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Effect of plant growth regulators on rooting survival of air layering in litchi

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ABSTRACT : The experiment was conducted at Bihar Agriculture College, Sabour in 2002- 03 with two Bio-regulators (IBA and NAA) and there combinations in Randomized Block Design with three replication to know the effect of bio-regulators either alone or in combination on rooting percentage, survival percentage, rooting ability, growth and development of air layers in litchi. In this experiment it was found that IBA 5000 ppm produced maximum rooting layers (90.00 %) in litchi cv. PURBI. IBA 5000 ppm also proved better in survival percentage (86.66 %) fresh weight of roots (4.37 g) was found more in case of IBA 5000 treated layers followed by IBA 5000 ppm + NAA 5000 ppm (4.35 g) and minimum (2.24 g) under control, dry weight of roots was found maximum (1.11 g) by IBA 5000 ppm + NAA 5000 ppm treated layers whereas it was minimum (0.71 g) in untreated layers. The diameter of primary roots was maximum (0.83 mm) in untreated layer and minimum diameter of root (0.57mm) was found in bio-regulators (IBA 5000 ppm) application. IBA 5000 ppm alone or in combination with NAA at higher concentration as IBA 5000 ppm plus NAA 5000 ppm (T_9) were found best in various parameters of root formation, root development, quality and growth of layers in the nursery.

Key Words : Litchi marcots, IBA, NAA, Rooting percentage, Survival percentage

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Litchi (*Litchi chinensis*) is known as a queen of fruits. Litchi has a special position among fruit crops due to its excellent quality, pleasant flavour and attractive colour. Fruit is a single seeded nut and rich sources of Vitamin B2 Calcium and minerals having excellent flavour. Edible portion of litchi is fleshy aril. Litchi belongs to the family Sapindaceae and is closely related to fruit like Longan and Rambutan.

In litchi production, India is second largest producer only next to China in spite of these, this crop is native to south China. In India litchi is grown mainly in the eastern part of the country. Bihar offers the most salubrious climate to grow this luscious fruit and has monopoly in litchi production in India. Bihar contributes about 74 per cent of litchi production in India (Indian Horticulture database, 2002). In Bihar it is extensively cultivated in Muzaffarpur, Samastipur, Dharbhanga and Bhagalpur region. Besides Bihar it is cultivated in U.P., Assam and West Bengal.

Litchi can be propagated by seed and vegetatively by air layering. Air layering is a commercial method of vegetative or asexual propagation (Bhambota *et al.,* 1968). In vegetative propagation bio-regulators like IBA and NAA play very important role in enhancing rooting percentage (Ram and Majumder, 1983; Nanda and Kochhar, 1955), survival percentage, fresh weight, dry weight and producing thinner roots. Bio-regulators help in easily settlement of roots, increase more number of leaves and produce thinner roots. So keeping these points in consideration the present trial was conducted to improve the rooting and survival of litchi marcots. It can be propagated by seed and vegetatively by means of stem cutting, mound layering, grafting and air layering. Plants raised by seed are seldom true to type due to heterozygous in nature. Seed propagation lead to immature genetic variation with the result it is difficult to find standardized quality or performance and plant take long time to come in fruit bearing. Vegetative propagation causes genetic uniformity in yielding capacity and fruit quality of mother plant. Due to hardy in nature of root, low rooting potential and transplanting shock, there is always scarcity of quality plant in market at reasonable price. Air layering can solve the problem and is a very commercial and economical method of propagation. In air layering it is attached

to its mother plant up to rooting which overcomes low rooting and transplanting shock. Success of air layering depends on early root initiation and formation of sufficient fibrous roots. Plant growth regulators play a key role in different phases of growth and development and it also influence early callus formation and producing fibrous roots. In air layering roots form on the aerial part of the plant on girdled stem enclosed in a moist rooting media. Air layering is also known as chinees layering, pot layering, marcottage and gooty. Air layering is also practiced in jackfruit (Singh, 1951; Mukharjee and Chatterjee, 1978), guava (Sharma *et al.*, 1990) and citrus (Kumar and Gill, 1996).

