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Influence of different type of rooting media on rooting, growth and development of air layering in pomegranate

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Abstract
Asexual propagation of pomegranate is highly confined to hardwood cutting but there is a grate scope of air layering method to exploit its potential. To understand this, an investigation was carried out at the student instructional field, department of Horticulture, School of Agricultural sciences, G. H. Raisoni University Saikheda, Saunsar, Distt- Chhindwara (M.P.) during *rainy* season of year 2021-22. The treatment consists of application of IBA @0 ppm, 300 ppm, 400 ppm, 500 ppm along with composition of soil, vermicompost, *Azospirillum* in combination. The study revealed that for establishment of rooting and success of pomegranate air layers under sub- tropical condition of Chhindwara, highly influenced by different growing media and IBA concentration. Minimum days for rooting (32.25), maximum rooting percentage (93.29%), number of secondary roots (63.80), number of primary roots (35.53), survival percentage of layers (84.09%) in air layer of Pomegranate was observed with IBA @500 ppm and media composition of soil + vermicompost + *Azospirillum* compared to control. The increase root density in air layer facilitating better phenotypic growth which suggest that the seedling prepared from this combination will show low mortality in the field condition along with it, it got cleared from our experiment that, lower concentration of IBA is also useful to produce greater roots, which may reduce the cost of cultivation of farmers in field.

Keywords: Rooting media, IBA, pomegranate, survival percentage, nursery evaluation

Introduction
Propagation of pomegranate by seed is easy but it takes more time for flowering and fruiting and it brings genetic variability and leads to low yield and poor quality fruits. Propagation through seeds is not preferred as the plants exhibit heterozygosity and non-uniformity. Clonal selection followed by vegetative propagation has resulted in improvement of quality and yield in pomegranate. The main methods employed in vegetative propagation are layering and cuttings. Nursery business is the emerging commercial sector in the field of agriculture. The area under pomegranate crop is increasing day by day; therefore, the supply of genuine planting material free from diseases as per demand is the prime task in front of nurseryman.

Propagation through hard wood cuttings is also the best and less expensive method (Upadhyay and Badyal, 2007) [18] but commercially air-layering is one of the most successful method in pomegranate propagation and has the advantage of being able to reproduce plants with better rooting than cuttings. Air layering can be advantageously useful in pomegranate propagation to minimize the time for fruiting earlier than cutting planting to increase the success percentage (Tomar, 2011) [17]. Hence farmer prefer quality planting material which is developed by layering or hard wood cutting.

The layering is done during rainy season i.e., May/ June and in the month of December-January; resulting in better success with profuse rooting of pomegranate (Bhosale *et al*., 2014) [6]. The potting media as soil is generally used in pomegranate nursery. This material used for potting and rooting purpose are generally not productive and not hygienic which cause spreading of diseases from nursery stage. The mortality of pomegranate layers is observed due to infections. This can be minimized by using some biofertilizers, biocontrol agent and suitable nutrient sources like vermicompost in potting mixture (Hota *et al*., 2021; Singh *et al*., 2018) [10, 16].

The application of rooting hormones can increase rooting percentage in order of 49-73% in pomegranate cuttings (Ahmad, 2017) [1].

Different chemicals play major role in rooting and survival also (Dubey *et al*., 2022; Dubey *et al*., 2020, Hota *et al*., 2017) [8, 7, 11]. As auxin synergists play significant roles and synergistic action promoted the root number when apply with IBA (Ansari, 2013) [2]. Use of root promoting chemicals or auxins such as IBA, IAA, and NAA are generally used to stimulate rooting in number of plants using there alone or in combination with auxin synergists (non-auxin compounds). Among these auxins IBA is found often beneficial (Ram *et al*., 2005) [14].

Indole Butyric Acid (IBA) is the synthetic plant hormone. It is active in inhibiting axillary bud break on developing new shoots, and it stimulates the root initiation. It promotes cell elongation which helped to increase in root length. It is a leading plant hormone used to generate new roots in the cloning of plants through cuttings. Although stem cutting is difficult to root, the use of plant growth regulators (PGRs) helps to induce roots in cuttings (Batista *et al*., 2011 and Bhosale *et al*., 2009) [3, 5]. Hence, knowing these facts, we conducted a trail to check the survivability of air layer pomegranate by hormonal and rooting media effect.

Material and Method

Site selection

The experimental site is located on the South-West region of 'Satpura Range of Mountains'. The experimental location extends from 21° 39' 20" north latitude and 78° 47' 48" east longitude at an elevation of 330 m above mean sea level. The present experiment was conducted during 2021- 22 at the Student Instructional field, department of Horticulture, School of Agricultural sciences, G. H. Raisoni University Saikheda, Saunsar, Distt- Chhindwara (M.P.).

