A Research Programme

On

Effect of IBA and IAA on rooting and growth of Pomegranate cuttings cv. Mridula and Ganesh in subtropical conditions

Dissertation-1 Report

Submitted

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BY

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CERTIFICATE I

I hereby declare that the Synopsis entitled **"Effect of IBA and IAA on rooting and growth of Pomegranate cuttings cv. Mridula and Ganesh in subtropical conditions"** is an authentic record of my work and will be carried out at Lovely Professional University as requirement for the degree of **Master of Science** in the discipline of **Horticulture**, under the guidance of Dr. Anis Ahmad Mirza, Assistant Professor, Department of Horticulture, School of Agriculture and no part of this synopsis has been submitted for any other degree and diploma.

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CERTIFICATE II

This is to certify that synopsis titled **"Effect of IBA and IAA on rooting and growth of Pomegranate cuttings cv. Mridula and Ganesh in subtropical conditions"** submitted in partial fulfilment of the requirement for the award of degree of **Master of Science** in the discipline of **Horticulture,** is a research work and will be carried out by **Elvira Vida Marbaniang (Registration No. 11717916)** under my supervision and that no part of this synopsis has been submitted for any other degree or diploma.

(**Signature of Supervisor**)
Dr. Anis Ahmad Mirza
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1. INTRODUCTION

Pomegranate (*Punica granatum* L.) belongs to the family Punicaceae is a favourite table fruit of tropical and subtropical regions. Pomegranate is native to Iran, where it was first cultivated, and then it spread to Mediterranean countries like Spain, Morocco, Egypt and Afghanistan at a very early date. It is now extensively cultivated in Baluchistan, Pakistan, Morocco, Iraq, China, India, Egypt, Iran, Spain, Afghanistan, Japan and Russia. Pomegranate is the national fruit of Azerbaijan and Iran.

In India, it is grown on a small scale in selected locations in many states. The country occupies a considerable area of 209 thousand hectare with the annual production of 2442 thousand MT with 11.68 MT/ha productivity (NHB, 2016-17). Pomegranate is mostly grown in Maharashtra (136.75 thousand ha.) and other leading states in India for pomegranate cultivation are Gujarat, Rajasthan, U.P., M.P., Haryana, Andhra Pradesh, Karnataka, and Tamil Nadu (NHB, 2016).

The genus Punica has two species viz., granatum and protopunica. *Punica protupunica* is found wild in Socotra Island and *Punica granatum* is cultivated in tropical and subtropical parts. *P.granatum* has been classified into two subspecies: *chlorocarpa* found in Transcaucasus region and *porphyrocarpa* in Central Asia.

Pomegranate varieties are of two types: Hard seeded and soft seeded varieties Hard seeded varieties: Kandhari, Alandi, Kabul, Musker Red. Soft seeded varieties: Ganesh, Dholka, Nabha, Mridula, Bassein Seedless, Jyothi, Paper Shell and Ruby.

Pomegranate is regarded as the "Fruit of Paradise". It is a good source of carbohydrate and minerals such as calcium, iron and sulphur. It is also rich in vitamin-C and citric acid which is the most predominant organic acid in pomegranate. The edible portion in this fruit is 68%. Pomegranate contains moisture 78%, protein 1.6%, carbohydrates 14.5%, calcium 10mg/100 g, phosphorus 70mg/100g, iron 0.3mg/100g, riboflavin 0.10mg/100g and Vitamin C 16 mg/100g fruit. The fruits of pomegranate are known to posses pharmaceutical and therapeutic properties. It is a symbol of health, fertility, eternal life and also being valued as medicinal plant to treat diabetes, cancer, hypertension, gastric inflammation, and heart and kidney diseases. The juice of pomegranate is useful for patients suffering from leprosy. Sweet varieties are mildly laxative, sour types are good for curing inflammation of stomach and heart ache. The flower buds are very useful in Ayurveda for managing bronchitis. The bark and pericarp of fruit is used for slimming, control of dysentery, diarrhoea and killing

tape worms. Extract of pomegranate fruit has antiviral activity. Rind of fruit contain high amount of tannins ranging from 47-68% depending on the cultivars, which are used for tanning leather. The bark of the stem and root contain a number of alkaloids belonging to pyridine group. Apart from these, pomegranates are mainly cultivated for their fruits, and there are some ornamentals with double flowers.

