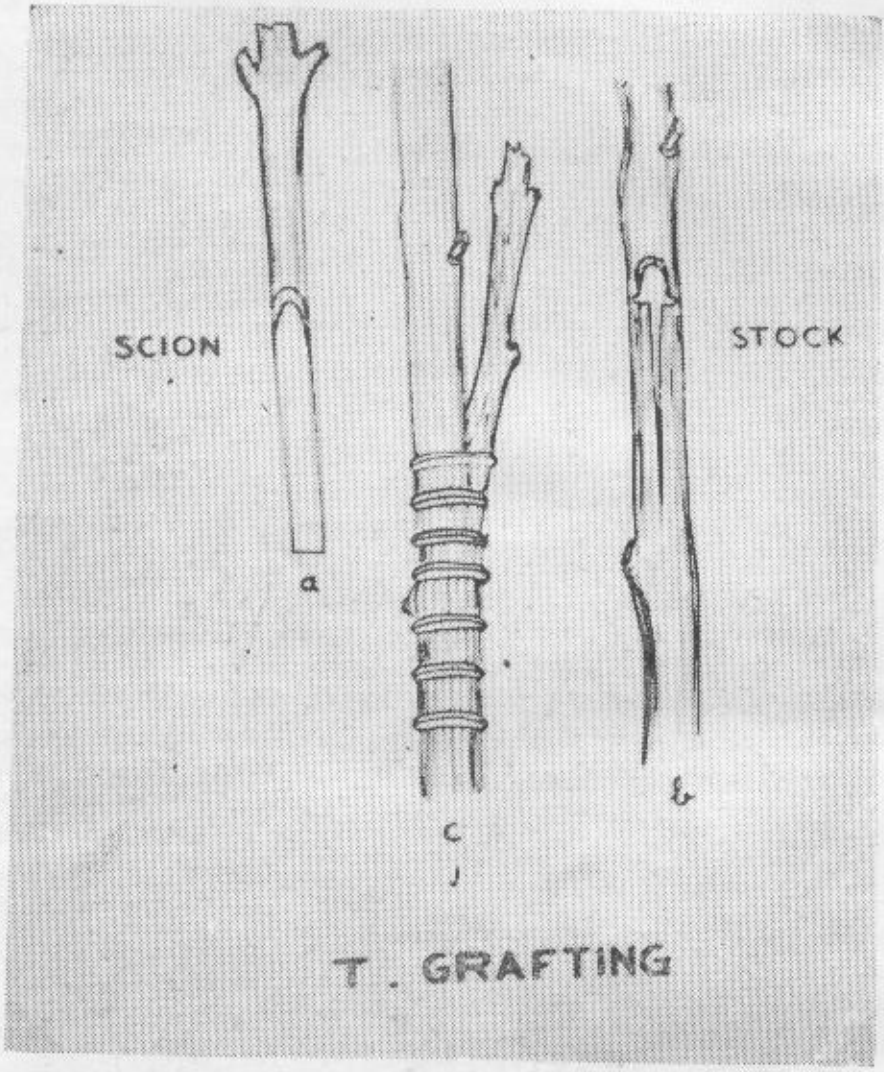


Fig. 2. T-grafting method.


Fig. 3. Seven months grown grafts by veneer grafting.


Fig. 4. Seven months grown grafts by T-grafting.

TABLE 2. *Percentage of sprouted grafts during summer 1969*

| | Number of Buds on Scion Wood | | | | | | | | | Means for methods | F. Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 buds | | | 3 buds | | | 4 buds | | | | |
| Dates : Methods. | 15th Jul | 1st Aug. | 16th Aug. | 15th Jul. | 1st Aug. | 16th Aug | 15th Jul. | 1st Aug. | 16th Aug. | | |
| Veneer grafting | 75 | 86 | 52 | 86 | 90 | 71 | 90 | 95 | 90 | 82 | N.S |
| T-grafting | 66 | 76 | 66 | 81 | 81 | 76 | 100 | 100 | 26 | 81 | |
| Means for No. of buds | | 70 | | | 81 | | | 94 | | | * |
| Means for dates:- | | 1st Aug. | | | 15th July | | | 16th Aug. | | | |
| | | 88 | | | 83 | | | 74 | | at 5% | |

methods was much greater in summer grafting (82%) than in spring (47%). On the other hand, Ahmad (1966) could not get any success by both the methods during spring and summer grafting. Smith (1953), however, found thas side and veneer graftings were successful in young plants of guava and showed better results in summer than in spring season thus corborating with our results. The findings of Tamburo *et al* (1956) and Singh (1960) also reported similar results. The high success in summer than in spring season shown by the present data and those of other workers may be due to more favourable growing conditions in summer than in the latter season. Again in summer, grafting done during monsoon season would give better results than during other times.

