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After Effect of Air Layering in Selected Trees Influencing Arbuscular Mycorrhizal Fungi

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Abstract: ***Air layering is a type of layering in which an aerial branch of a plant is girdled or wounded and wrapped with moist rooting medium then covered with polythene sheet. It is also known as Chinese layering, marcottage or gootee. For my study select more than one year old stem of Guava (Psidium guajava, L.;), Sapota (Manikara zapota) and Ficus (Ficus carica, L.;). The study has revealed that the combination use of arbuscular mycorrhizal fungi and Sphagnum moss in vegetative propagation through air layering in selected trees can significantly increase rooting which are considered as difficult. Propagation through air layering will ensure conservation, availability and sustainable exploitation of economically important crops. In Ficus higher and better root growth seen in the mycorrhiza used air layering. Less root growth is shown by the normal air layered branch. In Guava and Sapota no root initiation is occur till the end of my study, but the growth is takes place in the plant. So, in future days there is a chance for root initiation and root growth.***

Keywords: Air layering, Chinese layering, Marcottage, Gootee, Psidium guajava, Manikara zapopta, Ficus carica, Sphagnum moss, Mycorrhiza.

I. INTRODUCTION

Horticulture literally means “garden culture”. It is generally regarded as a special area of plant science that seeks to cater to the needs of a broad section of mankind, ranging from small backyard farmers in the urban sector to large scale producers in the agriculture sector. It essentially involves the cultivation of vegetables, flowering plants, fruit plants, medicinal plants, aromatic plants, ornamental plants, etc. in gardens, orchards and open fields, and the harvesting, processing and marketing of their produces. Now a day’s horticulture is a popular instructional programme and also a part time job or activity for many people. Horticulture enables us to manipulate plants for maximum growth, higher yield and superior quality of their produces.

Layering is a type of vegetative propagation. Vegetative propagation or asexual propagation refers to the multiplication or perpetuation of any plant from any vegetative parts of plants other than the seed. It involves the regeneration of new plants from portions of the plant, or the plant material, that is used for vegetative propagation is called propagule. The progenies produce by the vegetative propagation of a plant are genetically identical individuals, descended from one and the same original parent through several generations of vegetative propagation occurs as a spontaneous natural process of plant reproduction. Vegetative propagation is possible as the vegetative organs of many plants have the capacity for regeneration. For instance, stem cuttings have the ability to form adventitious roots; root cuttings can generate new shoot system while leaves can regenerate new shoots and root system.

Vegetatively propagated plants are generally dwarfed in stature than the seedlings. Dwarf trees facilitate pruning, spraying and harvesting besides more number of plants can be accommodated in a unit area. Many plants are propagated by vegetative means because of the speed and ease of multiplication. The progenies are true to type of the cultivars. Layering is the production of a new plant from an intact branch of a parent plant by inducing root initiation. The intact branch that produces roots is called layer. The layer is supported by the parent plant until it develops its own root system. In all forms of layering, the rooted branch is removed from the parent plant when enough roots have formed to enable it to lead an independent existence.

Air layering is also called gootee or marcottage is a type of layering in which an aerial branch is girdled (a ring of bark is removed) or wounded to promote rooting. The girdled part is then wrapped with a moist rooting medium and covered with polythene sheet. Roots usually start growing from above the girdle or wound. When a good number of roots formed, the branch is cut off and planted elsewhere.

Selection of shoots to be air layered is important. It is practically useless to propagate plants which are diseased or have been damaged by insects. Straight, clean stem should be selected. Completed or partial girdling by removing the bark or wounding will usually induce quicker rooting of woody plants. The movement of food downward is stopped at the girdle, thus encouraging root formation. Water can still move upward into the shoot to keep the leaves turgid.

Mainly fruit trees and ornamental plants are mainly propagated through air layering for large scale production. There are two problems with planting fruit trees from seed. The first is that a tree grown from seed will take a long time to produce fruit. It may take eight to ten years. The second problem is that although the seed may be taken from am very good tree, producing excellent fruit, the new tree may not produce good fruit. By air layering a tree, we can guarantee that it will produce fruit sooner, and the fruit will be as good as the tree from which the branch was taken.

