Proceedings of Pakistan Society for Horticultural Science
2nd International Conference on Horticultural Sciences, February 18-20, 2016
Theme: Production Challenges and Food Security
Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Punjab 38040, Pakistan

Effect of Different Concentrations of NAA on Air Layering of Litchi (*Litchi chinensis* Sonn.)

Malik Mohsin Abbas*[1], Muhammad Kashif Raza[1], Muhammad Ishfaq[1], Naseem Sharif[1], Saeed Ahmad[2]
[1]Horticultural Research Institute, AARI, Jhang road, Faisalabad, Pakistan
[2]Institute of Horticultural Sciences, University of Agriculture, Faisalabad.
Email: malikmohsin144@gmail.com (M.M.A)

Abstract

A field experiment was conducted during 2014-2016 to standardize clonal propagation technique in litchi (*Litchi chinensis* Sonn) by application of different concentrations of NAA (0, 2000, 3000, 4000 ppm) to enhance the rooting of litchi air layers at Horticultural Research Institute, AARI, Faisalabad. These attempts were carried out to produce true to type and trust worthy nursery plants of litchi (badana cvs.). Results depicted significantly higher success percentage (73%) in the shoots where 3000 ppm of NAA was used during air layering as compared to control (28%). The plants produce maximum number of leaves (24.5), highest length of sprout (63.5 cm) and maximum no of roots (13) when treated with NAA @ 3000 ppm as compared to all other treatments. The study provided valuable information on clonal multiplication of elite germplasm of litchi with application of 3000 ppm NAA for preserving the certain characters of the variety and its multiplication.

INTRODUCTION

Litchi (*Litchi chinensis* Sonn.) is one of the prominent subtropical fruit crop in Pakistan due to its refreshing taste and lucrative income. It has gained admiration as exotic fruit and its demand is increasing day by day. It was introduced in Pakistan during 1932 by Sardar Faqir Singh son of Sardar Mangal Singh at Lahore along the river bank of Ravi from Dera Dune, India. It has marvelous health benefits as the fruit contains high Vitamin C (71 mg/100g) and numerous mineral contents predominantly potassium (Khushk and Leghari, 2006). It remained un-noticed due to the slow growing behaviour and long precocity (Rajwana *et al.*, 2008). Due to its heterozygous nature, it behavesas a cross pollinated plant. Inaccessibility of an easy and reliable propagation technique is an enormous limiting issue in large scale cultivation of litchi. Plants produced sexually are not true to type so its propagation by means of seed is not suggested. Litchi can be propagated sexually but due to dis-advantages of seedling plants, it is mainly multiplied through vegetatively. The absence of easy and reliable clonal propagation method limits large scale cultivation of promising varieties and use of modern techniques like micropropagation has not proved very successful in litchi (Amin *et al.*, 1996).

In Punjab, litchi is generally propagated from seeds and the seedlings are variable in both plant and fruit characteristics. Establishment of orchard through seedlings is not recommended yet and most of these seedlings will not be like the parental type in yield, taste and fruit flesh color. The hottest issue in litchi plantation is discriminate multiplication of plants from unreliable sources by nurserymen (Wahab *et al.*, 2001). Non-availability of quality planting materials and consequent substitution of poor quality seedlings have adversely affected the litchi production and productivity. Trust worthy initial planting material is the basic requirement on which the final crop depends both in quality and quantity (Wahab *et al.*, 2001).

Several vegetative propagation techniques as air layering, root cuttings and stooling, have been tried with varying success rate to increase productivity and gains by clonal propagation and selection (Berthon *et al.*, 1990; Casimiro *et al.*, 2001). Though these techniques are still not commercially viable due to varying rate of success, absence of tap root system and cumbersome process. It is useful as compared to conventional method of propagation of litchi through air layering in addition with growth promoting hormones i.e. NAA in a short period of time.