An attractive shrub or small tree, to 20 or 30 ft (6 or 10 m) high, the pomegranate is much-branched, more or less spiny, and extremely long-lived. The leaves are evergreen or deciduous, opposite or in whorls of 5 or 6, short-stemmed, oblong-lanceolate, 3/8 to 4 in (1-10 cm) long, leathery. Showy flowers are home on the branch tips singly or as many as 5 in a cluster. They are 1 1/4 in (3 cm) wide and characterized by the thick, tubular, red calyx having 5 to 8 fleshy, pointed sepals forming a vase from which emerge the 3 to 7 crinkled, red, white or variegated petals enclosing the numerous stamens. Nearly round, but crowned at the base by the prominent calyx, the fruit, 2 1/2 to 5 in (6.25-12.5 cm) wide, has a tough, leathery skin or rind, basically yellow more or less overlaid with light or deep pink or rich red. The interior is separated by membranous walls and white spongy tissue (rag) into compartments packed with transparent sacs filled with tart, flavourful, fleshy, juicy, red, pink or whitish pulp (technically the aril). In each sac, there is one white or red, angular, soft or hard seed. The seeds represent about 52% of the weight of the whole fruit.

Pomegranate is a sub-tropical fruit. It can adapt itself to a wide range of climatic conditions and can grow up to 1800 m above mean sea level. The optimum temperature for fruit development is 38°C. It is considered that pomegranate is a hardy fruit and can thrive well under drought conditions, though yield is low. The plant bears well only under irrigation.

Pomegranate planting is possible in various types of soils. The plant is not very particular about its soil requirement. It can thrive well on comparatively poor soils where other fruits fail to grow. It is rated as salt-hardy fruit plant.

Pomegranate is commercially propagated by cuttings. Multiplication of plants through stem cutting is the most convenient method and by this method a stronger plant can be developed considerably in less time. Propagation through seeds is time consuming method as well as it produces genetically variable more vigorous plants, which bear late. It can also be propagated by air layering and root suckers but not commonly practiced. While propagation of plants through cuttings (vegetative) is easier, less time consuming, true to type and bear early with less vigour.

The rooting capability of cuttings varies from cultivar to cultivar, location to location, season to season and age of the branch. The success per cent of pomegranate cuttings depends on many factors such as conditions of the mother plant, part of the tree from where the cuttings are made, time of operation, rainfall, temperature fluctuation, aftercare etc. Besides, different environmental conditions growth regulators also play an important role in rooting and growth of pomegranate cutting. Therefore in order to improve rooting ability and success per cent, one technique has been improved in which synthetic root promoting growth regulator and biofertilizers are used. Indole-3-butyric acid (IBA) is the best growth regulator for promoting rooting of a large number of species. Besides, application of NAA also has great potential in improving rooting of cutting in most of the species.

Earlier studies on propagation of pomegranate cultivars by cuttings have given only moderate success in rooting. So, it made an avenue for the use of growth regulators like auxins. Auxin is generally accepted for having a role in the initiation and development of adventitious roots (Jarvis, 1986). This is the only group of chemicals (synthetic or natural) which consistently improve root formation in cuttings. Auxin is thought to influence the downward movement of carbohydrates. Indole Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) are usually more effective than Indole Acetic Acid (IAA). IBA is also much more stable than IAA. The effectiveness of auxin depends on many factors such as the species, age of the plant, temperature, humidity, type of cuttings, and method of application (Geneve and Heuser, 1982).

