

PRODUCTION OF TRUE-TO-TYPE GUAVA NURSERY PLANTS VIA APPLICATION OF IBA ON SOFT WOOD CUTTINGS

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ABSTRACT

This study was conducted at Horticultural Research Institute, AARI, Faisalabad, Pakistan during the year 2009-10 and 2010-11 to produce true-to-type nursery plants of guava (*Psidium guajava* L.). For this purpose nursery experiments were conducted on standardization of clonal propagation technique in guava (cv. Gola) by application of different concentrations of IBA (0, 1, 1.5 and 2%) on guava soft wood cuttings by creating 80-85 percent humidity and 25-28°C temperature in tunnels (1.80 x 0.90 x 0.75 m) covered with polythene sheet. Significantly higher success percentage (55.75%) was noted in soft wood cuttings treated with 1.5 percent IBA as compared to control (13 %). The plants produced 18.46 number of leaves, 9.72 cm sprouting length and 21.70 number of roots as compared to control (10.33 leaves, 4.25 cm sprouting length and 9.69 number of roots). The study provided useful information on clonal multiplication of elite germplasm of guava under protected environment to preserve certain characters and multiplication of cultivar Gola.

Keywords: *Psidium guajava*; callusing; IBA; protected environment; asexual; propagation technique; pedigree plants.

INTRODUCTION

Guava (*Psidium guajava* L.) the poor man's fruit or apple of the tropics is popular in tropical and subtropical climates. It is native to tropical America stretching from Mexico to Peru (7, 11). Guava is cultivated in every tropical and subtropical country around the world (19). This is a delicious fruit and is very nutritious and exceptionally rich in ascorbic acid and several minerals useful for human health (24). Besides its high nutritional value, it bears heavy crop every year and gives good economic returns (17).

Guava propagation through seed does not produce true-to-type plants while clonal propagation has assured true-to-type plants. Maqbool and Khan (10) reported that guava is commercially propagated from seeds in Pakistan.

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Guava, if propagated through seed, exhibits a great variation due to inevitable heterozygosity. Moreover, seed propagated plants come into bearing much later than vegetatively propagated plants. Through seed propagation unique characters of a certain variety cannot be preserved or multiplied. Seed propagation does not permit the utilization of superior important characters of a certain rootstock such as disease tolerance (viral fungal or bacterial), adaptability to varying agro-ecological conditions, manipulation of tree growth (dwarfness) and better influence of certain rootstock. Vegetative propagation is, therefore, inevitable in guava (22).

In fruit trees, several vegetative propagation techniques as air layering, root cuttings and stooling, have been tried with varying success rate to increase productivity and gains by clonal propagation and selection (12, 13). However, these techniques are still not commercially viable due to varying rate of success, absence of tap root system and cumbersome process.

Healthy planting material is essential to achieve good yield and quality produce. A well-established commercial nursery must improve the way of producing planting material using modern technology as there is the potential to produce true-to-type guava nursery plants with soft wood cuttings(1). In Punjab, guava is generally propagated from seeds and the seedlings are variable in both plant and fruit characteristics. Establishment of orchard through seedlings is not recommended at present time; as most of these seedlings will not be like the parental type in yield, taste and fruit flesh color. Guavas are open-pollinated that is why we usually see the fruit of guava in the field with characters of Gola and Surahi simultaneously (Fig. 1).



Fig. 1 True guava fruit with characters of Gola and Surahi, simultaneously.

The major issue in guava plantation is discriminate multiplication of plants from unreliable sources by nurserymen (18). Non-availability of quality planting material and consequent substitution of poor quality seedlings have adversely affected the guava production. True-to-type initial planting material is basic need to ensure both quality and quantity in guava (18). Breeding

programmes for perennial plants like fruit trees are time consuming because of their slow growth rate and long generation time. In present context, rapid methods of propagation become very important when planting material is limited due to scarcity of a clone or varieties or due to sudden expansion in acreage. Adventitious root formation is a key component of clonal propagation of selected woody plants (19).

The present study was initiated to standardize the technologies for producing true-to-type plants of guava in short period of time via soft wood cuttings with application of different concentrations of indole-3-butyric acid.