Plant growth regulators also reduce marcotting period. Among different growth regulators auxin are more effective as a rooting aid. The natural auxin, IAA produces good rooting but synthetic auxin like NAA, IBA are more effective than natural auxins as reported by Bhagat *et al.* (1999) and Chinappa (1962) in litchi.

RESEARCH PROCEDURE

The experiment was conducted at Bihar Agricultural College, Sabour in 2002-03 with two bio-regulators (IBA and NAA) and their combinations in Randomized Block Design with three replications to know the effect of bio–regulators either alone or in combination on rooting percentage, survival percentage, rooting ability, growth and development of air layers in litchi. For the experiment, litchi tree of uniform growth and canopy size was selected as mother plant. One year old shoot of 70-75 cm length and pencil thickness were selected for layering. The number of nodes in each selected shoots was 7-9 with an average distance of 6 cm from node to node. Selected branches were tagged for further operation. Ringing was done in selected branches in the month of June. The plants were free from disease and pest and grown in similar soil and climate condition. Similar culture and manorial schedules were adopted. For air layering upright branches (1.0-1.5 cm thick and 40-60 cm long) are selected. The selected branches are girdled first. A strip of bark 3-4 cm in length is completely removed from around the stem. Scraping the exposed surface to ensure complete removal of phloem and cambium is desirable to retard healing. After one week of ringing all chemicals alone or in combination were applied with lanolin paste at time of marcotting one time. Application of regulators in lanoline on the upper end of the girdle. For making 2500 ppm of IBA and NAA paste in lanoline, 25 mg of these chemicals were weighed and mixed thoroughly with 10 g of lanoline in a Petridis. Similarly for 5000 ppm of IBA and NAA paste in lanoline 50 mg of these chemicals were weighed and mixed thoroughly with 10 g of lanoline in Petridis. Likewise mixtures of different concentrations were also prepared. After selection of suitable shoots (720 in number) ringing was done in the month of June (third week) and 4 cm wide ring of bark was removed. After one week of ringing wrapping was done. All chemicals alone or in combination were applied with lanoline paste before wrapping. Wrapping was done with polythene sheet which were 200 gauges thick. On the same day of PGR application, the exposed portions of shoots were covered with transparent polythene sheets of 200 gauges thickness and 25 x 2.5 cm size. Both the ends of Polythene were tied tightly with sutli to prevent moisture loss of rooting media and ensure good success of layering. Rooted marcots were detached six weeks after marcotting when fibrous roots developed and clearly visible. Layers are removed from the parent plant when thinner roots are observed through the transparent film. Rooted layers after detachment, planted in nursery treatment wise separately. After planting, beds were watered regularly according to moisture available in beds and final survival, growth and development were recorded after 90 days of planting in nursery. The percentage of survival was counted on the basis of layering prepared. The fresh weight of root was weighed on a physical balance per layer six week after wrapping. And dry weight of roots was recorded by weight after taking fresh weight the roots were dried in hot oven at 80^0C for 24 hours. The diameter of primary roots was recorded with the help of slide callipers and average diameter of primary roots was calculated. During experiment twelve treatments were taken details given in Table A.

Table A : Treatments details

Treatments	Particulars and concentrations
T_1	IBA-2500 ppm
T_2	IBA-5000 ppm
T_3	IBA-7500 ppm
T_4	NAA- 2500 ppm
T_5	NAA- 5000 ppm
T_6	IBA-2500 ppm + NAA- 2500 ppm
T_7	IBA-2500 ppm+ NAA- 5000 ppm
T_8	IBA-5000 ppm+ NAA- 2500 ppm
T_9	IBA-5000 ppm+ NAA- 5000 ppm
T_{10}	IBA-7500 ppm+ NAA- 2500 ppm
T_{11}	IBA-7500 ppm+ NAA- 5000 ppm
T_{12}	Control

The experimental data were analyzed to know that which concentration either alone or in combination was superior over others. The analysis of variance table was prepared in the usual way. The percentage data were transformed into angles by √percentage for the purpose of statistical analysis in case of observation if any were 'O' the original values were transformed by the formula :

$$\mathbf{Y} = \sqrt{(\mathbf{X} + \mathbf{0.05})}$$

where,

Y=Transformed value,

X= Original value.

RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Rooting percentage :

The data pertaining to the rooting percentage as a result of different treatment are presented in Table 2. The analysis of data on rooting percentage revealed that there was a significant difference between the treatments. Rooting percentage in layers induced by all the growth regulators and their combinations varied from 48.33 to 90.00 per cent. It was observed that IBA 5000 ppm treated marcots produced maximum (90%) rooting followed by IBA 5000 ppm + NAA 5000 ppm (86.66%) and minimum rooting percentage (48.33%) was observed in control. The analysis of variance table revealed that IBA 5000 ppm produced best rooting which was at par with treatment T_9. Root initiation depends on the auxin balance and rhizocalin interaction. Rhizocalin is distributed throughout the length of twigs which subsequently mobilized to the end of layers and thus root initiation take place as reported by Bonner and Wildman (1946). Auxin increases rooting due to hydrolysis of nutritional reserves under the influence of auxins as expressed by Gregary and Samantarai (1950). The greater effectiveness of IBA over NAA may be due to its non toxic nature in a wide range of concentration and effective in promoting rooting. These results further get support from findings of Sharma *et al.* (1990) in litchi and Lal *et al.* (2007) in guava. IBA promotes rooting in a large number of species as reported by Hartman and Kester (1965). Better rooting with the application of IBA 5000 ppm was also expressed by Dimri and Nautiyal (2000) in lime and Mandal *et al.* (1988) in litchi.

Survival percentage :

The analysis of data of survival percentage varied from 40.00 to 86.66 per cent. It was found that IBA 5000 ppm treated layer produced maximum survival (86.66%) which was at par with IBA 5000 ppm + NAA 5000 ppm (80%) and minimum survival (40.00 %) was found under control. The increase in survival percentage may be due to profuse and thinner root produced by the application of different treatments. Thinner root system improve water absorption capacity of plant which reduce mortality in the nursery. IBA has greater chemical stability and low mobility in plant which result in prolong action giving better chance of success as reported by Audus (1963). The beneficial effect of IBA on batter survival in layers was confirmed by Sen *et al.* (1961), Mukharjee and Bid (1965) in mango and Brahmachari *et al.* (1997), Ray*et al.* (2001) in litchi.

Diameter of primary roots :

The observation regarding diameter of primary roots revealed that it varied from 0.57 mm to 0.83mm. Minimum diameter of primary root was obtained in T_2, T_3, T_6, T_7 and T_9 treatments (0.57 mm.) and maximum diameter(0.83 mm.) was observed in control. Reduction in diameter of primary root was closely associated with more number of thinner roots as a result of IBA application. Same view was also expressed by Kumar (1971) in lime.

