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Effect of Plant Growth Regulators and Vesicular Arbuscular Mychorrhiza on Air Layering of Litchi (*Litchi chinensis*) Cultivars

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Abstract

The most acceptable commercial method for litchi propagation is Air layering. Problem in rooting as well as survival of litchi air layers are still main constraints challenging propogation of litchi. Treatment combinations of Plant Growth Regulators, Vesicular Arbuscular Mychorrhiza (VAM) and cultivars of litchi were laid out in Factorial Randomized Block Design. Application of Plant Growth Regulators and VAM gave beneficial effect on rooting characteristics and survival of air layers of litchi cultivars.

Key words : Litchi, Air layering, Plant growth regulators, Vesicular arbuscular mychorrhiza.

Litchi chinensis Sonn.), is an important subtropical evergreen fruit crop belonging to family Sapindaceae. Litchi is propagated by seeds in nature. But it takes more time for flowering, fruiting and reproduction. In case of cutting, its survivability rate is low, although being a fast method of propagation. Micro-propagation technique has not been found much successful in litchi.Hence, air-layering or marcottage will probably continue to be the most acceptable commercial methods for litchi propagation (1). There are genetically diverse cultivars of litchi which have remarkable influences in root initiation. Response of these cultivars on rooting and survival of layers is to be standardized. Diverse species of Vesicular Arbuscular Mycorrhizal (VAM) fungi habitat in soil naturally forms symbiosis with litchi roots (1). Studies around the world have pointed out that problem in root establishment of litchi air layers are due to involvement of several viz., Genetically difference, root thickness, pathogen attack, unfavorable climatic conditions, low phosphorus uptake and other essential minerals and disturbance in the symbiotic relationship between root and Mycorrhizal fungi. Litchi fruit have gained popularity as an exotic fruit. The demand of planting material of litchi is increasing tremendously. Standardization of faster multiplication technology in litchi is the need of the hour. It was hypothesized that by administering proper concentration of Plant Growth Regulators (PGRs), application of VAM, use of suitable growing condition and specification of cultivars will help in production of quality planting material with improved rooting of air layers and final survival of litchi air layers in the nursery. Therefore, keeping above prospectus and challenges, experiment was conducted to study effect of Plant Growth Regulators and VAM on rooting characteristics and survival of air layers of litchi cultivars.

Methods

The present study was conducted at Horticultural Research Centre, Patharchatta and Department of Horticulture, GB Pant University of Agriculture and Technology, Pantnagar, Uttarakhand during the year 2008-2009. The experiment was conducted with one year old litchi shoots and tagged. Average shoot

length was 23.0 cm, with 2.5 to 4 cm diameter. The shoots having almost same vigor were selected according to the age group. The equal numbers of required branches were tagged from all the four directions of the tree. All the growth regulators were prepared in 150g of lanolin paste. The lanolin paste was heated to melt down and then added slowly 450 mg, 300 mg and 150 mg both IBA and NAA for preparation of 3000 ppm, 2000 ppm and 1000 ppm lanolin paste, respectively. The growth regulators were dissolved by adding small amount of 70% ethyl alcohol before mixing to the lanolin paste. Three important Litchi cultivars viz. Rose Scented, Calcutta and Late Bedana with different concentrations of IBA, NAA with control and different growing conditions were laid out in Factorial randomized block design (FRBD) as given by Panse and Sukhatme (2). The soil was autoclaved twice (121 C, 1.1 kg/cm^2) for one hour with 24 hour intervals between autoclaving. Rooted layers were treated with 1g VAM along with control and planted in nursery bed and root trainers in poly-house was observed after six months of plantation of air layers. Survival percentage of rooted layers was calculated with the help of following formula :

$$\text{Survival percentage} = \frac{\text{Total number of rooted air layered survived}}{\text{Total number of rooted air layered planted}} \times 100$$

Results and Discussion

It has been well documented that VAM greatly improve the P uptake and hence, growth of host plant. VAM will enhance the growth of trees propagated from large stem cutting and air layers that involve considerable woody tissue containing abundant carbohydrate and possibly substantial mineral nutrients. Results obtained from present study of survival percentage of air layers (Fig. 1) showed that the effect of treatment, cultivar and growing condition, interaction between treatment and cultivar and treatment and growing condition were significant. Treatment showed maximum survival percentage of air layer when layers were treated with IBA 3000 ppm while minimum survival percentage of air layer was reported in control. The possible reason for more survival percentage of air layers in root trainer might be due to improved morphology and physiology of the roots. Their vertical ridges encourage the plant roots to grow down straight without getting intermingled with the adjoining roots. This helped in ensuring a better survival of litchi plants. The similar findings were also obtained by Gera et al. (3). The maximum survival percentage of air layer with higher concentration of IAA and IBA might be due to the fact that lower concentration of auxin might not reach to the combinal zone. However, higher concentration of IBA and NAA 3000 ppm might have triggered root primordial initiation, so that more number of fibrous roots with maximum length was produced. This helps in absorbing more nutrients from soil and hence gives maximum survival percentage of air layer. The possible reason of increase in survival percentage of air layer might be due to the fact that microorganism associated with Mycorrhizal fungus would degrade the toxins and reduce the activity of pathogen responsible for inhibition of P uptake and plant establishment.

