

Wedge Grafting In Guava - A Novel Vegetative Propagation Technique



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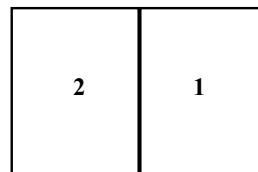
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Cover photographs

1. Mass multiplication of guava through wedge grafting in greenhouse
2. Grafted plants under shade net

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WEDGE GRAFTING

Introduction

Guava is one of the most promising fruit crop of India and is considered to be an exquisite, nutritionally valuable and remunerative crop. Fruits are used both for fresh consumption and processing purposes. The flavour is variable and is distinguished by a characteristic and penetrating musky aroma of varying intensity. As one gets accustomed to its penetrating aroma, it becomes most delicious and fascinating fruit for consumers. It excels most other fruit trees in productivity, hardiness, adaptability and vitamin C content. Besides its high nutritive value, it bears heavy crop every year and gives handsome economic returns. This has prompted several farmers to take up guava cultivation on a commercial scale. In recent years, guava is getting popularity in the international trade due to its nutritional content and processed products. However, the greatest handicap in guava plantation is indiscriminate multiplication of plants from unreliable sources by nurserymen. Proper care is not exercised in the selection of scion material from really outstanding and disease-free mother trees. The result is that a large number of low grade guava plants are distributed and planted in the field every year. These trees become a permanent liability to the growers as no amount of

fertilization and care can change their genetic qualities. Non-availability of quality planting materials and consequent substitution of poor quality seedlings have adversely affected the guava production and productivity levels. Although a large number of nurseries have been established, there is an acute shortage of quality planting material. The initial planting material is the basic requirement on which the final crop depend both in quality and quantity. The scenario is changing from traditional propagation with incorporation of science and technology in nursery management and trade. A good nursery should produce true-to-type planting material scientifically which will be the foundation for a good orchard.

In view of the high return and the potential for processing, there is a tremendous scope for bringing substantial additional area under guava crop in India. So, a rapid and successful propagation technique is required as the area under crop is expanding and there is a demand to prepare the guava samplings throughout the year.

Raising planting material through rapid multiplication technique

Guava plants have been propagated through seeds for a long time. Propagation from seeds results in considerable

variation in the size, shape, form and quality of fruits. Vegetative propagation in guava results in true-to-type crop with short juvenile phase. Though guava is propagated through budding, air-layering, stooling and inarching, these are still not commercially viable due to varying rate of success, absence of tap root system and cumbersome process. Therefore, there is need to produce healthy planting material of important commercial varieties. While choosing a particular technique for propagating guava, time of grafting operation and climatic conditions should be taken into consideration. Now, the Govt. of India has given focused attention on establishing the model nurseries for full-filling the requirement of genuine planting materials to the Indian farmers under National Horticulture Mission (NHM). Therefore, a technique of rapid multiplication (**Wedge grafting**) has been developed at Central Institute of Subtropical Horticulture (CISH), Lucknow. Wedge grafting has a tremendous potential for multiplying guava plants rapidly throughout the year either in greenhouse as well as in open conditions. In view of varied climatic conditions of our country, guava plants are required round the year. Presently, the institute is producing raising quality materials of guava through wedge grafting technique round the year in greenhouse as well as in open conditions.

Advantages of wedge grafting

- Wedge grafting is a relatively easy method of propagation.
- Success percentage is higher than that of budding.
- The plants grafted with wedge method takes less time (9-12 days) for sprouting and plant gets ready for sale within five months from day of grafting operation.
- The grafted plants showed very high field establishment on account of undisturbed tap root system.
- Wedge grafting has a tremendous potential for multiplying guava plants rapidly through the year either in greenhouse as well as in open field conditions.
- The major advantage of this technique is that, plants get higher success rate with the help of polycap even at low temperature (winter months).
- After grafting, if scion dies for any reason, the split portion is beheaded and rootstock can be used for further grafting.

Seed germination for rootstocks to be grafted

The method of wedge grafting in guava raised in polythene bags has been standardized. The technique envisaged growing of seedlings in polythene bag, grafting, capping and hardening of grafts.