In Punjab, Pomegranate was not grown commercially. However, Gurvinder Singh, a farmer of village Kallerkhera started his cultivation of pomegranate in his 45 acre farm. The suggestion to start pomegranate farming was made to Gurvinder by Dr. Arora, who used to produce sweet orange in the local university earlier. Today, Gurvinder's pomegranates are known for their quality and can compete with the available fruits in the market.

The major insect-pests of pomegranate are Pomegranate Butterfly (*Virachola isocrates)*, Bark-eating Caterpillar *(Inderbela telraonis)*, Whitefly (*Siphoninus phillyreae*), Aphids, Mealy bugs, Scale insects and Fruit fly. The diseases of pomegranate are Cercospora Fruit Spot (Cercospora sp.), Fruit Rot (*Aspergillus foetidus)*, Leaf Spot or Blight (*Colletotrichum gloesporioidesl; Pseudocercospora punicae; Curvularia lunata and Cercospora punicae)* and Alternaria Fruit Spot (*Alternaria alternata*). The most important physiological disorder is fruit cracking. These problems occur in plant seasonally and by some deficiency. Also the nutritional constituents are very important component for healthy

pomegranate cultivation. Therefore, keeping the above problems in mind, proper organic practices, fertilization and manuring, mulching and plant growth regulators can be applied or used for better growth, good quality and higher yield.

Thererfore keeping in view the above, the present research work entitled **"Effect of IBA and IAA on rooting and growth of Pomegranate cuttings cv. Mridula and Ganesh in subtropical conditions"** will be carried out with the following objectives:

1. To study the role of growth regulators in rooting of hard wood cuttings in pomegranate
2. To study the effect of growth regulators on growth parameters of pomegranate cuttings
3. To evaluate the effect of growth regulators in different cultivars of Pomegranate cuttings

2. REVIEW OF LITERATURE

The literature for the present study entitled **"Effect of IBA and IAA on rooting and growth of Pomegranate cuttings cv. Mridula and Ganesh in subtropical conditions"** has been reviewed and discussed below

Gadekar (1967) carried out investigations on the rooting of pomegranate cuttings under Poona conditions. IAA at 0, 50, 100, 200 and 300 ppm was tried. Among the plant growth regulator treatments, 200 ppm IAA gave the best results. The treatment 200 ppm IAA produced maximum number of primary roots (49.584), maximum length of primary roots (9.283 cm), maximum number of secondary roots (524.640), maximum length of secondary roots (2.488 cm), maximum fresh weight of roots (5.7212 gm) and maximum length of shoots (86.856 cm) as compared to 300 ppm IAA, 100 ppm IAA, 50 ppm IAA and control.

Hurov (1967) dipped cuttings of pomegranate, cocoa and custard apple in 0.2% IBA and placed them in rooting media in 0.02 mm gauge 4.0x7.2 cm polyethylene bags. The best results were obtained with cuttings taken from epi-caronic shoots during dry weather.

Phadnis (1968) observed that the use of 200 ppm IAA (2 hours dip) prior to planting of pomegranate cuttings helped in producing max roots with more length.

Chauhan and Singh (1971) reported that when pomegranate stem cuttings were planted in media containing moisture levels of 5.80, 11.85, 15.95 or 20.141 % corresponding successful rooting figures were 39.33, 6721, 56.79 and 90 %. Pre treatments with 50 or 100 ppm IBA improved the rooting percentage only at 15.95% moisture levels although it increased the number of primary roots at higher moisture levels. The best overall treatment was 50 ppm at 15.95% moisture.

Kulkarni (1974) from Parbhani conditions found that the growth regulator treatment had beneficial effects on the rooting of cutting of pomegranate. IBA and IAA were found significantly superior over NAA in respect of number of roots, fresh weight, dry weight of roots, number of leaves and number of sprouts. Among the treatments tried, 50 ppm, 100 ppm and 150 ppm of IBA, 500 ppm and 1000 ppm of IAA were found better in increasing the number of roots, length of roots, fresh weight and dry weight of roots, number of leaves, number of sprouts and length of sprouts.

