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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 5 (11): 1259-1260, 2002

Rooting and Survival of Air Layers in Litchi as Influenced by Layering Time and Plant Growth Regulator

M.A. Rahman, [1]M.N. Amin, M.S. Islam, M.M. Begum and M.A. Uddin
Fruit Research Station, Bangladesh Agricultural Research Institute Binodpur, Rajshahi-6206, Bangladesh
[1]Department of Botany, Rajshahi University, Bangladesh

Abstract: Air layering on five different times with the help of indole butyric acid (IBA) at 1000, 1500, 2000, 2500, 3000 and 3500 ppm concentration was evaluated in BARI-1 variety of litchi. Five different dates of layering were 15 May, 01, 16 June, 01 and 16 July. It was observed that the number and average length of primary roots and survival of layers were markedly increased where layers were prepared on 01 and 16 June. Layers prepared with IBA at 2500 ppm produced the maximum number (27.14) and length (6.69 cm) of primary roots and obtained the highest percentage (77.66%) of success in the survivability of litchi layers. The best rooting performance and the final survival of air layers in the nursery after 90 days of severing was recorded to be the highest (90%) where layers were prepared on 16 June with IBA at 2500 ppm.
Key words: Rooting, survival, air layering, IBA, litchi

Introduction

Litchi (*Litchi chinensis* Sonn.) is an important subtropical fruit with translucent and scented aril. Its cultivation is becoming popular as farmers are getting lucrative income from their litchi orchards. But absence of easy and reliable clonal propagation method limits large scale cultivation of promising varieties and use of modern technique like micro propagation has not been proved very successful in litchi (Amin *et al.*, 1996). It is the most widely used method of propagating litchi in Bangladesh. Bhambota *et al.* (1968) also reported that among the different methods of propagation air layering was the most convenient for litchi. Nevertheless, the major bottleneck associated with this method of propagation is the high mortality of layers after severing them from the mother plants and establishment in the nursery on their own root systems as reported by many workers (Sharfuddin, 1983; Sharma *et al.*, 1990; Syamal and Singh, 1993). Thus, it restricts us with availability of very few propagules from an elite genotype of litchi. The use of plant growth regulators like IBA, NAA etc. have been advocated for accelerating rooting in litchi layers (Ram and Majumder, 1983). Nanda and Kochhar (1985) and Sadhu (1986) also reported that the application of root promoting substances during layering helps to get profuse root within a short time and IBA has been found most effective. On the other hand, time of layering plays an important role in rooting and production of quality layers. Because root induction during layering may be associated with the particular physiological conditions in the stem associated with time of the year as reported by Hartmann and Kester (1986). In order to find out a suitable time of layering and optimum concentration of IBA, this study was carried out for minimizing the loss of mortality and promoting better growth of litchi layers in the nursery.

Materials and Methods

The present investigation was carried out in the experimental orchard of Fruit Research Station, BARI, Binodpur, Rajshahi in 2001. The experiment was laid out in a factorial randomized complete block design. The variety BARI litchi-1 was used as mother plant in this experiment. Layering operation was done in the mother plants on 15 May, 01, 16 June, 01 and 16 July 2001. Twenty-five uniform 1.5 - 2.0 - year matured twigs were selected from all directions on healthy trees. To perform air layering, rings of 3-4 cm long were made by removing the bark on the selected twigs. Six concentrations of IBA like 1000, 1500, 2000, 2500, 3000 and 3500 ppm were applied on rings just after removing the barks. Medicated cotton piece of 2x5 cm^2 with uniform thickness was used to apply indole butyric acid (IBA) solutions at the distal cut surface of the layers. At first the cotton pieces were soaked in different IBA solutions and placed them around the distal cut surface. It was then covered with a rooting mixture comprising of sandy loam soil and well-decomposed cowdung (3:1) presoaked in water. Then the rooting mixture was covered with a polythene piece of 15x10 cm^2 in size. Both ends of polythene were tied tightly to minimize the evaporation of moisture. The layers were detached from the mother plants after 65 days from the date of operation when the roots were visible and planted them in the nursery at a distance of 35x35 cm^2. The number of primary roots and average length of primary roots were counted before planting of layers and data on final survival of layers was recorded after three months of planting when new growth started in the transplants. Computer using MSTAT software analyzed the collected data and using Duncan's multiple range test (DMRT) did the range test of the means.

