Plant Archives Vol. 20, Supplement 2, 2020 pp. 3826-3828 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF BIO REGULATORS ON HASTENING THE GROWTH OF MANGO ROOTSTOCK

Venkatesan, S* and G. Yuvaraj
Department of Horticulture, Faculty of Agriculture
Annamalai University, Annamalai nagar-608 002,Cuddalore District, Tamil Nadu, India,
*E-mail : venkihorti@yahoo.co.in, Mobile.No.9443540013.

Abstract

The present investigation was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University. A field trial was conducted in a Completely Randomized Design with 10 treatments in three replications. The treatment consisted of two growth regulators *viz*., Gibberellic acid @ 100 ppm, 200 ppm and 300 ppm; Naphthalene acetic acid 500 ppm, 1000 ppm, and 1500 ppm and a growth retardant Alar @ 500 ppm, 1000 ppm, and 2000 ppm. were sprayed at monthly intervals. The first spray was given at 30 days after planting in the poly bag.The results of the study revealed that foliar application of GA_3 @ 300 ppm increasing the seedling growth characters like plant height, inter nodal length, number of leaves, leaf area, length of the tap root and number of secondary roots of mango rootstock. From the results of the present study, it can be concluded that foliar application of GA_3 @ 300 ppm has beneficial effect on hastening the growth and development of mango rootstock to attain the graftable size in earlier.

***Keywords**:* Mango (*Mangifera indica*), Growth regulators, GA_3, NAA, Growth retardant & Alar.

Introduction

Mango (*Mangifera indica* L.) is the most important fruit crop in India having a great cultural, socio-economic and religious significance since the ancient time. Owing to its origin in Indo-Burma (Myanmar) region, there is no word to express about the taste, flavor and its attractive colour, possessing the delicious fruit quality with rich in vitamins and minerals, accessibility to common man, liking by the masses and coverage of large area under cultivation ranging from the near coastal areas to the Himalayan foot hills, mango has been assigned the status of the 'king of the fruit' in India and its is considered as the national fruit of India. India is the leading producer of mango in the world.

Mango is a cross-pollinated and highly heterozygous plant. Most of the mango varieties are monoembryonic. Such varieties are thus propagated by vegetative means for multiplying true-to- type plant. The propagation of plants by the method other than sexual propagation is referred as vegetative or asexual propagation. It involves no change in genetic makeup of the new plant. All the characteristics of the mother plant are reproduced in the progeny plant due to exact duplication of chromosome during cell division. Thus, the plants are true-to type in growth, yield and fruit quality.

The area under mango is increasing rapidly owing to great demand for fresh fruits as well as processed product in the international market. Even though the area under mango is increasing rapidly, the pace of development is not appreciable. However the greatest bottleneck in the expansion of area under fruits is the non-availability of genuine and quality planting materials in adequate quantity from reliable nurseries. Healthy and good quality planting material is the foundation of successful fruit industry in the country (Reddy and Shukla, 2007). In view of growing importance of fruit crop, the demand for quality planting materials has increased manifold throughout the country in the recent past. In most of the fruit crops, rootstock influences the vigour, longevity, tree size, yield and quality (Mukherjee and Majumdar 1963). The rootstock is a very vital component of a grafted plant and once the tree are grafted on a certain rootstock and planted in the orchard, it is not possible to change it without incurring losses. Like high degree of compatibility with the scion variety, adaptable to the agro-climatic conditions of the proposed area, tolerant to salt, resistant to drought, endurant to frost, resistant to disease and pests prevailing in the proposed area. So raising of good quality rootstock is very important for future amble.

The experimental evidences under mango propagation indicates that seedling growth of mango in the nursery stage is very slow, and hence, its takes longer time nearly about 12 months to attaine graftable size. In order to make the nursery practices efficient, the rootstock seedlings must attained good healthy, vigour and proper size for grafting. It is therefore, highly essential to accelerate the growth rate of mango seedling to attain the graftable size earlier. Such a forcing of growth may ultimately reduce the cost and time of raising the graftable size of mango seedling.