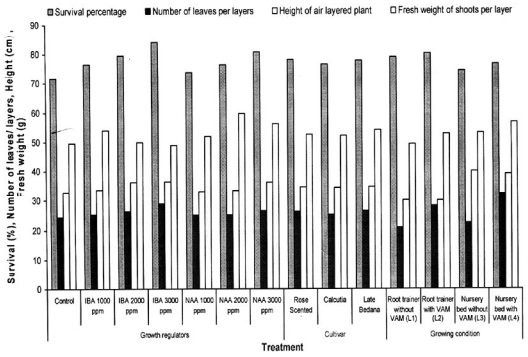

Figure 1. Effect of PGR, cultivar and growing condition on different parameters of litchi air layer.

Number of leaves per layer is a potential characterization which is directly related to the better growth and development of plant and ultimately yield of litchi. As presented in Figure 1, the maximum number of leaves per layer was obtained with IBA 3000 ppm and minimum number of leaves per layer was obtained in control. The possible reason for increase in number of leaves per layer might be due to the increase in carbohydrate and metabolic activities in treated plant. The results are in line with the findings of Ginwal et al. (4). The effect of various concentration of IBA and its interaction with cultivar as well as growing condi-

tion showed significant influence on height of air layer and fresh weight of shoot per plant, but cultivar individually do not showed any significant effect. The maximum height of air layer recorded with IBA 3000 ppm and minimum height of air layer observed in control. Among three factor interaction, The combination of Late Bedana + IBA 3000 ppm + Nursery bed gave maximum height of air layer and minimum height of air layer found with combination of Late Bedana + IBA 2000 ppm + Nursery bed with VAM. The increased height of air layer and fresh weight of shoot per plant might be due to greater transpiration which may possibly increased the flow of water and N to the roots of mycorrhizal treated plant. This result is in conformity with the findings of Gera et al. (3).

Present investigation revealed that treatment, cultivars and growing condition and interaction between treatment and cultivar showed significant effect on fresh weight of root (Fig. 2). VAM treated Air layers in nursery bed gave maximum dry weight of shoot while minimum was recorded in root trainer without VAM. The possible reason might be explained on the basis of highest diametric growth in the above treatment. This finding was also supported by the findings of Awasthi (5) in guava. It is apparent from data that treatment, cultivar, growing condition and interaction between treatment and cultivar and between treatment and growing condition had significant effect on dry weight of root (Fig. 2). The maximum dry weight of root was observed with IBA 3000 ppm while minimum dry weight of root in control. This finding was also supported by findings of Awasthi (5) in guava. The effect of treatment was observed significant on dry weight of shoot per air layer. Maximum dry weight (33.86 g) of shoot was recorded with IBA 3000 ppm while minimum dry weight (27.83 g) of shoot was noted in control condition which was statistically at par with IBA 1000 ppm and NAA 1000 ppm.

Figure 2, shows that treatment, cultivar and growing condition and interaction between treatment and cultivars, treatment and growing condition as well as all three factors interaction had a significant effect on root : shoot ratio (dry weight basis) of air layers. Maximum root : shoot ratio (dry weight basis) of air layers was observed with IBA 3000 ppm while minimum root : shoot ratio (dry weight basis) of air layers was reported in control.

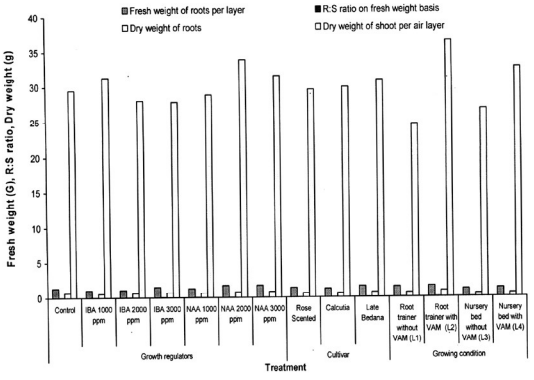

Figure 2. Effect of PGR, cultivar and growing condition on different parameters of litchi air layer.

The effect of all three factors individually and interaction between them had a significant effect on leaf area per layer (Fig.2). The maximum leaf area was observed with the application of NAA 1000 ppm while minimum leaf area was recorded in control condition. Increased leaf area was caused by the production of phytohormones that helps in activation of cell division which are responsible for more leaf formation. Similar finding were reported by Smalle et al. (6). Thus on the basis of the overall effect of treatment, cultivar and growing condition and their interaction, it can be concluded that in air layering of litchi, the maximum rooting and survival percentage of air layers in root trainer with VAM can be obtained by application of IBA 3000 ppm in Late Bedana followed by Rose Scented variety of Litchi.

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