Results and Discussion

Time of layering had a noticeable effect on rooting and survival of air layers in litchi (Table 1). The maximum number of primary root (27.28) was observed in layers where layering was done on 16 June. On the other hand, statistically identical results (26.53 and 26.25 roots /layer) were recorded in layers which were prepared on 15 May and 01 June (Table 1). The lowest number of primary root (10.43) was observed in layers that were prepared on 16 July. Variation was also found in length of primary roots to different layering dates. Layering of 15 May, 01 and 16 June produced higher length (6.79, 6.97 and 6.88 cm) of primary root compared to 5.69 and 5.56 cm with 01 and 16 July respectively. Layering of 01 and 16 June resulted in significantly higher survival (66.67, 67.38%) of layers in the nursery after 90 days of severing compared to 55.95, 51.42 and 44.52% with 15 May, 01 and 16 July, respectively. It is, therefore, apparent that the best time of air layering in litchi is ranged between second half of May to first half of June. The present result agrees with that of Maiti (1985) who reported that the best season for operation of air layers in litchi is the beginning of monsoon.

The use of IBA had a significant effect on total number and length of primary root and survival of air layers in litchi (Table 1). The maximum number (27.14) of primary roots were observed with IBA at 2500 ppm followed by 25.9 roots with IBA at 3000 ppm and the lowest number (10.56) of roots were recorded in control treatment. The finding agrees with that of Sharma *et al.* (1990) who obtained the maximum number of root in the shoots treated with IBA at 2500 ppm. Audus (1963) also reported that the application of auxin in proper concentration had initiated root meristems in different mature non-meristematic tissues. The increase in the number of roots in treated layers is possibly due to

Table 1: Effect of layering time and IBA on rooting and survivability of air layers in litchi

Treatments	No. of primary roots/layer	Length of primary root (cm)	Survival of layers in the nursery (%)
Layering time			
T_1 15 May	26.53a	6.79a	55.95b
T_2 01 June	26.25a	6.97a	66.67a
T_3 16 June	27.28a	6.88a	67.38a
T_4 01 July	13.53b	5.69c	51.42c
T_5 16 July	10.43c	5.56c	44.52d
Concentration of IBA (ppm)			
H_1 1000	15.18c	6.30ab	52.66d
H_2 1500	20.85b	6.33ab	53.00d
H_3 2000	22.64b	6.65a	58.33c
H_4 2500	27.14a	6.69a	77.66a
H_5 3000	25.90a	6.61a	63.33b
H_6 3500	23.34b	5.90b	55.67cd
H_7 Control	10.56d	5.42c	39.66e
F-value	**	*	**

Table 2: Combined effect of layering time and IBA on rooting and survivability of air layers in litchi