Growth regulators are organic compounds, which modify or regulate physiological processes in plants in appreciable measures when are used in low concentrations. They are also knowns as magic chemicals as they can exert miracle in the growth, development and yield of crop plants. Various bio-regulators are available in two types, one as promoters and other as retardants, but both enhance the production and quality of a particular crop. However, their concentration may vary according to the climate, crop and season (Phookan *et al*., 1991). On the contrary, observation proved that increased concentration of growth regulators could produce reverse result in respect of both growth and yield (Muralidhara *et al*., 2014).

Therefore, the successful and rapid means of raising good root stock seedlings of mango has been a primary concern of nursery men and research workers. Hence, the present study was undertaken to reduce the time required to reach graftable size of mango rootstocks by using plant growth regulators.

Materials and Methods

The present investigation was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University. Healthy uniform size mango stones of neelum variety were procured from the pulping industry during the first week of July from Krishnagiri, Tamilnadu. The stones procured from the processing industry were washed thoroughly and dipped in water. The stones, which were floating in water, were discarded and only those that settled in the bottom were selected and spread over ground. After surface drying, the stones were treated with bavistin at one percent and stones were sown in raised beds mixed with well decomposed farm yard manure and the stones were sown in lines and the beds were mulched with paddy straw. When the seedlings attained the age of fifteen days old, uniform and healthy seedlings were transplanted in the polythene bags of 15x10 cm size containing 1:1:1 potting media. A field trial was conducted in a Completely Randomized Design with 10 treatments in three replications. The treatment consisted of two growth regulators *viz*., Gibberellic acid @ 100 ppm, 200 ppm and 300 ppm; Naphthalene acetic acid 500 ppm, 1000 ppm, and 1500 ppm and a growth retardant Alar @ 500 ppm, 1000 ppm, and 2000 ppm. were sprayed at monthly intervals. The first spray was given at 30 days after planting in the poly bag.The observations on growth characters like plant height, inter nodal length, stem girth, number of leaves, leaf area. The root characters like length of the tap root, root girth and number of secondary roots of mango rootstock were recorded at 150 days after planting in the poly bag. The experimental data were analyzed statistically as per the procedure described by Gomez and Gomez (1984). The AGRES programme was used for the statistical analysis of the data.

Results and Discussion

The results of this study presented in table. 1 & 2 indicated that irrespective of the stages of observation, growth regulators increased the rootstock growth characters like seedling height, internodal length, leaf production, leaf area and total leaf area. The maximum values (60.46 cm, 2.65 cm, 31.67, 67.25 cm^2 and 2129.81 cm^2 respectively) for these traits were registered in GA_3 300 ppm (T_4) at 150 days after planting in poly bag. Which was followed by GA_3 at 200 ppm (T_3) which recorded the values of 60.42 cm, 2.38 cm, 29.23, 62.31 cm^2 and 1821.32 cm^2 respectively. The least values of seedling height, internodal length and leaf area (29.76 cm, 0.98 cm and 32.54 cm^2 respectively) were recorded in the treatment which received the foliar application of the growth retardant Alar 2000 ppm (T_{10}) and with regard to number of leaves and total leaf area the least values of 14.72, and 679.47 cm respectively were registered in the control.

It was apparent that foliar application of mango rootstocks with GA_3 increased the seedling growth characters over the control and other treatments, which may be attributed to the growth promoting effect of GA_3 in stimulating and accelerating cell division, increasing cell elongation and enlargement or both as suggested by Hartmann *et al*. (1990). Significant increase in the internodal length noticed due to GA_3 treatment may be due to cell elongation of the individual cells as reported earlier by Nanda *et al*. (1967). Further, Phinney (1983) opined that exogenously applied gibberellin does not release axillary buds from the apical dominance, but can cause rapid elongation in released buds leading to increase in plant height.

Foliar application of GA_3 react almost exclusively in the stem elongation properties. that have direct effect on stem elongation by inducing cell wall lossening, by increasing the solute concentration by increasing cell wall extensibility, stimulating the wall synthesis, reducing the rigidity of cell wall by increasing cell division leading to more growth (Yallesh Kumar *et al.,* 2008). This is in agreement with the findings of Shaban (2010) and Muralidhara*et al.* (2014) in mango.