MATERIALS AND METHODS

Nursery experiments were conducted at Horticultural Research Institute, AARI, Faisalabad during the year 2009-10 and 2010-11. Healthy disease free mother plants of guava (cv. Gola) were selected to collect soft wood cuttings. First the pedigree nursery plants of guava were produced through soft wood cuttings by maintaining 80-85 percent humidity and 25-28°C temperature (5) in tunnels (1.80 x 0.90 x 0.75 m) covered with polythene sheet. The tunnels were placed under semi shade of green sheet (50% shade). Three concentrations of indole-3-butyric acid (IBA) i.e. 1, 1.5 and 2 percent alongwith control (zero) were prepared by diluting in talcum powder (W/W). To prepare one percent powder of IBA, its 1 g was mixed in 99 g talcum powder and similarly other concentrations were made. The fresh tip cuttings of 10-15 cm were made. All leaves except the apical and two lateral leaves were clipped. These cuttings were treated with IBA concentrations to enhance rooting initials. The media for rooting of cuttings was prepared by mixing 50 percent sand and 50 percent silt. Three fourth portion of each cutting was inserted into the soil after treating with IBA. The irrigation was applied with sprinkler at alternate day because during August the temperature rises decreasing the humidity of atmosphere. The temperature was measured by thermometer model, AZ-8801 and humidity was measured by hygrometer (Model C3-4154).

Layout system of experiment was RCBD replicated four times making 16 number of experimental units. Each treatment carried 50 number of cuttings. Data on success percentage, days to sprout, length of sprouting (cm) after 30 days and number of roots were collected during both years and were averaged and analyzed statistically using Fishers analysis of variance. Treatments were compared using least significant difference (LSD) test at 5 percent probability level (20).

RESULTS AND DISCUSSION

Success percentage

The data (Table) revealed that success percentage differed significantly among IBA treatments. Maximum success percentage (55.75%) was observed in soft wood cutting treated with IBA @ 1.5 percent followed by 2 percent IBA concentration (39%). Usually higher dose of root promoting hormone inhibits the sprouting of initials (21), which happened truly in this experiment. Minimum success percentage (13%) was observed in cuttings kept as control. These results are in line with those of Manan *et al.* (9) who reported that cuttings treated with IBA at 1000 ppm gave 37 percent success against control (17.5%). Abdullah *et al.* (1) also observed that stem cuttings collected from mature stock plants gave the highest rooting percentage (60%) when treated with 0.4 percent IBA solution followed by 2 percent IBA.

Table. Effect of IBA concentrations on different parameters.

IBA concentration (%)	Success percentage	Sprouting length (cm)	No. of leaves after 60 days	No. of roots after 90 days
0 Control	13.00 d	4.25 c	10.33 c	09.69 c
1	28.25 c	5.93 b	11.38 c	14.57 b
1.5	55.75 a	9.72 a	18.46 a	21.70 a
2	39.75 b	6.66 b	14.92 b	17.68 b
LSD value	6.0457	1.2637	2.2588	3.3884

Sprouting length (cm)

Sprouting length also differed significantly among IBA treatments. Maximum sprouting length (9.72 cm) was measured in soft wood cuttings treated with IBA @ 1.5 percent (Table 1) followed by 2 percent IBA treatment (6.66 cm). Minimum branch length (4.25 cm) was measured in control. Abdullah *et al.* (1) also reported maximum shoot length (8.24 cm) soft wood cuttings treated with 1000 ppm IBA and minimum (3.83cm) in control treatment.

Number of leaves

Maximum number of leaves after 60 days (18.46) were observed in soft wood cuttings treated with 1.5 percent IBA followed by 2 percent IBA (14.92) (Table). Minimum number of leaves (10.33) was recorded in cuttings kept as control. Wahab *et al.* (23) have also reported significantly higher number of leaves per cutting in 3000 ppm IAA at These results were also supported Rahman *et al.* (14) who observed maximum number of leaves (10.20) in 1000 ppm IBA treatment.

Number of roots

Maximum number of roots (21.70) was observed in soft wood cuttings treated with 1.5 percent IBA which significantly differed from other treatments (Table). Minimum number of roots (9.69) was recorded in control treatment. Wahab *et al.* (23) also reported that number of roots per cutting increased with higher IBA (4000ppm) against the lowest number of roots per cutting in 2000 ppm concentration. The present results also support the findings of Khatak *et al.* (8). It was further observed that cuttings with more number of leaves produced more number of roots, due to fact that photosynthesis and other activities were carried out in leaves that caused more number of roots.

Adventitious root formation is a key step for vegetative propagation comprising root induction, in which molecular and biochemical changes occur before any cytological event; root initiation when first anatomical modifications take place; and protrusion, corresponding to the emergence of root primordial (3, 6). Lateral roots development in Arabidopsis provided a model for study of hormonal signals that regulated post embryonic organogenesis in higher plants (4, 15, 25). Lateral roots originated from pairs of pericycle cells, in several cell files positioned opposite the xylem pole, that initiated a series of asymmetric, transverse divisions to create 3 to 10 "short" daughter cells (4). These short daughter cells have undergone radial enlargement and subsequently divided periclinally to give rise to inner and outer cell layers. Further periclinal divisions resulted in formation of lateral root primordial (2).