Mycorrhiza is the product of an association between a fungus and plant root. Vesicular Arbuscular Mycorrhiza (VAM) is formed by the symbiotic association between certain fungi and angiosperm roots. The fungus colonizes the root cortex forming a mycelial network and characteristic vesicles (bladder-like structures) and arbuscles (branched finger like hyphae). The arbuscles are the most characteristics structures formed intracellularly and probably having an absorptive function. The vesicles are terminal swelling storage in function.

Incorporation of Vesicular Arbuscular Mycorrhiza (VAM) is established that can enhance growth of seedlings of many tropical tree species (Janose., 1980). The arbuscular mycorrhiza will enhance the growth of trees propagated from large stem cuttings or air layers (girdled, rooted branches) that involve considerable woody tissue containing abundant carbohydrate reserves (Menzel *et al*., 1995)and possibly substantial mineral nutrients,

Moreover, mycorrhiza may not enhance the plant growth in soil free potting mixes if there is low retention of phosphorus by the substrate such that extraradical hyphae of the fungi provide little advantage for acquisition of phosphorus beyond provided by the fine roots and root hairs alone (Biermann *et al*., 1983).

A. Objectives

1) Propagation of plants using air layering.
2) Reduce the dependence on seed propagation.
3) To find the method of propagation giving maximum root growth using arbuscular mycorrhizal fungi.
4) To compare the root growth in plants.

II. MATERIALS AND METHODS

A. Selection of Plants

For this study three plants were selected for experiment, namely Guava (*Psidium guava*, Linn.,), Sapota (*Manikara zapota* (L.) P. Royen.,) and *Ficus* (*Ficus carica*, Linn.,). For this experiment select more than one year old stem of the each selected plants.

B. Materials

More than one year old stem of selected plants, knives, *Shagnum* moss, polythene sheet, water proof tape, thread, soil, vermicompost, arbuscular mycorrhiza, pots.

C. Method

Stems more than one year old are suitable for this operation, girdling is done by removing a strip of bark about 1.5-2.5cm broad around the stem. Complete removal of pholem and cambium reduces the transport of food and water. Application of auxin such as IBA (Indole Butyric Acid), NAA (Naphthalene Acetic Acid) on the exposed part of the stem promotes rooting. The cut area is then covered with rooting medium to hold moisture and also to keep the portion well aerated. After the covering with rooting medium wrapped with a polythene sheet and tied firmly with water proof tape. Then keep the plant well watered. When root developed, the layer is separate from the parent plant and planted separately.

Two type of layering is done to complete this study. At first the girdled portion of stem is covered with rooting medium which is mixed with vermicompost. In another the girdled portion of stem of the selected plants covered with rooting medium additionally mixed with vesicular arbuscular mycorriza. After covering with the rooting medium wrapped with polythene sheet and tied firmly with water proof tape. After completing the procedure two different cultures takes carefully and provide optimum growth parameters. Check regularly and records the progress in root growth. When the root growth is over the layer is separated from the parent plant and compare the root growth of the different layers.

III. RESULTS AND DISCUSSION

In Guava the result revealed that weather, time and the month play a crucial role in the rooting. In my experiment root initiation and root growth not occur in guava due to lack of enough time, unfavourable climatic conditions and effect of month. In guava layering is done in the month December but suitable month of air layering in guava is June to August. Different time and methods of

propagation had significant influence on rooting of guava. In my experiment guava shows negative result which means rooting is never occur in guava till the end of my experiment. The selected branch or both the layers are continuously growing and metabolism is also takes place in the branches(figure 2 and figure 4). Due to this, there is a chance to occur the root formation and root growth in guava in future.