Purohit and Shekharappa (1985) studied the effect of IBA on rooting of hardwood cuttings of pomegranate. Cuttings were treated with 2500, 5000, 7500 and 10000 ppm IBA by quick dip method. Cuttings treated with 5000 ppm IBA gave the highest percent survival, number of length of roots and number of shoots.

Vivarekar (1986) reported that pomegranate cuttings pre treated with $2NH_2SO_4$ followed by quick dip in 2500 ppm IBA and planted in soil media induced most desirable response in terms of percentage survival, number and length of roots and shoots.

Rajanna (1987) carried out investigation to improve the rooting of the difficult to root Bassein Seedless pomegranate cuttings and the cause for poor rooting during rainy season. The cutting soaked in 50 ppm IBA for 18 hours resulted in the highest rooting percentage and more number of roots per cutting as compared to other treatments (IAA at 100, 200 and 300 ppm and IBA at 100 and 150 ppm concentration).

Sharma and Sharma (1987) reported that the rooting of hardwood cuttings of pomegranate varied from 63 to 80% when treated with 4000 ppm IBA. It was 56 to 79% among untreated cuttings. The percent rooting in semi hardwood cutting ranged from 57 to 75% when treated with 4000 ppm IBA and from 43 to 77% in untreated.

Ghosh *et al*., (1988) reported that IBA was more effective than NAA for inducing rooting in hardwood, semi-hardwood and softwood cuttings of pomegranate. IBA at 5000 ppm resulted in maximum rooting success 83.33% but at 10000 ppm more roots and increased root length were recorded. Maximum rooting success was obtained in hardwood cuttings than semi-hardwood and softwood cuttings with the help of IBA.

Panda and Das (1990) treated the pomegranate cuttings with 2500 to 10000 ppm IBA or IAA. The cuttings were planted in sand and kept under intermittent mist conditions. Highest rooting of cuttings (76.10%) and number (40.12) and length (5.15 cm) of roots were obtained with cuttings dipped in 5000 ppm IBA. All the rooted cuttings survived with this treatment. Better results were obtained with IBA than IAA.

Reddy and Reddy (1990) treated the hardwood cuttings of pomegranate cv. Bassein Seedless with IBA and NAA each at 2500 ppm. The cuttings were either covered with polyethylene film or left open and all cuttings were kept in the shade. The highest rooting

percentage, number of roots/cutting and mean root length were obtained with polyethylene covering for all treatments.

Sandhu *et al.*, (1991) studied on rhizogenesis in hardwood cuttings of pomegranate. Hardwood cuttings of 20 cm length were taken from 5 year old pomegranate cv. Kandhari and Malas. The cuttings were dipped in 50, 100, 150 and 200 ppm IBA for 24 hours and then planted in nursery beds. Highest rooting and number of roots were obtained with 100 ppm IBA in both cultivars. The 100 ppm IBA treatment resulted in the highest root length in Kandhari (24.3 cm) and the greatest plant height (167.8 cm) in Malas. The 50 ppm IBA treatment resulted in the highest plant girth (3.96 cm) and the plant height (157.0 cm) in Kandhari and root length (22.5 cm) in Malas.

Dhillon and Sharma (1992) revealed that hard wood cuttings of pomegranate cv. Ganesh dipped in IBA 100 ppm gives best percentage of rooting in cuttings, number and length of roots per cutting, plant height, stem girth and plant weight. The higher concentration of IBA had a detrimental effect on the rooting of cuttings and on growth parameters.

Jain and Parmar (1993) reported that hard wood cuttings of pomegranate treated with IBA 1000 + B at 50 ppm and planted in river silt alone or mixed with FYM. The number of roots per cutting, root length and diameter were greater in river silt + FYM than in river silt alone. The cuttings treated with 1000 ppm IBA+ 50 ppm B produced the most root sprouts and were most likely to survive.