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Technique of seed sowing

Raising rootstocks in polythene bags is recommended as they give better establishment of plants in the field on account of undisturbed tap root system. Moreover, nursery raising in polythene bags saves labour in weeding, watering, shifting and lifting of saplings. The chief advantage of using polythene bags is that, the seedlings can be raised almost round the year under controlled conditions. Guava seeds have a hard coating over the endocarp as a result of which usually long time is required for germination. Fresh seeds should be extracted from ripe fruits and washed thoroughly to remove the pulpy material clinging to the seeds. It should be treated with fungicide (copper oxychloride) to prevent damping-off of seedling before sowing in the polythene bag. If the damping-off occurs as the seedlings emerge, both the seedlings and the media surface should be treated with a fungicide. A group of fungi is responsible

for damping-off the seedlings. For controlling damping-off, treatment with 0.3% copper oxychloride has been found very effective. Seeds of guava (Allahabad Safeda, Sardar, Lalit or any improved cultivars or promising selections) are sown in polythene bags/ plastic pot (20x10 cm or 18x27 cm) at any time (January-December). Polythene bags/ plastic pots are filled with soil, sand and farmyard manures in 3:1:1 ratio. All the polythene bags are covered with 100 micron (400 gauges) white polythene sheet soon after seed sowing. During winter months, the polythene mulch induces heat and create conducive environment (micro-climate) for rapid germination and early establishment of seedlings. Seed covered with polythene sheet gives as high as 97 per cent within three weeks.

Technique of rapid multiplication through wedge grafting

The technique envisaged growing of seedlings in polythene bag, grafting, capping and hardening of grafts. Seedlings are raised for rootstocks in the nursery for approximately 6 to 8 months. When the stem diameter of seedling is of pencil thickness (0.5-1.0 cm), such are picked up for wedge grafting.



Raising seedling rootstocks in polythene bag for grafting



Rootstocks ready for grafting

Selection of scion wood

In this technique, proper selection and preparation of scion sticks is very important for obtaining higher success. Shoot with growing apical portion (apical growth) which is 3 to 4 - months - old is ideal for this technique. The scion shoot of pencil thickness with 3 to 4 healthy buds of 15-18 cm long is used for grafting. Selected scion shoots are defoliated on the mother plant, about 5-7 days prior to detaching. At the same time, the apical growing portion of selected shoot is also beheaded. This helps in forcing the dormant buds to swell. In this way, the buds on the scion will be ready to start sprouting at the time of grafting. This treatment is essential for high success of grafts.

Grafting Technique

After selection of the scion, rootstock (seedling) is headed back by retaining 15-18 cm long stem above the polythene bag. The beheaded rootstock is split to about 4.0 - 4.5 cm deep through the centre

of the stem with grafting knife. A wedge shaped cut, slanting from both the sides (4.0 - 4.5 cm long) is made on the lower side of the scion shoot. The scion stick is then inserted into the split of the stock and pressed properly so that cambium tissues of rootstock and scion stick should come in contact with each other. Care must be exercised to match the cambium layer of the stock and scion along with full length of each component. The union is then tied with the help of 150 gauge polythene strip, 2 cm in wide and 25 - 30 cm in length. Immediately after grafting, the graft is covered by 2.5 x 18.0 cm long white polythene cap which is tied with rubber band at the lower end. The scion starts sprouting after 9 to 12 days which is visible from outside. The cap is removed after 25 days in the evening hours. The grafts are transferred in net house for hardening. In case of open condition, the grafts are kept in partial shade. Propagation of guava by wedge grafting is very successful in environment controlled greenhouse. In controlled greenhouse, the humidity ranges from 60

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to 70% and the temperature (25-30 °C) is ideal for grafting. Wedge method of grafting has been tried in cvs. Allahabad Safeda, Sardar, Lalit and new promising selections viz. CISH-G-4, CISH-G-5 and CISH-G-6 in four consecutive years from January to December (Table 1 & 2). Successful propagation through wedge technique is possible throughout the year even in extremely adverse and harsh climatic condition such as severe cold. In greenhouse,

success rate of graft in range of 70 to 92 per cent from January to December. However, the maximum success rate of graft is realized in greenhouse (93 to 95%) when grafts covered with polythene cap from October to February. Similarly, in open field condition, the success rate of about 80 to 90 per cent during October to February with polythene cap and 37 to 77 per cent without polythene cap (January to December).