Treatments	No. of primary roots/layer	Length of primary root (cm)	Survival of layers in the nursery (%)
T_1H_1	15.40f-l	5.76g-k	58.33f-j
T_1H_2	30.33a-c	7.06b-f	55.00g-k
T_1H_3	29.53a-c	7.03b-f	58.33f-j
T_1H_4	33.77ab	7.43a-e	76.67bc
T_1H_5	33.00ab	7.06b-f	66.67c-g
T_1H_6	29.57a-c	7.26a-e	45.00k-n
T_1H_7	14.10g-j	5.93g-k	31.67o
T_2H_1	20.57ef	6.30f-l	66.67c-g
T_2H_2	23.20de	6.60d-g	60.00e-l
T_2H_3	26.80cd	7.46a-d	71.67b-e
T_2H_4	34.20ab	8.06a	78.33bc
T_2H_5	33.80ab	7.93ab	73.33b-d
T_2H_6	30.60a-c	6.26f-l	68.33c-f
T_2H_7	13.60g-j	6.20f-j	48.33l-m
T_3H_1	20.90ef	6.30f-l	55.00g-k
T_3H_2	28.37b-d	7.45a-e	63.33d-h
T_3H_3	34.17ab	7.85a-c	68.33c-f
T_3H_4	35.20a	7.93ab	90.00a
T_3H_5	33.93ab	6.96e-f	78.33bc
T_3H_6	32.67a-c	5.23k	68.33c-f
T_3H_7	6.93k	5.13k	48.33i-m
T_4H_1	9.75i-k	7.30a-e	46.67j-n
T_4H_2	11.73i-k	5.16k	51.67h-l
T_4H_3	11.37i-k	5.70 g-k	45.00k-n
T_4H_4	19.53e-g	6.53e-h	83.33ab
T_4H_5	18.33e-h	5.46i-k	48.33l-m
T_4H_6	14.23g-j	5.43i-k	45.00k-n
T_4H_7	9.76i-k	4.26l	40.00l-o
T_5H_1	9.30i-k	5.86g-k	36.67m-o
T_5H_2	10.63i-k	5.40i-k	35.00no
T_5H_3	11.33i-k	5.43i-k	48.33i-m
T_5H_4	13.23h-k	5.70g-k	60.00e-l
T_5H_5	10.47i-k	5.65h-k	50.00i-l
T_5H_6	9.63i-k	5.30jk	51.67h-l
T_5H_7	8.43jk	5.60h-k	30.00o
F- value	**	*	**

Values in each column followed by same letter (s) are not differed significantly. ** Significant at 1% level, * Significant at 5% level

the fact that IBA influenced on acceleration of the rate of initiation of root meristems and consequently the production of greater number of roots (Sharfuddin and Husain, 1973). Statistically significant difference was observed in root lengths among the layers produced by IBA treatments and those of control treatment. However, there was no significant difference in respect to root lengths in layers treated with IBA at 1000 to 3000 ppm (6.30 to 6.69 cm). Among the IBA treatments significantly lowest length of 5.90 cm was recorded with IBA at 3500 ppm. The final survival of air layers in the nursery after 90 days of severing was recorded to be the highest (77.66%) in IBA at 2500 ppm followed by 63.33% at 3000 ppm. The results of present experiments are in conformity with that of Sharma *et al.* (1990) who obtained similar result in the survivability (74.2%) of litchi layers *in the* nursery where wrapping was done after first week of *ringing with* IBA at 2500 ppm. The present findings regarding the effect of IBA is in agreement with that of Mukhopadhaya (1986) who reported that there was increasing trend for rooting and survival up to 2500 ppm and thereafter it declined. The lowest survival (39.66%) of litchi layers was noted in control treatment.

Regarding the combined effect of layering time and IBA it was noticed that some combinations showed better rooting performance and higher success in the survivability of the air layers in litchi than that of individual effect (Table 2). Layering on 16 June with the use of IBA at 2500 ppm produced the maximum number of primary root (35.2) followed by 34.2 roots with IBA at same concentration with 01 June. The average length of primary root was also maximum (8.06 cm) in 16 June layers with IBA at 2500 ppm that was followed by 7.93 cm with same concentration with 01 June layers. However, the final survival of litchi layers in the nursery was highest (90%) with IBA at 2500 ppm where layering was done on 16 June. The findings relating to rooting and survivability of the litchi layers agrees with that of Singh *et al.* (1963) who reported that the layers which survived most had higher number of roots.

The results of this study revealed that the time of layering and use of IBA had significant effect on the rooting and survivability of air layers in litchi. However, from the foregoing results, it may be advocated that layering on 16 June with the use of IBA at 2500 ppm can be practiced for obtaining higher rooting and better stand of layers in the nursery.

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