Table 1 : Response of bio-regulators in air layering of litchi

Tr.	Bio. regulators	Rooting percentage	Survival percentage	Fresh weight of root per layer (g)	Dry weight of root per layer (g)	Diameter of primary roots (mm)
T_1	IBA 2500 ppm	73.33 (59.00)	68.33 (55.77)	3.61	0.75	0.59
T_2	IBA 5000 ppm	90.00 (71.95)	86.66 (68.86)	4.37	0.75	0.57
T_3	IBA 7500 ppm	70.00 (54.78)	66.66 (54.74)	3.35	0.76	0.57
T_4	NAA 2500 ppm	66.66 (54.78)	58.33 (49.80)	3.71	0.70	0.59
T_5	NAA 5000 ppm	71.66 (57.98)	60.00 (50.85)	3.74	0.76	0.58
T_6	IBA 2500 ppm + NAA 2500 ppm	76.66 (61.33)	61.66 (51.81)	3.65	0.75	0.57
T_7	IBA 2500 ppm + NAA 5000 ppm	68.33 (55.97)	66.66 (54.83)	3.57	0.76	0.57
T_8	IBA 5000 ppm + NAA 2500 ppm	75.00 (60.19)	65.00 (53.93)	3.90	0.75	0.59
T_9	IBA 5000 pm + NAA 5000 ppm	86.66 (69.55)	80.00 (63.54)	4.35	1.11	0.57
T_{10}	IBA 7500 ppm + NAA 2500 ppm	81.66 (65.19)	73.33 (59.05)	3.91	0.75	0.61
T_{11}	IBA 7500 ppm + NAA 5000 ppm	78.33 (63.60)	70.00 (56.84)	3.25	0.71.	0.73
T_{12}	Control	48.33 (40.04)	40.00 (39.21)	2.24	0.75	0.83
C.D. (P=0.05)		10.3565	7.4973	0.5269	0.3226	0.0611
C.V. (%)		10.19	8.06	8.55	24.63	5.88
S.E. ±		4.9935	3.6149	0.2540	0.15556	0.0294
CF		129764.4521	108654.83	476.9856	21.5466	13.5387

Note:-Value within bracket shows angular value

Fresh weight :

The data pertaining to the fresh weight of root as a result of different treatments have been presented in Table 2.The observation regarding fresh weight of roots per layer under different treatments varied from 2.24 g to 4.37 g. Fresh weight of root was found more in IBA 5000 ppm treated layers (4.37g) followed by IBA 5000 ppm + NAA 5000 ppm (4.35g) minimum fresh weight (2.24 g) of root was observed under control. It was found that maximum fresh weight was produced by T_2 treated layer followed by and at par with T_9 which was at par with T_{10} and minimum fresh weight were observed in T_{12}. It may be due to more number of primary and secondary roots produced by the application of IBA 5000 ppm. The result of the present investigation is in line with the work of Dua and Sen (1982) and Kumar *et al.* (2007) in jackfruit.

Dry weight :

Dry weight of root as a result of different treatments has been presented in Table 2. The analysis of data regarding dry weight of roots showed marked variation under different treatments and varied from 0.70 g to 1.11 g. It was found that dry weight of roots was maximum (1.11g) in IBA 5000 ppm + NAA 5000 ppm treated layers and minimum dry weight (0.70 g) of root was found in NAA 2500 ppm treated layers. The increase in number and length of root was probably responsible for enhancement of dry weight of root. IBA in combination with NAA appeared more effective in increasing dry weight of root. The beneficial effect of IBA and NAA used in increasing dry weight of root was also expressed by Lingarajappa (1982) in jackfruit.

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LITERATURE CITED

Audus, L.J. (1963). Plant growth substances, Leon and Hill (Books) Limited, LONDON (U.K.).

Bhagat B.K., Singh, C., Chaudhary, B.M. (1999). Effect of PGR on rooting and survival of air layering in guava. *Orissa J. Hort.,* **27** (2): 72-75.

Bhambota, J.R., Singh, K.K. and Saini, H. (1968). Propagation litchi plant. *Punjab Hort. J.*, **8**: 200-203.

Bonner, J.F. and Wildman S. (1946). Growth substance and propagation, sixth symposium on development and growth. Rhode Island state coll. Kingsten CCF propagation by Mahlstede and Haber. *John willey & sonn. Inc.* New York, 1975.

Brahamchari, V.S., Singh, M.P. and Yadav, G.S. (1997). Effect of etiolation and growth substance on success of marcottage in litchi. *Orissa. J. Hort.,* **25** (2): 87-89.

Chinappa, K.S. (1962). Effect of PGR on rooting of air layering in litchi. *Lalbagh,* **7** (1): 28-31.

Dimri D.C. and Nautial, M.C. (2000). Effect of IBA on rooting and survival of air layering in lemon cv. pant lemon and Kagzi lime under low hill valley area of Uttaranchal. *Prog. Hort.,* **32** (2): 186-189.