Mass multiplication of guava through wedge grafting in greenhouse as well as in open field condition



Grafts without polythene cap



Grafts with polythene cap during winter months

Wedge grafting of guava in Greenhouse



Grafts without polythene cap



Grafts with polythene cap during winter months

Wedge grafting of guava in open field condition

Table 1: Relative performance of guava grafting under greenhouse in comparison to open field condition

Month of grafting	Success percentage	
	Greenhouse condition	Open field condition
January	88.59	77.0
February	87.00	70.0
March	76.66	55.0
April	81.00	67.0
May	71.19	47.0
June	70.00	37.0
July	73.50	65.0
August	83.33	60.0
September	76.96	68.0
October	90.00	60.0
November	92.00	47.0
December	90.33	70.90

The guava serves as a perennial source of high quality planting material

Greenhouse



Open field condition

Table 2: Relative success rate of guava grafts using polythene cap in greenhouse as well as in open field condition during winter season

Months of grafting	Success percentage	
	Greenhouse condition	Open field condition
	Polythene cap	Polythene cap
October	93.0	90.0
November	97.0	90.0
December	95.38	80.62
January	93.51	86.66
February	95.03	81.33



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These plants showed very high field establishment on account of undisturbed tap root system. Grafts can be transported to long distance without any damage. Plants multiplied through this technique are being distributed to developmental agencies and progressive farmers of UP, Bihar, MP, Punjab, Gujarat, Haryana,

Delhi, Tamil Nadu, and Karnataka. Several training programmes are being organized to horticultural officers, Agricultural graduates, nurserymen, progressive farmers and malies to upgrade the knowledge and skill towards the technique of wedge grafting using of polythene cap in greenhouse.



Grafted plants under shade net

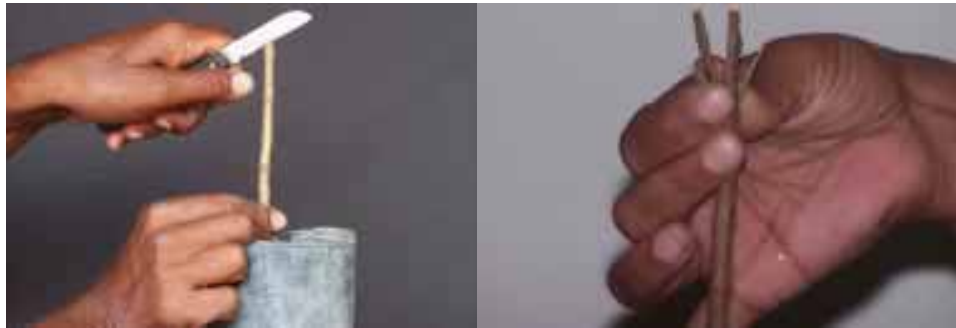
Sequential steps for wedge grafting

- A) Seedlings are grown in the nursery for approximately 6 to 8 months. When the stem diameter reaches pencil thickness (0.5 – 1.0 cm), it is ready for grafting. The top of the rootstock is cut off with sharp, clean and hygienic knife at the height of 15-18 cm from the surface of polythene bag.



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- B)** The knife is used to split the stem vertically down the centre, to a point 4 to 4.5 cm below the cut surface.



- C)** Scion stick is collected from desired varieties. Selected scion shoots are defoliated on the mother plants, about 5-7 days prior to grafting. The shoot with 3-4 healthy buds, 12 to 15 cm long of pencil thick (0.5-1.0 cm) is cut from selected mother plants.



- D)** Scion stick should be cut from both side into a tapering wedge approximately 4 - 4.5 cm long.



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- E) The tapered end is inserted into the split stem of the rootstock. To assure good alignment of the vascular cambium from scion and rootstock, it is very important that both should be of the same diameter at the point of contact.



- F) The rootstock and scion are wrapped tightly along with the zone of contact with 2 cm wide and 25-30 cm in length polythene strips. Wrapping exerts pressure to facilitate graft union formation and minimize drying of the cut surface.



- G) Immediately after grafting the scion stick is covered with polycap. The polythene cap is tied at the base with a rubber band. Polythene cap is instrumental for higher success through congenial micro-climate.



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- H)** The grafted plant is kept in a greenhouse. A skilled person can perform grafting up to 300 plants in a day.



- D)** After 15 to 25 days, when new growth from the scion is observed, the polythene cap is gradually removed.

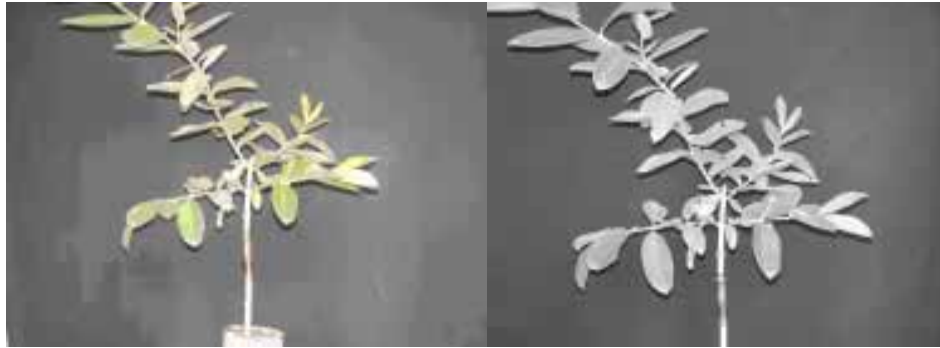


- J)** The wrapping should be left in place until the union has been formed. After that it is removed to avoid stem girdling as the growing plant increases in diameter.