The results with scion wood of 4 buds were better than with 3 or 2 buds. In other words the success in grafting was directly proportionate to the number of buds carried by the scion wood. Since the buds are the seats of hormone production, which move basipetally to stimulate cambium activity, their would be better chances of graft union which initially starts in the cambia of the two parts.

From the results of present experiments and other workers, it appears that veneer and T-grafting can be practised successfully for guava propagation under our conditions. The two new methods of grafting being suggested now would go a long way to fill up the gap for asexual propagation of guava under our condition. These methods can be practised very conveniently in the nursery with less cost as compared to inarching.

*Total Growth of the Successful grafts:* The two grafting methods did not show differential behaviour as far the growth of the successful grafts in spring and summer seasons was concerned. The number of buds on the scion wood and the time of grafting, however, had influenced the growth.

In case of spring graft the two buds on the scion wood showed 22.81 cm. total growth of the graft which was significantly greater than when 3 (15.54 cm) and 4 (15.81 cms.) buds were present (Table 3). On the other hand in summer grafting the bud wood having 3 and 4 buds, produced a total growth of 4.46 and 4.33 cm. which was significantly more than scion wood having 2 buds which produced 3.23 cm. length per plant (Table 4).

TABLE 3. *Total growth of grafts produced in spring season of 1969 (mean length in cm.)*

| | Number of buds on Scion wood | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2 buds | | | 3 buds | | | 4 buds | | | Mean F./Ratio. |
| Dates / Method | 15th Feb. | 1st Mar. | 16th Mar. | 15th Feb. | 1st Mar | 16th Mar | 15th Feb. | 1st Mar | 15th Mar | for method |
| Veneer grafting | 33.7 | 13.2 | 23.9 | 21.1 | 13.0 | 15.4 | 19.5 | 16.2 | 20.2 | 19.58 N.S. |
| T-grafting | 29.3 | 16.6 | 20.1 | 18.1 | 13.1 | 11.9 | 11.7 | 10:8 | 16.5 | 16.53 |
| Means for No. of buds | | 22.81 | | | 15.54 | | | 15.81 | | |

Means for dates: 15th Feb. 22.32 — 16th Mar. 18.01 — 1st. Mar. 13.83

TABLE 4. *Total growth of grafts produced in summer season of 1967 (Mean length in cm.).*

| | Number of buds on Scion Wood | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2 buds | | | 3 buds | | | 4 buds | | | Means F/Ratio |
| Dates / Methods of grafting | 15th July | 1st Aug. | 16th Aug. | 15th July | 1st Aug. | 16th Aug. | 15th July | 1st Aug. | 16th Aug. | for methods. |
| Veneer grafting | 2.1 | 2.6 | 2.9 | 4.5 | 6.5 | 2.3 | 4.0 | 4.3 | 4.5 | 3.77 N,S. |
| T-grafting | 2.7 | 5.5 | 3.5 | 2.7 | 6.3 | 4.3 | 3.7 | 5.7 | 3.k | 4.24 |
| Means for No. of buds. | | 1.23 | | | 4.33 | | 4.46 | | | |

Means for dates: 1st Aug. 5.87 — 16th Aug. 3.58 — 15th July 3.28


Fig. 5. One year grown grafts by veneer grafting.

Fig. 6. One year grown grafts by T-grafting.

With regard to dates, the grafting of 15th February produced the maximum growth of 22.32 cm. per plant but was significantly higher than only 1st March (13.83 cm. per plant). In summer season, grafting done on 1st August produced greater growth which was significantly higher than 16th August and 15th July. The total growth on 1st August was 5.17 as compared to 3.58 and 3.28 cm on 16th August and 15th July. respectively. The interactions were non significant. The total growth of such grafts produced in spring can be compared with those produced in summer season in Fig. 3 to 6.

The present results show that grafts made in spring season produced much higher growth than those prepared in summer season. The success in grafting was, however, greater in summer than in spring. This is probably due to the reason that spring season is followed by a prolonged active growing season whereas the summer grafting is succeeded by only a short period of growth in September and October, then interrupted by a dormant winter season in which the shoot growth is greating checked.

*Replationship Between Buds Sprouting And Callus Formation.*—In order to know whether callus formation has any effect on bud sprouting, a rank correlation (Sr) between callus formation and bud sprouting was determined for each season.

The calculated value of Sr in spring season was 0.923 against critical value 0.623 at one percent level. Thus the data have shown strong positive correlation between bud sprouting and callus formation (Table 5). The calculated value of Sr in summer season was 0.947 against a critical value of 0.623 at one percent level, thus confirming the conclusion of spring grafting. On the basis of present results it seems reasonable to conclude that callus appears to be an essential pre-requisit for bud sprouting.

TABLE 5. *Rank correlation between bud sprouting and callus formation during spring and summer, 1969.*

| Season | Rank Correlation | Critical value at 1 % | Conclusion |
|---|---|---|---|
| Spring 1969 | 0.923 | 0.623 | Strongly positive correlation |
| Summer 1969 | 0.947 | 0.623 | Strongly possitive |

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