Foliar application of GA_3 have been reported to increase the plant height and the production of more number of leaves and leaf area caused the increased plasticity of the cell wall followed by the hydrolysis of starch to sugars which lowers the water potential of cell resulting in the entry of water into the cell causing cell elongation. This might have attributed to increase the photosynthetic activity, accelerated translocation and efficiency of utilizing photosynthetic products resulting in cell elongation and rapid cell division in growing portion. (Sargent, 1965). Similar views were also expressed by Kadam *et al.,* 2010 in Kagzi lime, Surakshita *et al.,* 2014 in Jamun.

Significantly lowest plant height and internodal length obtained with alar 2000 ppm compared to other treatments including control might be due to the retardation effect of alar and also due to their inhibitory action, as they bring about the reduction of cell division in the meristematic tissue and retard elongation of cells of internodes as observed by Dennis and Esther (1969). The results are in close conformity with the findings of Jasbir Singh Wazir (2011) in alstromeria.

With regard to the stem girth and root girth, it was observed in the present study that application of alar 2000 ppm (T_{10}) increased the stem girth (3.02 cm) and root girth (27.65 mm), followed by (T_9) alar 1000 ppm which recorded the values of 2.87 cm and 26.79 mm respectively. While the least values (2.16 cm and 21.42 mm respectively) for this trait was recorded in the control (T_1). Retardation of plant height and transverse cell expansion and division in the sub apical tissues were stimulated by alar and might have resulted in the increase in stem girth observed by Barras-Ali (2002). Similar results were obtained with foliar application of alar has been reported by El-Sheibany *et al*. (2007) in Chrysanthimum.

The results of the present investigation revealed that the differences in root length and number of secondary roots was significant due to application of growth regulators and it was observed that rootstocks sprayed with GA_3 300 ppm (T_4) exhibited the longest tap root (37.59 cm) and the maximum number of secondary roots (27.54) and the next best treatment was GA_3 at 200 ppm (T_3) which recorded the values of 35.26 cm and 25.93 respectively. The least length of tap root (24.72 cm) was registered in the treatment (T_{10}) alar 2000 ppm and the minimum number of secondary roots (18.73) was recorded in the control (T_1). This cloud be attributed to gibberellins, auxins and vitamins produced at the effect of these compounds on plant growth and development have been well documented (Torrey, 1976). The different degree of stimulation of roots parameters might be further related to different degree of production of these compounds by foliar application of GA_3 and also GA_3 having phenolic compounds stimulate the physical efficiency of storage organs to increase the root parameters. Modification in root geometry and morphology might be morphogenic effect mediated by gibberellins (Allen *et al.* 1980). The results are in confirmation with the finding of Patil *et al.*

(2013) in Rangpur Lime and Vachhani *et al*. (2014) in Khirnee.

In the present investigation, it was observed that the root girth was found to be significantly influenced by the foliar application of alar. The least root girth was observed in the control. Increased root girth might be due to foliar application of alar, which affected the cell in the quiescent meristematic nuclear zone, causing reduction in cell size in nuclear abnormalities. There was some selectivity within the root apex, because elongation of the root cap and epidermal cells was not as inhibited as the vascular and cortical cells. Inhibition of cell elongation at high concentrations of alar was very pronounced. Although alar has been classified as a growth retardant, its biochemical action is reported by Moore (1967) to be different from growth retardants. The results of several works like Julianna Harmath and Gabor Schmidt (2010) in bluebeard and Basford *et al*. (2010) in several ornamental plants like Dahlia, Fuchsi, Ageratum, Antirrhinum, Petunia, Salvia, Zinnia, Phlox, Nemesia and Lobelia genera.

References

Allen, M.F.; Moore, T.S. and Christensen, M. (1980). Phytohormone changes in *Boutelouagracillis* infected by vascular- arbuscular mycorrhizae. Cytokinin increase in the host plant. Canadian J. Botany 58: 371-374.

Barras-Ali, A. (2002). Effect oh Growth Retardant ALAR on growth and flowering of chrysanthemum. M.Sc. Thesis. Benghazi: Garyounis University.

Basford, B.; Burgess, C. and Brough, W. (2010). Horticultural Development Company Plant Growth Regulation Workshop – Chemical Growth Regulators. Wyeplants Ltd., Ivan Ambrose.