Singh (1994) found the best rooting (51.91%) of pomegranate cuttings with IBA at 1000 ppm. Seradix-B was the second best treatment (46.15%) for rooting. The longest roots were observed in the Seradix-B.

Shinde (1996) observed wounded hardwood cuttings of pomegranate treated with 3000 to 4500 ppm IBA gave better rooting, root and sprout growth, survival percentage (88 33%) and 86.77 per cent saleable plants.

Gurjar and Patel (2001) studied the effect of different treatment of rooting media, type of stem cutting and growth regulator on rooting and growth of pomegranate cv. Ganesh. All the root and shoot characters viz. percentage of cutting success number of sprouts per cutting, length of sprout, number of roots and leaves per cutting legnth and diameter of root and

survival percentage of rooted cutting were significanlty increased with hard wood cutting planted in soil + sand + leaf mold medium Significantly maximum values of these root and shoot characters were recorded with hard wood cutting treated with IBA 4000 PPM. in addition to this soft wood cutting gave the better response when treated IBA at 2000 PPM.

3. MATERIALS AND METHODS

The study will be conducted at V.P.O. Maheru, Tehsil Phagwara, District Kapurthala, Punjab under the Department of Horticulture, Lovely Professional University, Phagwara, Jalandhar, Punjab during the year 2018-19.

3.1 MATERIALS REQUIRED:

Crop: Pomegrante

Plant cultivar: Ganesh and Mridula

Planting material: Hardwood Stem Cuttings

Rooting media: Vermicompost: Cocopeat: Perlite

PGR's to be used: IBA, IAA

Conc. : (Under Consideration as per quick dip and basal dip method)

3.2 EXPERIMENTAL DETAILS

Variety: Ganesh and Mridula

Date of Planting: July-Aug.

Number of Treatments: 7

Number of Replications: 5

Total Number of Cuttings: 35

Design: RBD

TREATMENTS:

Treatment 1: IBA

Treatment 2: IBA

Treatment 3: IBA

Treatment 4: IAA

Treatment 5: IAA

Treatment 6: IAA

Treatment 7: Control

3.3 OBSERVATIONS TO BE RECORDED

A. Shoot characters

1. Days taken to start sprouting.

2. Percentage of success of shooting in cutting.

3. Number of shoots per cutting.

4. Number of leaves per shoot.

5. Total number of leaves per cutting.

6. Survival percent.

B. Root characters

1. Number of roots per cutting.

2. Length of roots (cm).

3. Diameter of roots (mm).

4. Fresh weight of roots (g).

4. EXPECTED OUTCOMES

The experiment will be conducted at V.P.O. Maheru, Tehsil Phagwara, District Kapurthala, Punjab under the Department of Horticulture, Lovely Professional University, Phagwara, Jalandhar, Punjab during the year 2018-19. The present research work will be carried out with the objective to study the effect of different growth regulators with various concentrations on the rooting and growth of pomegranate cuttings in different cultivars viz., Ganesh and Mridula. These are considered as soft seeded varieties. Pomegranate can be grown in three seasons of the year as per the prevailing climatic conditions and can be propagated by air layering too. We are working on the modalities to apply growth regulators and study propagation with air layering too. But this propagation is said to be successful in rainy season generally. However propagation through cuttings is commercially used. But in Punjab conditions propagation of pomegranate through cuttings are considered to be somewhat difficult to root. So we are experimenting and standardizing the role of growth regulators in pomegranate cuttings so that appropriate results can be obtained and success % in propagation through cuttings can be obtained and success percentage can be increased to have rooting in cuttings of pomegranate cultivars and also to find out the best cultivar among the two for Punjab conditions. Material quality and location of collection also plays an important role in rooting of cuttings.

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