

Review paper on effects of growing media and different concentrations of rooting media on rooting of air layered guava plants

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Abstract

Guava is a tropical and subtropical fruit (20) plant which can be propagated vegetatively through various methods like cutting, grafting, inarching but layering is the most common and widely used method. In layering also, air layering is considered best for guava propagation. Air layering on guava is performed with different IBA concentrations which is used as a rooting hormone. Effect of environment on time and technique used is being noticed at various intervals of time during different months. Alongwith IBA and NAA, various organic and inorganic rooting medias are used individually or in combination to perform layering. Comparisons are being made that which media cause faster rooting in guava plants and at which concentrations. Various parameters like survival rate, maximum rooting length, maximum root diameter and maximum numbers of primary and secondary roots are considered by using different rooting medias.

Keywords: guava, air layering, IBA, media

Introduction

Guava (Amrood) is scientifically called as *Pisidium guajava* and belongs to the family Myrtaceae which is mainly cultivated for the edible fruits in different parts of the world (54). It is a native of Peru in South America and was introduced to India in 17th century by Portuguese. The leading state in guava cultivation is Uttar Pradesh with production of 928.44 million tonnes and share of 22.93% (1). The cultivars are grown in different parts of world like Spain, Europe, Portugal, Israel, United States etc. In India, it is the fourth most widely grown crop grown in almost all states. Major states are Bihar, Andhra Pradesh, Madhya Pradesh, Orissa, Tamil Nadu and Maharashtra. It is also grown throughout major districts of Punjab and Haryana.

The edible part of guava is thalamus and pericarp. Pericarp is the outermost layer which is developed from the ovary and it protects the seeds from outside environment. Mainly cultivated from sub-tropical area to tropical ones. It is known as Poor man's apple or Apple of Tropics because it is highly nutritive, drought tolerant and cheap in nature and affordable by everyone to cultivate easily. It requires around 1000mm of rainfall (14) between June to September for proper growth. It is grown in frost free areas with temperatures of 23-26°C but can even tolerate upto 46°C.

Guava has a slender trunk with reddish brown bark. The trunk of this fruit is highly branched at the base and are spreading in nature. It is grown on a wide range of soils and have a shallow root system. Leaves are oval in shape having hairy surface on lower side and glossy smooth surface on upper side. The full grown trees are around 20 feet in height. The flowers are born singly on leaf axils and its inflorescence is known as cymes. Flowers are hermaphrodite with one pistil and many stamens having white showy colour. Fruits are delicate in nature and therefore efforts are done so that they reach to consumer in a safe manner (2). Fruits are oval in shape with edible seeds and light green to yellow skin but it may vary according to growing region. Botanically, its fruit type is berry. There are many cultivars of guava grown in different regions of the world but most famous is Allahabad Safeda, Sardar (Lucknow-49), Arka Mridula, Kohir Safeda etc. Some varieties are varied according to area in which they cultivated (9).

The guava fruit is climacteric in nature i.e. they can ripen even after harvest and thus are very perishable in nature (48). Guava fruits are rich in antioxidants, Vitamin C, potassium, lycopene, calcium, manganese, high in fibres but low in calories and provides many health benefits like regulate blood sugar and heart rate, its seeds are easily ingested and used along with pulp to cure dengue patients and respiratory diseases(24). It can be used as a snack and can be kept for long and its peel contain high nutritional content (16). Besides, it can also be processed for making jams and jellies (19). Due to lack of processing units in and storage facilities in the country, there are high chances of post-harvest losses. (31).

Guava can be propagated either by seeds or by asexual methods. Vegetative propagation is preferred more because even if guava is a self-pollinated crop, there are high chances of cross pollination and therefore seeds are only used to raise rootstocks. Guava have been multiplied by different vegetative methods like cutting, budding and grafting but layering is used commonly. In this, the selected shoot remains partially attached to its parent plant until the formation of new roots. In layering, especially air layering is performed in guava which is also known as gootee. Field establishment of guava air layering is also observed in month of October (53).