Dennis, B.; Connell, Mc and Struckmeyer, B.E. (2016). Effect of alar on the Developing Root-Hypocotyl Axis of *Zinnia elegans*. J.UCHICAGO.EDU 130 (2): 97-101

El-Sheibany, O.M.; El-Malki, N.A. and Barras-Ali, A. (2007). Effect of Application of Growth Retardant Alar on Some Foliage Characters of Local Cultivar of Chrysanthemum. J. Sci. and its Applications. 1(2): 15-20.

Gomez, A.K. and Gomez, A.A. (1984). statistical procedure for agriculture reseaech, 2^{nd}Edn. John and sons, New York

Hartmann, H.T.; Kester, D.E.; Davies, F.T. (1990). Plant propagation Principles and practices, 5^{th} ed. Prentice – Hall, Englewood Cliffs, NJ.

Julianna, H. and Gabor, S. (2010). Effect of some growth retardant on *Caryopteris x clandonensis* “Grand Bleu” Bulletin UASVM Hort., 67(1): 354-358

Kadam, A.B.; Singh, D.B. and Kade, R.A. (2010). Effect of plant growth regulators and potassium nitrate on growth of seedling of Kagzi Lime. The Asian J. Hort., 5 (2): 431-434.

Moore, T.C. (1967). Biochemistry and physiology of plant hormones. 2^{nd} ed. Springer. Verlag, Inc. New York, NY.

Mukherjee, S.K. and Mujumdar, P.K. (1963). Standardization of rootstock of mango and studies on propagation of clonal rootstocks by stooling and layering. Indian J.Hort., 20: 204 -209.

Muralidhara B.M.; Reddy, Y.T.N.; Shivaprasad, M.K.; Akshitha, H.J. and Kishor, K.M. (2014). Studies on foliar application of growth regulators and chemicals on seedling growth of mango varieties, The bioscan an int. quarterly J. Life Sci., 9(1): 203-205.

Nanda, K.K.; Dhindas, R.S. and Bindy, B. (1967). The effect of gibberellic acid and photoperiod on extension growth of soybean (*Glycine max*. L.). Indian. J. Pl. Physiol., 10(2): 20-22.

Patil, S.R. Waskar, D.P. and Sonkamble, A.M. (2013). Effect of gibberellic acid, urea and neem cake on growth of Rangpur lime (*Citrus limonia*, Osbeck) seedlings. The Asian . J. Hort., 8 (1): 285-287.

Phinney, B.O. (1983). The history of gibberellins. In. Crozer, A (ed.), The biochemistry and physiology of gibberellins. Vol.1. Maeger, New York. NY.pp. 15-52.

Phooken, D.; Shadeque, B.A. and Baruah, P.J. (1991). Effect of plant growth regulators on yield and quality of tomato. Veg. Sci., 1(1): 9

Reddy, B.M.C and Shukla, S.K. (2007). Handbook of seed and planting materials testing manuals. In seed and planting material testing manual for subtropical fruit crop.

Sargent, J.A. (1965). The penetration of growth regulators into leaves. Ann. Rev. pl. Physiol., 16: (1-12).

Shaban, A.E.A. (2010). Improving the seed germination growth of some mango rootstock, American- Eurasia J. Agric. & Environ. Sci., 7 (5): 535-541.

Surakshita, N.C.; Mahadevamma, M. and Kumar, S.M. (2014). Studies on application of plant growth regulators and macro nutrient on seedling growth in jamun (*syzygium cuminii* L.) Skeels. Indian J. Applied Res. 4 (12): 03-05.

Torry, J.A. (1976). Root hormones and plant growth. Annual Review of pl. Physiol., 27: 435-459.

Vachhani, K.B.; Gohil, J.H.; Pandey, R. and Ray, N.R. (2014). Influences of chemicals, PGR’s and Cow-dung Slurry seed treatment on germiability,Growth and development of Khirnee (*manilkarahexandra Roxb*) under net house condition. Trends in Bioscience 7 (14): 1641-1643.

Wazir, J.S. (2011). Response of plotted alstroemeria to different growth retardants under protected conditions. J. farm sci., 1(1): 27-36.

Yalleshkumar, H.S.; Swamy, G.S.K.; Kanmadi, V.C.; Kumar, P. and Sowmaya, B.N. (2008). Effect of organics and chemicals on germination, growth and graft-take in mango. The Asian. J. Hort., 3(2):336-339.