The *result* substantiates the suggestion on B. Manga et al., (2017) on effect of month and IBA concentration on success of air layering in guava. The result revealed that minimum days for for root initiation is 84 days, maximum number of roots 12, higher rooting is 33.335 and survival percentage (100.00%) in layers prepared in the month August applied with IBA – 4000ppm. Growth of these layers was vigorous as depicted by maximum number of sprouts (8.25), number of leaves (22.64) and shoot length (59.00 cm) at 90 days after separation from mother plant layers placed under shade house for hardening (Manga et al .,) similar findings obtain by Tyagi and Patel (2004). Similar study carried out by Sharma *et al*., they studied on effect of butyric acid and naphthalene on the rooting of air layers of guava. They find growth parameters of the layers depends upon pre- condition shoots on mother plant, the speed and number of roots formation on layer and post separation environment to which the layer is exposed. This might be due to the congenial weather conditions prevailed during the month, triggered cell activity resulted in early sprouting , number of sprouts and shoot length. In August month higher accumulation of carbohydrates and C:N ratio which readily served as a reservoir of food for new growth reflected in layers (Sharma *et al*., 1975)

Figure 1: Normal air layering

Figure 2: Normal air layering in Guava in Guava after 7 weeks

Figure 3: Mycorrhiza used air

Figure 4: Mycorrhiza used air layering layering in Guava in Guava after 7 weeks

In Sapota the result of experiment is negative, because the rooting or success is also depends upon the time of propagation and the method of propagation. In Sapota layering is done in the month of December. The month of December is also not suitable for the propagation of Sapota through air layering. The root initiation is not occured till the end of my end of my experiment, but there is a chance for root initiation. Because both the air layered branch is continuously growing and the metabolism is takes place in the branches (figure 6 and figure 8). So, there is a chance of root formation in future days.

In Mamey sapote [Calocarpum sapota (Jacq.) Merr.,] the propagation by cutting, air layering and tissue culture has not been successful. Grafting and budding can be done successfully and are currently the most practical methods for vegetative propagation of the Mamey sapote. Successful method includes approach grafting, veneer grafting, cleft grafting and shield budding. Timing of grafting is important (Campbell and Lara 1992).

Figure 5: Normal air layering in Sapota

Figure 6: Normal air layering in Sapota after 7 weeks

Figure 7: Mycorrhiza used air layering Sapota

Figure 8: Mycorrhiza used air layering in Sapota after 7 weeks

Result of air layering done in Ficus carica , Linn., shows maximum root growth in mycorrhiza used air layering compared to normal air layering. In Ficus, layering is done during the month of November in the year 2018. It takes four weeks for root initiation in mycorrhiza used air layer. Normal air layer takes five weeks for root initiation and found that the root growth is slower in normal air layer as compared to mycorrhiza used air layering. The month of February in the year 2019 both the layer is separated from the parent plant for the comparison of root growth and planted separately. Potted plants keep it in green house. The result revealed that air layering is successful in Ficus. Seed propagation or sexual propagation takes time for growing, so air layering reduce the dependence on seed propagation. Arbuscular Mycorrhiza used air layering is gives maximum root growth (figure 12) and minimum root growth shown in normal air layering (figure 10).

Three chitosan concentration (1%, 2%, 3% w/v) were tested for their root growth promotion properties in air layering of three popular ornamental Ficus species namely Ficus triangularis, Ficus microcarpa, Ficus benjamina (Mihiri Gamlath et al., 2010). 3% (w/v) chitosan treatment concentration was shown to promote the root growth significantly. 3 % (w/v) chitosan treatment resulted in the highest mean of root length of (15.3 cm) in F. triangularis compared to the 10.3 cm of tap water control. Highest mean root length of 38.8 cm was recorded for F. microcarpa for 3% (w/v) chitosan treated layers compared to 14.8 cm of tap water treated layers. Further, the highest mean root density of 3.17 was recorded for 3% (w/v) chitosan treated layers of F. triangularis (Mihri Gamlath et al., 2010).

Figure 9: Normal air layering

Figure 10: Rooted layer formed through in Ficus normal air layering in Ficus

Figure 11: Mycorrhiza used air layering in Ficus

Figure 12: Rooted layer formed through normal air layering in Ficus

IV. CONCLUSION

Mycorrhiza used air layering gives early root initiation and maximum number of root growth than the normal air layered one. The study has revealed that the combination use of arbuscular mycorrhizal fungi and *Sphagnum* moss in vegetative propagation through air layering in selected trees can significantly increase rooting which are considered as difficult. Propagation through air layering will ensure conservation, availability and sustainable exploitation of economically important crops.