Air Layering

Air layering is the most successful method for propagating guava crop in which shoots initiate the rooting without being separated from the parent plant (25). It is done mostly in monsoon during month of June to September as guava requires warm and humid climate (33). In this, a pencil size thickness of shoot is selected. Small outer portion (peel) of the bark is removed by giving a cut (30). After removal, rooting media is applied to that cut which is then covered with a polythene tape to protect it from harsh environment. It is noticed that auxin is most effective in inducing rooting inspite being what is the nature of shoot i.e hardwood or semi hardwood (56). (37) He reported maximum dry and fresh weights of shoot by applying poultry manure and sphagnum moss (26). Different rooting medias are used like perlite, vermiculite, cocopeat, sand etc. Auxin hormone also used for rooting of plants in which IBA is most common. (47). Sphagnum moss is used for providing sufficient moisture to the layered shoots. Sand was more effective than sand –perlite (1:1) concerning root dry weight (4). Effects of IBA and NAA is shown by maximum rooting percentage in plants alongwith their concentrations (38). Effect of exogenous application of IBA has shown signing effects (7).

Selection of Plants and Shoots for Layering

For air layering in guava, 3-4 years old plants are selected which are at 4-5 feet of spacing in a square plot design. On these plants, one year old shoots of pencil thickness size are selected for layering with smooth bark having enough moisture in it so that cutting is done without any kind of interruptions. Plants are tagged property by giving numbers. Dead, infected or drooped branches are rejected for layering. Air layering is greatly influenced by length and width of girdled shoot (50).



Fig 1



Fig 2

Method of Application

After the selection of desired shoot, a cut of 2-2.5 cm is made with the help of knife. Knife should be sterilized with ethyl alcohol to prevent any contamination. Two parallel circular cuts and then a longitudinal cut is made. Remove the bark or flap carefully and scrapping of exposed area is done without causing any injury to the underlying tissue. This is done to expose the xylem tissue which helps to initiate rooting and delays the wound healing process(13). Then apply the selected treatments which are made by mixing different concentrations of IBA. This can be applied with the help of a brush or by a glass rod. Different rooting media (Organic or non organic) with IBA are applied on different plants and 3-4 layers is made per plant for comparisons. (27) He shows that root emergence is early when soil is used with dung and sphagnum moss. Wrapping is done with polyethylene wraps and ends are tied with the help of a thread. Time and condition of wrapping effects the root formation(10). Misting is done frequently according to the prevailing weather and regular checking of layered plants is done to record the observations. IBA at 4000 ppm show maximum result in terms of rooting and shoot percentage. (23) layering when done on Sardar variety of guava shows superior results after transplanting into polyethylene bags.

**Fig 3****Fig 4**



Fig 5



Fig 6



Fig 7

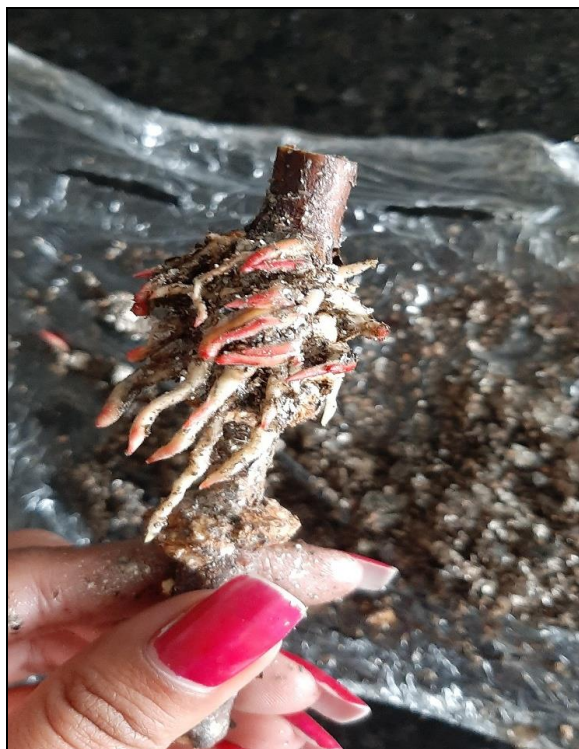


Fig 8



Fig 9

Lifting of Layered Shoot after Rooting

After 30-35 days, rooting on layered plant is visible throughout the plastic wrap. Layered portion is removed when there is an emergence of 50% roots. Before separating the layered portion from its parent plant, give two cuts at weekly intervals to avoid immediate stress conditions. Roots arising are basically adventitious in nature except those that arise from embryonic tissue (5). Separate the layered portion by giving a cut just below the girdle. Then remove the thread and plastic wrap. During removing some roots may get broken down because of opening of tight plastic wrapping. Now count different parameters like number of primary and secondary roots, root volume, their fresh, dry weight and number of leaves. Maximum number of leaves were found when 5000 ppm of IBA is used with sphagnum moss as rooting media in the month of July (36). After counting the desired parameters, plant the layered plants in polybags and kept under shade. Water it regularly and finally check the survival rate by counting number of new leaves. When they become strong enough, transplant them in garden under open field conditions.