Air layering is most widely used propagation method in litchi. The major tail back in the air layering is the high mortality of layered shoots after separating from parent plants and establishment in the nursery on their own root system (Sharfuddin, 1983; Sharma *et al.*, 1990; Syamal and Singh, 1993). Thus, it results in a very limited availability of plants of elite genotype. Plant growth regulators like IBA, NAA are very useful in accelerating the rooting in litchi (Rajwana *et al.*, 2008). To find out optimum dose of NAA in Air layering of Litchi, this study was carried out for minimizing the mortality and promoting better growth of litchi layers in nursery resulting in maximum number of true to type plants. The main objective of this study was to assess the suitable concentration of Naphthalene acetic acid (NAA) for the production of true to type plants of litchi in short period of time employing air layering method of propagation.

MATERIALS AND METHODS

This experiment was conductedat research area of Horticultural Research Institute, AARI, Faisalabad (Latitude 31.42°N, Longitude 73.09°E, elevation 189 m) during 2014-2016. Soil of the experimental area was loamy, having pH 8.1 (Basic), phosphorus (8.1 ppm) organic carbon (0.86 %), and potash (200 ppm).

Vigorous, healthy and disease-free plants of litchi cultivar "Bedana" were selected for layering operation during month of July and August. For layering, at least one hundred uniform twigs were selected from all directions on healthy trees. Air layering was performed by giving the circular rings of 3-4cm wide by removing the bark on twigs. Three different concentrations of NAA i.e. control, 2000 ppm, 3000 ppm and 4000 ppm were applied with the help of sterilized cotton, on the twigs during the layering operation and compared with the control where no chemical was used. The cotton pieces were soaked in NAA solutions of different concentrations and placed them around the portion of twigs where the bark was peeled. After application of NAA a media (clay, silt and compost 1:1:1) was wrapped around the peeled surface and further covered with polythene sheet. Both the ends of polythene were tied tightly to minimize the loss of moisture through evaporation. After formation of roots (75 days later) the layered branches were cut off from mother plant and shifted in the lath house for acclimatization.

Data were collected on parameters including success percentage, number of leaves, length of sprouting (cm) after 90 days and number of roots. The temperature was measured by thermometer model, AZ-8801and humidity was measured by hygrometer model C3-4154. The survival percentage and number of roots were counted after two months of transplanting in lath house. Length of sprouting was measured by measuring tape. Experiment was laid out according to randomized complete block design having four treatments replicated four times. Data were analyzed statistically by using the Fishers analysis of variance and treatments were compared by using the Least Significant Difference (LSD) test at 5% probability level.

RESULTS AND DISCUSSION

The data regarding the success percentage revealed that the maximum success percentage (73%) was observed in the shoots treated with NAA at the rate of 3000 ppm, followed by (53%) when treated with NAA @ 4000 ppm. Minimum success percentage (28%) was observed in control (Table 1). These results display resemblance with the findings of Tomar *et al*., 1999 who observed maximum success percentage in air layering with application of NAA.

Table 1: Effect of different concentrations of NAA on physical parameters of litchi.

Treatments	Success (%)	Number of Leaves	Length of sprouts (cm)	Number of Roots
T_0 (Control)	28d	2.75d	24.75d	6.5c
T_1 (NAA 2000 ppm)	38c	9.25b	40.00b	8.25b
T_2 (NAA 3000 ppm)	73a	24.5a	63.5a	13.00a
T_3 (NAA 4000 ppm)	53c	3.5c	28.5c	7.75bc

Means not sharing the same letter(s) within each column are significantly different at 0.05% level probability.

Data concerning number of leaves depicted in Table. 1 revealed significant results. Maximum number of leaves (24.5) was counted in the shoots treated with NAA at the rate of 3000 ppm. Shoots treated with NAA at the rate of 2000 ppm gave 9.25 number of leaves. On the other hand, the least number of leaves (2.75) was recorded in the shoots reserved as control. The present investigation is in accordance with the previous findings of Tamor, (1979). The present results also corroborated with the results of Ohja, (1985). According to statistical analysis, maximum sprout length (63.5 cm) was measured in shoots treated with 3000 ppm sequenced by 40 cmand 28.5 cm when treated with NAA @ 2000 and 4000 ppm respectively. The minimum sprout length (24.75 cm) was recorded in the shoots kept as control. Paul and Aditi (2009) also found the same results previously.