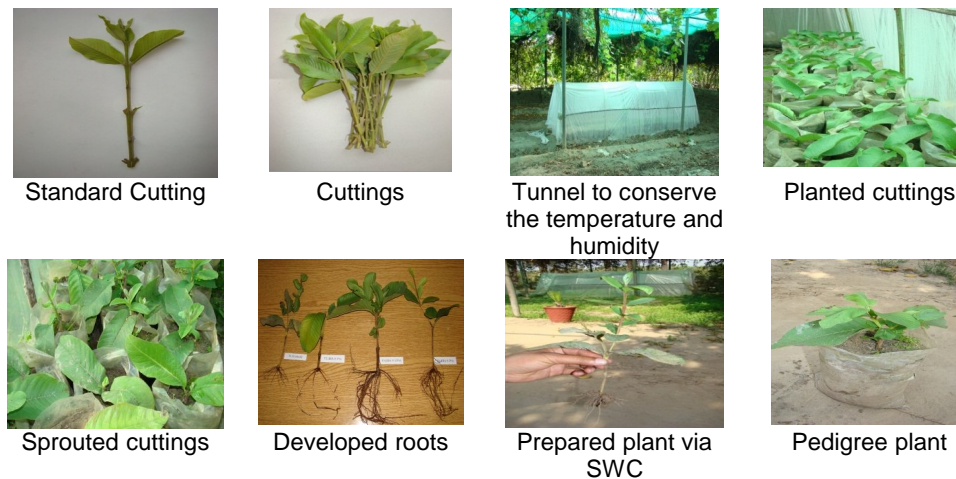


Fig. 2 Production technology of true-to-type guava nursery plants.

CONCLUSION

The study concludes that production of pedigree plants in small tunnels proved to be the best for rapid multiplication of guava true-to-type plants. Significant results were obtained when guava nursery produced by soft wood cuttings after application of 1.5 percent IBA, during month of July. The plants produced by this technique will be true-to-type and can be planted in high density plane. These plants will bear earlier than the seedlings. The unique characters of a variety can be preserved through this technique.

The technique was developed in this study is simpler, rapid, less labour intensive and economical, as root promoting hormones are required for root initiation. It is useful as compared to conventional method of propagation (grafting/budding) of guava because of higher success rate, independence of season and climate, small size of cuttings, use of juvenile shoot cuttings, disease free nature and production of large number of uniform true to mother type plants in a short period of time.

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First I planted a Hawaiian type guava which produced several guava fruits with pink flesh, but the taste was slightly sour. So I removed that tree and planted an Indian type which is producing very sweet fruits. Guava Varieties. There are several varieties of guava. How To Plant. Guava can be propagated by seed, branch cutting, grafting and air layering. For commercial cultivation, it is best grafted onto an established root-stock. The guava seedlings grow very fast if proper care is taken. A fertilizer high in potassium is the best fertilizer for guava trees to increase fruit production. I feed my guava plant with a liquid fertilizer throughout the growing season. Guava trees become iron deficient in alkaline and high pH soil. Fertilize 1-2 times with iron sulphate each year. Plants differ in their response to the different propagation techniques. The success in propagation depends upon how much attention is given to the technique most suitable for a particular plant species. Grapes is one of the most important fruit crops, accounting for about one quarter of the fruit production of the world. It is grown throughout the temperate regions, especially in warm sunny climates with mild winters and dry periods during fruit ripening. Grapes are generally propagated vegetatively. For grafting; the rootstock should be tolerant or resistant to phylloxera. Tâ€“ budding is the most common method of grafting. Layering is of common use in difficult to root types like muscadine. Since guavas cannot be depended upon to come true from seed, vegetative propagation is widely practiced. They are not easy to graft, but satisfactory techniques have been worked out for patch-budding by the Forkert Method (probably the most reliable method), side-veneer grafting, approach grafting and marcotting. Guavas are fast growers and heavy feeders, and benefit from regular applications of fertilizer. Mature trees may require as much as 1/2 pound actual nitrogen per year. Apply fertilizer monthly, just prior to heavy pruning. The yield may start at 10 tonnes per hectare in the third year of production and increase to 30 tonnes per hectare after the tenth year. Properties/Actions.