Parameters

▪ Days to Root Initiation

When air layering is done successfully in plants, the layers are checked after a month for root initiation. Layered plants are able to form roots which may get visible through the plastic wrap (6). Carefully note the time period that after how many days the layered shoot will form the roots which may vary according to the treatments. (15) obtained no effects of IBA on 60% rooting of plant. There was 100% rooting when media used are loamy soil, compost and cow dung but in case of saw dust as a substrate, rooting is only 60% (41). Highest rooting

percentage is recorded with IBA concentration 7500 ppm (28). Minimum days taken for root initiation was observed during July as this month has less humidity as compared to others (42).

▪ **Rooted air Layer Percentage**

In this parameter, percentage of layering is checked by comparing the total number of layers made on a plant and from them how many layers are able to form the roots (40). It was evaluated that IBA at 7000 ppm concentration gave maximum percentage of rooting and also survival rate is more when layers are transplanted in open field conditions (21). In litchi, different seasons influence on rooting percentage was recorded and it was noticed that maximum rooting is obtained in months between September to March (22). Some findings are observed in Lalit variety of guava where layering performed in June and July month have maximum rooting percentage (46).

▪ **Number of Primary and Secondary Roots**

After cutting the layer from parent plant, remove the plastic wrap and carefully counts the number of primary root (8) and number of secondary roots (32). In another experiment, IBA concentration of 8000ppm with media like coconut husk and moss shows maximum number of root formation (34). Highest number of primary and secondary layers were found in month of July when layering is performed in Litchi (39). Also high number of primary roots were found when layers treated with 125 ppm and 100 ppm of NAA (52). While minimum number of roots were found when NAA used at 50 ppm concentration with white polywrappers (55).

▪ **Length of Roots (cm)**

After lifting up the rooted layer, use three layers from each plant treatment and measure the length of roots with the help of a scale T (52). Experiments are done in similar crops like litchi by using IBA 2500 ppm which recorded highest length of primary roots which was noticed after 90 days (42). Similarly maximum length was recorded in treatment of 125 ppm of NAA i.e. 4.89 cm (43). Maximum length of roots were obtained at IBA concentration of 5000 ppm in Dushehri variety of mango. Similar findings are observed with NAA concentration of 5000 ppm recorded longest length of root i.e. 8.9cm (49).

▪ **Root Diameter**

Detach the roots, clean them by removing extra media from their surface and then their diameter is being noted with the help of slide calliper or measuring scale. Root with highest diameter is taken into consideration. Maximum diameter recorded in rooting media of Moss grass+ Cocopeat (28). Maximum primary root diameter was found out to be 0.41 cm when different rooting medias are used in combination like sphagnum moss, cocopeat and vermicompost (34). Another research done in guava cv. Allahabad Safeda where mean root diameter is found upto 1.63 mm for primary root and 0.82 mm for secondary root when rooting media cocopeat and sphagnum moss used in combination (36).

▪ **Fresh Weight and Dry Weight**

Fresh weight is the weight of roots when they have water content in them. After calculating fresh weight, roots are heated in an oven at high temperature for few minutes to make them dry. Note the original weight of roots before drying and then after drying on a weighing balance. Application of IBA 5000ppm gave better results in terms of weight on litchi plants (11). If concentrations of IBA used is higher than weight of roots are generally found higher in such cases (35). Contrasting results are obtained when air layering is done in litchi cv. Purbi where maximum survival rate and fresh and dry weights are noticed at IBA 5000 ppm (43).

▪ **Survival Rate of Layered Plants**

After cutting the layers, plant three layers out of the total five layers made in a polybag with media like garden soil and farm yard manure. Keep these polybags in shade house, water them regularly and note the growth rate of plants after few weeks which is usually checked by counting number of new leaves formed (29). Similar experiments are done by using palm fibre and sand as rooting media in rambutan air layers with IBA concentrations of 2000 ppm (51).

Conclusion

It is noticed that when layering performed at specific time period coupled with high relative humidity, rains and favourable temperature promote early rooting in plants. Different medias in combination with different IBA concentrations show different results. Different parameters are being noticed when rooted plants are checked for their survivability like number of primary and secondary roots, length and width of roots, number of root per layered plant, days to root initiation and fresh and dry weight of roots. From comparison, it is noticed that when medias are used in combination shows higher results rather than using them individually. Rooted layered plants performed better in polyhouse than in open field conditions.

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