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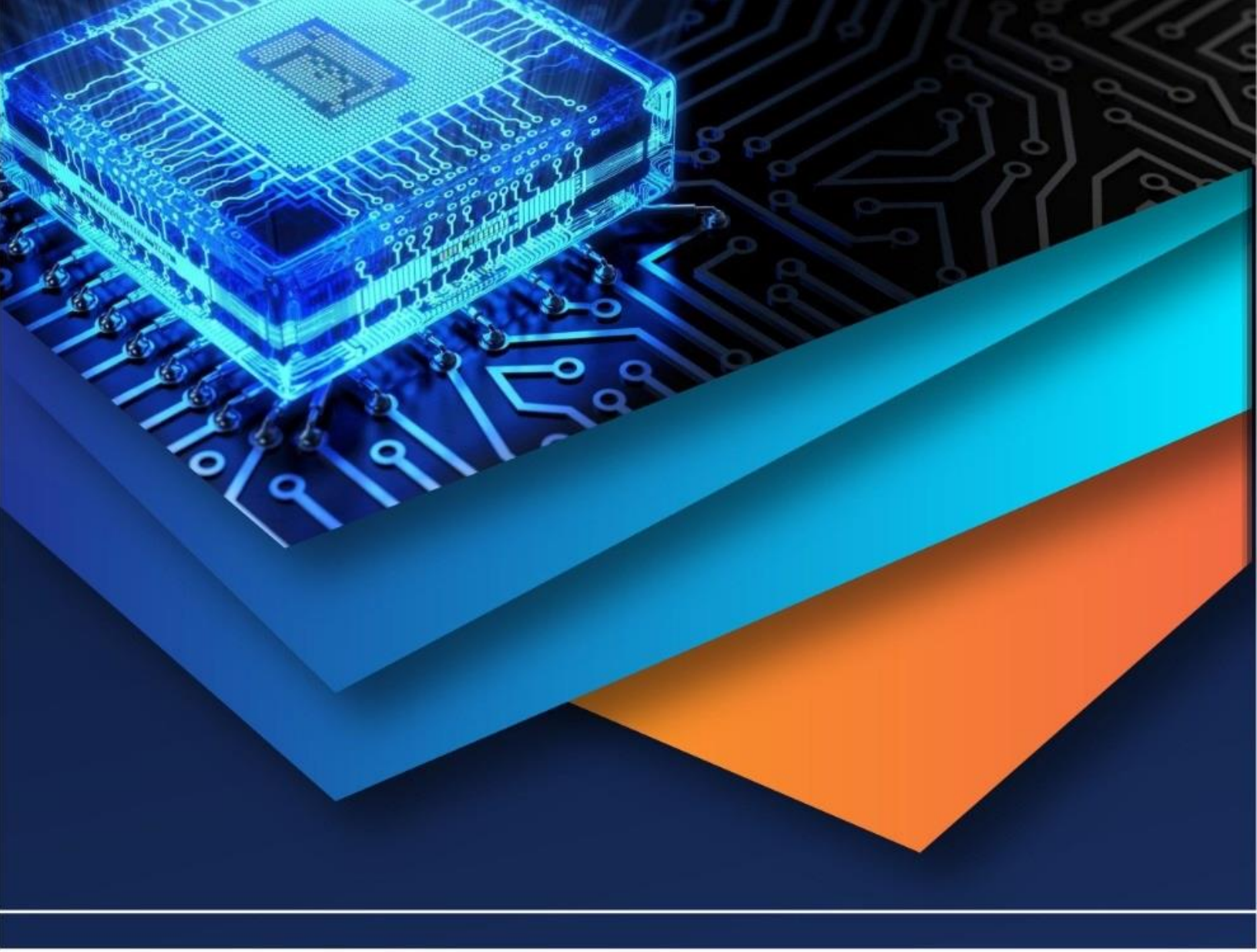

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