The experimental farm lies in humid subtropical-monsoonic zone with an average rainfall from 1,183 mm which mostly occurs during July to September. The onset of monsoon is mostly expected by the end of June to beginning of July and cessation by September, most of the rainfall received during July and August months. The experimental site falls under sub-tropical condition, experiencing a maximum temperature of 47.17 °C, minimum temperature of 23.83°C, average relative humidity of 80% rainfall of 8mm.

Experimental Set up

There are three number of replications of twelve treatments. IBA was used in three different concentrations *viz*. 0 ppm, 300 ppm, 400 ppm and 500 ppm and three different rooting media were used *viz*. soil, vermicompost, azospirillum in combination. 100 ml of 300 ppm IBA solution was prepared by dissolving 0.03 g IBA in approximately 25 ml absolute alcohol (95%) then it was diluted with double distilled water to make 100 ml solution. Similarly, 400 and 500 ppm IBA solution was prepared by dissolving 0.04 g IBA and 0.05 g IBA, respectively.

Observations Recorded:

The air layers were detached after 60 days of operation. The planted layers were observed daily under each treatment and the number of days taken for rooting of air layers in each treatment were calculated. Successfully and rooting percent was calculated by following formula

$$\text{Rooting \%} = \frac{\text{No. of rooted air layered plant}}{\text{Total no. of air layers of treatment}} \text{ X } 100$$

Total number of primary and secondary roots of randomly selected five air layers, under each treatment was recorded at 60 days and mean number of roots per air layer was worked out. The survival percentage of air-layers was calculated by

$$\text{Survival percentage of air layers} = \frac{\text{Total number of established plants}}{\text{Total number of planted layered plants}} \text{ x } 100$$

The Leaf Length was observed with the help of digital Vernier caliper (yamayas classic) @60days. Plant height, number of branches, number of leaves was observed @ 30, 60, 90, 120 days

Statistical method:

Experiment held under randomized block design in twelve treatments and three replications. The data generated in the experiment was tabulated in Microsoft Excel and analyzed through OPSTAT.

Result and Discussion

Application of IBA @ 500 ppm along with rooting media composition of soil + vermicompost + *Azospirillum* recorded minimum days taken to root initiation (32.25days), maximum rooting percentage of air- layering (93.29%), maximum number of primary roots per air-layer (35.53), maximum number of secondary roots per air-layer (63.80), highest length of primary roots per air-layer (16.28 cm) and highest length of secondary roots per air-layer (14.32 cm), which make it the statistically most effective treatment. On contrast to it minimum root growth parameters were observed with untreated control.

Growth refers to a positive change in size and/or maturation, often over a period of time. Survival percentage of air-layering was significantly increased with the application of IBA concentrations and rooting media. Maximum survival percentage of air- layering (84.09), highest seedling height per air-layer (76.46 cm), maximum number of branches per air-layer at 60 days (10.20) and maximum number of leaves per air-layer (66.27) were significantly increased with the application of IBA concentrations along with rooting media composition of soil + vermicompost + *Azospirillum*.

Success of vegetative propagation mostly depends upon the ability of plants to form roots on layering and cutting, when placed in a favorable environment for rooting. Root primordial are sometimes present on the stem of most plants, but may not be induced to form roots on layering and cutting. However, the formation of root primordia and root development can be accelerated in many species of plants by the application of plant growth regulators and rooting media. However, amount of rooting depends upon type of plant organ used. Generally, stems are an ideal planting material, because they usually have sufficient undifferentiated tissues to permit easy differentiation of root and have buds already formed. These results indicate the response of rooting media of soil + vermicompost + *Azospirillum* increase in these characters might be due to attributing to proper aeration, good nutrient availability and high-water holding capacity. These results are also supported with those reported by Bhasal *et al.* (2009) [4], Gurjar *et al.* (2007) [9] and Kaur and Kaur (2016) [13]. The possible reason for the maximum survival percentage of recorded with 500 ppm IBA may be due the rooting co-factors and their balance with nutritive substances and

auxin. The success of IBA may further be attributed to the fact that it produced a strong fibrous root system. These results are in conformity with Sahoo *et al*. (2019) [15] and Karna *et al*. (2017) [12].