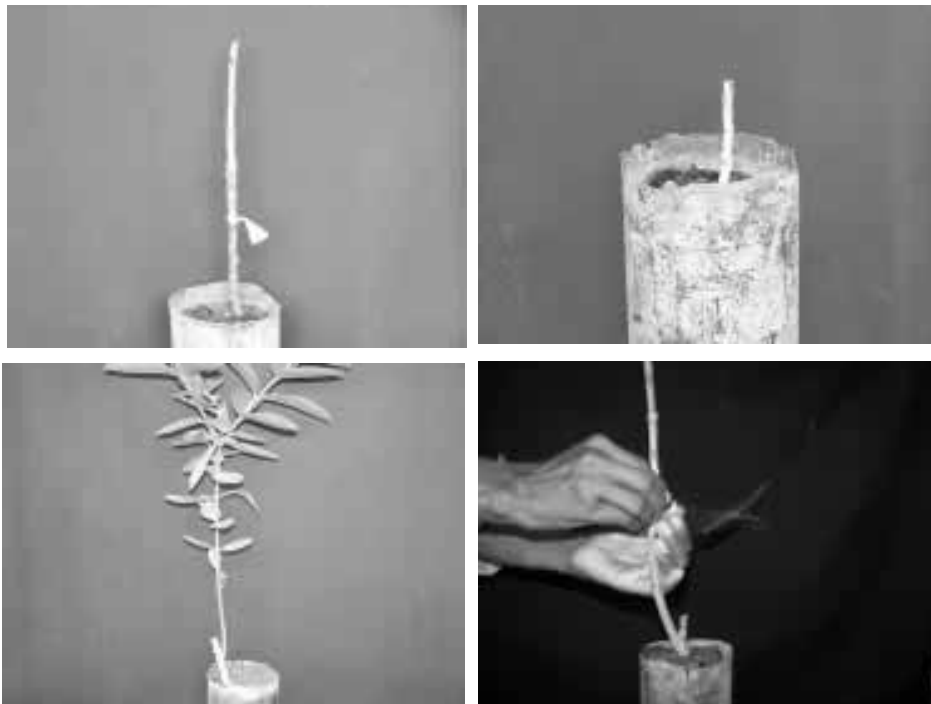


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- K)** The grafted plant attains a height of 45-55 cm within five months. This is the standard plant height which is suitable for planting in the field.



- L)** Not all graft union takes successfully. In some cases, scion dies due to incompatibility with the stock, desiccation, poor cambial contact or other causes. Rootstock of failed graft can be reused. They are beheaded from just below the graft portion to reactive growth. This rootstock is being re-grafted after five months.



Standard of planting Material

Sl. No.	Character	Observations
1.	Method of grafting	Wedge grafting
2.	Raising rootstock	In polythene bag
3.	Size of polythene bag	20x10cm / 10x25cm
4.	Type of rootstock	Straight and active growth stage
5.	Age of rootstock	6 to 8 month old
6.	Diameter of rootstock	0.5 to 1.0 cm
7.	Age of scion stick	3 to 4 month old
8.	Diameter of scion stick	0.5 to 1.0 cm
9.	Length of scion stick	12 to 15 cm
10.	No. of buds on the scion stick	3 to 4 bud
11.	Union height (grafting height)	15 to 18 cm from upper surface of polythene bag
12.	Root type	Tap root system
13.	Standard height	45.0 -55.0 cm
14.	Stem girth	1.5-2.5 cm
15.	Foliage	Healthy and green foliage having 3 to 4 branches
16.	Time of grafting	January to December in greenhouse as well as in open field condition
17.	Conditions	i. Greenhouse ii. Open field condition iii. Polythene cap is used to cover the grafts on day of grafting particularly during winter month for better success.
18.	Precaution	When grafts are set out in the nursery, always handle them by the rootstock. Do not bump the scion because this may disturb the callus tissue, causing the graft to die.



SARDAR

LAHABAD SAFSA