Dua, R.S. and Sen, S.K. (1984). Root regeneration in litchi stem cutting with auxin and auxin synergistic and interminent mist. *South Indian. Hort.,* **30** (3):188-191.

Gregary, F.G. and Samantarai (1950). Factors concerned in the rooting response of isolated leaves. *J. Exp. Bot.*, **1**: 159-163.

Hartmann, H.T. and Kester, D.E. (1965). *Plant propagation principles and practices*. Prentice Hall : Ing, Englewood coliffs. NEW JERSEY (U.S.A.) 224pp.

Indian Horticulture Database (2002). NHB, Gurgaon.

Kumar, M., Lal, S., Kumar, R. and Kamal, S. (2007). Response of indole butyric acid on air layering in jackfruit cv. PANT GARIMA. *Environ. & Ecol.*, **25** (4): 1167-169.

Kumar, N. (1971). Studies on the effect of growth substance IBA and NAA on rooting of lime cutting, P.G. Thesis, Bhagalpur University, Bhagalpur (BIHAR) INDIA.

Kumar, P. (1998). Propagation of jackfruit by marcottage. Thesis, Rajendra Agricultural University, Pusa, Samastipur, BIHAR (INDIA).

Kumar, Rakesh and Gill, D.S. (1996). Effect of IBA and P. Hydroxy - benzoic acid on rooting behaviour of air layering of baramasi lemon. *Haryana J. Hort. Sci.,* **25** (4): 172-176.

Lal, S., Tiwari, J.P., Awasthi, P. and Singh, G. (2007). Effect of IBA and NAA on rooting potential of stooled shoots of guava (*Psidium guajava* L.) cv. SARDAR. *Acta Hort.*, **735** : 193-196

Lingarajappa, V.G. (1982). Studies on the effect of pre treatments and growth regulators on the rooting of jackfruit air layering, *Hort. Abst.*, **53** (2): 1354.

Mandal, Brahamdev, Sengupta, B.N. and Brahamchari, V.S. (1988). Effect of PGR n rooting of cutting in litchi. *Bihar Acad. Agric Sci.*, **35** (36): 19-23.

Mukharjee S.K., Chatterjee, B.K. (1978). Effect of Etiolation and Bioregulators on air layering of Jackfruit (*Artocorpous heterophillus* Lam.). *Indian J. Hort.*, **35** (1): 1-4.

Mukharjee, S.K. and Bid, N.N. (1965). Propagation of mango (*Mangifera indica* L.). II. Effect of etiolation and growth regulator treatment on the success of air layering. *Indian J. Mric. Sci.*, **35** (4): 309-314.

Nanda, K.K. and Kochhar, V.K. (1985). Vegetative propagation of plants. Kalyani Publishers, NEW DELHI (INDIA).

Ram, M. and Majumder, P. K. (1983). Effect of indole butyric acid on stooling in litchi. *Indian J. Hort.*, **40**: 211-212

Ray, R.N., Dwivedi, A.K., Rao, P.S. and Jain, B.P. (2001). Effect of indole butyric acid and coloured wrapping material on propagation of litchi cv. Purbi. *Haryana J. Hort. Sci.*, **30** (3/4): 170-172

Sen P.K., Bose, T.K. and Sasibhusahan, T. (1961). Propagation of mango (*Mangifera indica* L.) by air layering with growth substances. *Indian Agriculturist*, **5** (2): 167-172.

Sharma, R.S., Sharma, T.R. and Sharma, R.C. (1991). Influence of growth regulators and time of operation of air layering in guava (*Psidium guajava* Linn.) cv. Allahabad Safeda. *Rissa J. Hort.*, **19** (1-2): 41-45.

Sharma, S.B., Ray, P.K. and Singh, B.K. (1990). Note on rooting and survival of litchi layers. *Indian J. Hort*., **47** (2): 174-176

Singh, L.B. (1951). Propagation in Jackfruit (*Artocorpous heterophillus* Lam.) by air ayering with Harmones. *Curr. Sci*., **20**: 102-103.