Table 1: Influence of different type of rooting media on rooting success of air layered pomegranate

Tr. No.	Treatment Combination	Days taken to root appearance	Rooting percentage (%)	Number of primary roots	Number of secondary roots	Length of primary roots (cm)	Length of secondary roots (cm)
T_1	IBA @ 0 ppm + rooting media of soil	32.25	53.52	7.73	14.87	8.25	4.93
T_2	IBA @ 0 ppm + rooting media of soil + vermicompost	30.97	54.43	9.80	19.53	9.71	5.72
T_3	IBA @ 0 ppm + rooting media of soil + vermicompost + *Azospirillum*	29.35	56.05	11.07	22.27	10.03	6.59
T_4	IBA @ 300 ppm + rooting media of soil	28.74	75.44	19.20	24.40	10.84	7.35
T_5	IBA @ 300 ppm + rooting media of soil + vermicompost	25.60	80.53	21.27	25.80	11.73	8.56
T_6	IBA @ 300 ppm + rooting media of soil + vermicompost + *Azospirillum*	25.05	82.03	22.80	29.33	12.05	10.03
T_7	IBA @ 400 ppm + rooting media of soil	24.84	85.48	23.00	34.20	12.84	10.81
T_8	IBA @ 400 ppm + rooting media of soil + vermicompost	24.15	88.92	23.20	37.73	13.15	11.21
T_9	IBA @ 400 ppm + rooting media of soil + vermicompost + *Azospirillum*	24.10	89.01	24.40	40.60	14.06	12.25
T_{10}	IBA @ 500 ppm + rooting media of soil	23.52	90.18	28.93	48.67	15.19	12.64
T_{11}	IBA @ 500 ppm + rooting media of soil + vermicompost	23.36	90.90	31.67	54.87	16.02	13.28
T_{12}	IBA @ 500 ppm + rooting media of soil + vermicompost + *Azospirillum*	22.95	93.29	32.53	63.80	16.28	14.32
S.Em±		0.56	0.81	0.97	8.76	0.52	0.68
C.D.		1.64	2.35	2.83	26.30	1.50	2.08

Table 2: Influence of different type of rooting media on survival and growth attributes of air layered pomegranate

Tr. No.	Treatment Combination	Diameter of root (mm)	Survival percentage (%)	Plant height (cm)	Number of branches	Number of leaves	Leaf length (cm)	Leaf width (cm)
T_1	IBA @ 0 ppm + rooting media of soil	0.37	52.45	31.57	1.73	38.40	2.29	1.10
T_2	IBA @ 0 ppm + rooting media of soil + vermicompost	0.43	53.01	33.01	2.20	46.27	2.32	1.19
T_3	IBA @ 0 ppm + rooting media of soil + vermicompost + *Azospirillum*	0.49	53.59	33.49	2.60	49.13	3.05	1.20
T_4	IBA @ 300 ppm + rooting media of soil	0.53	73.18	54.36	3.27	56.07	3.09	1.49
T_5	IBA @ 300 ppm + rooting media of soil + vermicompost	0.56	75.06	65.61	5.00	58.20	3.77	1.54
T_6	IBA @ 300 ppm + rooting media of soil + vermicompost + *Azospirillum*	0.59	75.93	66.28	5.80	60.40	4.04	1.62
T_7	IBA @ 400 ppm + rooting media of soil	0.65	76.85	66.62	6.00	62.27	4.57	1.64
T_8	IBA @ 400 ppm + rooting media of soil + vermicompost	0.82	77.81	68.00	6.20	62.53	4.71	1.65
T_9	IBA @ 400 ppm + rooting media of soil + vermicompost + *Azospirillum*	0.84	78.38	68.26	7.40	63.47	5.06	1.75
T_{10}	IBA @ 500 ppm + rooting media of soil	0.92	79.60	70.00	8.33	63.93	5.20	1.76
T_{11}	IBA @ 500 ppm + rooting media of soil + vermicompost	1.05	81.06	73.58	9.67	65.20	5.40	1.86
T_{12}	IBA @ 500 ppm + rooting media of soil + vermicompost + *Azospirillum*	1.08	84.09	76.46	10.20	66.27	5.45	1.90
S.Em±		0.08	1.52	2.85	1.33	1.25	0.32	0.07
C.D.		0.22	4.59	8.56	4.00	3.77	0.94	0.20

Conclusions

The use of IBA in fruit crop is not a new concept, but it always being used in higher concentration. In this experiment we tried the lower concentration of IBA along with suitable rooting media (soil, vermicompost, *Azospirillum*) to check the multiplication and survival percentage of guava air layers. From this experiment we can conclude that 500 ppm of IBA along with a rooting media composition of soil, vermicompost and *Azospirillum* showed a The maximum number of shoot and shoot length suggesting that higher concentration of IBA with rooting media of soil + vermicompost + *Azospirillum.* This might be due to early initiation of roots, more number of primary and secondary roots, length of primary and secondary root etc., which increased the absorption of nutrient from the rooting media and there by increased the number of shoots and shoot length ultimately maximum success percentages. So instead of using higher concentration of IBA in air layer are may modify the rooting media and concentration to fetch a good economic return.

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