Data related to number of roots revealed that the maximum number of roots (13.0) was recorded in the shoots treated with NAA at the rate of 3000 ppm whereas minimum no of roots (6.5) was counted in shoots retained as control. This study is confirmatory to the findings of Tomar, 1979 and Sharma, (1981) who found NAA is most effective for rooting of air layering.

CONCLUSION

On the basis of present investigation, it is concluded that NAA @ 3000 ppm found superior with higher success percentage (73%), maximum number of leaves (24.5), highest number of roots (13) and maximum sprout length (63.5) as compared to all other treatments. It is recommended that NAA can be most effective to promote rooting in air layering for multiplication of different varieties of litchi.

REFERENCES

Abdullah, T.M., M.A. Hussain and M.K. Bhuiyan. 2006. Clonal propagation of guava (*Psidiumguajava Linn.*) by stem cutting from mature stock plants. J. Forestry Res. 17(4):301-304.

Amin, M.N., M.A. Razzaque, and M. Anisuzzaman. 1996. Regeneration of plants in vitro from seedling explants of lychee (*Litchi chinensis* Sonn.). In: Plant Tissue Culture. 21-25.

Berthon, J.Y., B. Tahar and G.T. Boyer. 1990. Rooting phases of shoots of Sequoiadendrongiganteum *in vitro* and their requirements. Plant Phys. Bio. 28:631-638.

Casimiro, I., A. Marchant, R.P. Bhalerao, T. Beeckman, S. Dhooge, R. Swarup, N. Graham, D. Inze, G. Sandberg, P.J. Casero and M.J. Bennett. 2001. Auxin transport promotes Arabidopsis lateral root initiation. Plant Cell. 13:843-852.

Khushk. A.M. and N. Leghari. 2006. Potential of Lychee production. Access at: http://www.pakissan. /english/news/newsDetail.php?newsid=9502

Ojha, R.P. 1985. Effect of twig maturity and different growth regulators on rooting. Growth and survival of (*Carissa carandas* L.) air layers. Thesis submitted to J.N.K.V.V., for M.sc. (Ag) degree (unpublished).

Paul, R., and Ch. Aditi. 2009. IBA and NAA of 1000 ppm induce more improved rooting characters in air-layers of water apple (*Syzygiumjavanica* L.). Bulgarian J. Agric. Sci. 15 (2):123-128.

Rajwana I.A., A.U. Malik, A.S. Khan and R. Anwar. 2008. Lychee Industry in Pakistan: Potential and Prospects, Acta Hort. (ISHS).863:67-72.

Sharfuddin, A.F.M. 1983. Effect of pruning on the severity of detached rooted air layers in Litchi. Bangladesh Hort.11:39-40.

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

Sharma, S.K. 1981. Coperative studies on rootage and growth of karonda (*Carissa carandas* L.) airlayers. Thesis submitted to J.N.K.V.V., Jabalpur (unpublished).

Syamal, M.M. and S.K. Singh. 1993. Effect of etiolation and plant growth substances on rooting of air layers in litchi. Ind. J. Hort. 50:242-244.

Tomar, K.S. 1979. Studies on rooting and growth of karonda (*Carissa carandas* L.) air layers with & without growth regulators. Thesis submitted to J.N.K.V.V., Jabalpur.

Tomar, K.S., B.S. Gurjar and R.S.S. Tomar. 1999. Response of different concentration of IBA and NAA on rootage and growth of air layers of guava (*Psidium guajava* L.) cultivar Gwarlior -27. Advances in Plant Sciences. 12 (2):535-538.

Wahab, F., G. Nabi, N. Ali and M. Shah. 2001. Rooting response of semi hardwood cuttings of guava (*Psidium guajava L.*) to various concentrations of different Auxins. J. Biol. Sci. 1(4):184-187.