

# Effect of Growth Regulator (IBA) and Natural Substances on Root and Shoot Growth and Survival Percentage of Pomegranate Cuttings (*Punica granatum. L*)

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(Received 2 June, 2022; Accepted 28 July, 2022)

## ABSTRACT

The present investigation entitled "Effect of Growth Regulator (IBA) and Natural Substances the Root and Shoot Growth and Survival Percentage of Pomegranate Cuttings (*Punica granatum. L*)" was carried out during the year 2021-2022 at the Department of Horticulture, Sam Higginbottom University of Agricultural Technology & Sciences, Prayagraj. The experiment was laid out in Completely Randomized Design (CRD) with nine treatments and three replications. The treatment comprises; T1- Control (water), T2- IBA @1000 ppm, T3- IBA @750 ppm, T4- Vermiwash @100%, T5- Vermiwash @75%, T6- Seaweed extract @100%, T7- Seaweed extract @75%, T8- CPP (Cow Pat Pit) @100%, T9- CPP (Cow Pat Pit) @75%. On the basis of analysis of results, it is found that T4- vermiwash@100% proved best as a potential input for different parameters recorded such as days of first shoot initiation (11), average shoot length (35.78 cm), number of roots per cuttings (38.22), number of leaves per plant (83.89), average root length per cuttings (25.55cm), average leaf area (7.01cm<sup>2</sup>), fresh weight of roots (7.36g), dry weight of roots (3.78g), average shoot girth (3.31cm), average shoot fresh weight (18.89g), average shoot dry weight (9.89g) and survival percentage of pomegranate cuttings in the field after transplanting (93.75%).

**Key words:** *Punica granatum*, Vermiwash, IBA, Sea Weed extract, Cow pat pit

## Introduction

Pomegranate (*Punica granatum. L.*) is an ancient fruit crop, belonging to the family Punicaceae and genus Punica. The scientific name *Punica granatum* is derived from the name Pomum (apple) granatus (grainy) or seeded apple. Pomegranate is cultivated commercially only in Maharashtra. Small scale plantations are also seen in Gujarat, Rajasthan, Karnataka, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Punjab and Haryana. Maharashtra contribute about 73% of the total area followed by

Karnataka and Andhra Pradesh. The most popular varieties suitable for processing and table use are Ganesh, Mridula, Arakta, Bhagwa (Kesar), G-137 and Kandahar. Out of these 'Bhagawa', 'Ganesh', 'Mridula', 'Ruby', 'Phule Arakta', 'Kandhari' and 'Jalore Seedless' are popular among the farmers. Though, at present 'Bhagawa' is the leading variety.

Pomegranate is propagated by both sexual and asexual means. But pomegranate is commonly propagated by air layering, hard wood cuttings, semi hardwood cuttings, because propagation through stem cuttings is the simplest, convenient

and most effective (Sharma *et al.*, 2009). Auxin is generally accepted as playing a role in initiation and development of adventitious roots. This is the only group of chemicals (synthetic or natural) which consistently improves root formation in cuttings (Damar *et al.*, 2014). Extracts of green, brown and red seaweeds are widely used in horticulture especially the brown one for their plant growth-promoting effects. Seaweed extract, being organic and biodegradable in nature is important in sustainable agriculture. The use of seaweed products in organic farming has widely increased (Rader *et al.*, 1985). Its extract contains growth promoting hormones like auxins, gibberellins, cytokinins, ethylene and polyamines other than the trace elements, vitamins, amino acids, antibiotics and micronutrients. Seaweed acts like phytohormones especially auxin which has an essential role in regulating root development and adventitious rooting process. Vermiwash is a liquid leachate obtained by excess water to saturate the vermicomposting substrate. It is collection of excretory products and mucus recreations of earthworms along with nutrients from the soil organic molecules. It contains hormones (cytokinins and gibberellins), several enzymes, vitamins along with macro and micronutrients secreted by the earthworms (Zambare *et al.* 2008). CPP (Cow Pat Pit) is a biodynamic preparation prepared with locally available materials along with cow dung. It contains high level of Humus along with natural plant hormones like Auxin, Gibberalic acid, Cytokinin etc. CPP also contains various soil microorganisms which help in symbiosis of nutrient exchange between plant roots and soil microbes.

## Materials and Methods

The field experiment was carried out to study the effect of growth regulator (IBA) and Natural Substances on Root and Shoot and Survival Percentage of Pomegranate (*Punica granatum* L.) cuttings during the year 2021-2022 at the Department of Horticulture, Naini Agricultural Institute, Sam Higgin bottom, University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh) located on 25.87' N and 81.15' E longitudes and has altitude of about 78 meters above the mean sea level. The experiment was conducted in Completely Randomized Design (CRD) with three replications and nine treatments. Polybags used were of 15-inch size and growing media used was. FYM, soil, sand and cocopeat. Cut-

tings were taken from properly matured one year old shoots with 20 cm in length and 0.8 to 0.9 cm thickness. The required concentrations of growth regulator IBA (1000, 750 ppm) was prepared by dissolving 1g, and 75mg of IBA in few ml of 50% ethanol and the volume was made up to one litre by adding distilled water in 1000 ml volumetric flasks. The natural substances like vermiwash, seaweed extract and CPP (cow pat pit) were taken at different percents *viz* 100% and 75%. And 100% is made by taking 1000 ml of pure form of the substances. And 75% is made by taking 750 ml of the pure substance with 250 ml of water. And the treatments were T1- Control (water), T2- IBA @1000 ppm, T3- IBA @750ppm, T4- Vermiwash @100%, T5- Vermiwash @75%, T6- Seaweed extract @100%, T7- Seaweed extract @75%, T8- CPP (Cow Pat Pit) @100%, T9- CPP (Cow Pat Pit) @75%. The planted cuttings were also drenched with treatments at 15 days interval and also fungicide mancozeb (3 ml/l) was sprayed.

## Results and Discussion

### Shoot Parameters

#### Days to first shoot initiation

The data pertaining on days to first shoot initiation of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments. The minimum days taken to shoot initiation (11.00) was seen in treatment T4 (vermiwash @100%) followed by T6 seaweed extract @100% (11.07) and T5 vermiwash @75% (12.00). While the maximum days taken to shoot initiation (16.78) was recorded in treatment T9 CPP @75%.

Days taken to shoot initiation was minimum for cuttings treated by vermiwash, as it contains auxin, auxins are involved in the chelation of iron for the plant, improving growth health and nutrient intensity of the plant, especially the development of root system of the plant. The similar results were obtained by Damar *et al.* (2014) and Rajarama (1997).

#### Shoot Length (cm)

The data pertaining on shoot length of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum shoot length (35.77cm) was seen in

treatment T4 vermiwash @ 100% followed by T6 seaweed extract @100% (30.00 cm) and T2 IBA @1000 ppm (29.44 cm). While the minimum shoot length (10.00 cm) was obtained with T9 CPP@75%. Vermiwash contains high amount of enzymes, vitamins and hormones (like auxins, gibberellins *etc.*) along with macro and micronutrients. It can be used as foliar spray. Nutrients have direct role in plant growth and both macro and micronutrients present in vermiwash may resulted in increase in shoot length. The similar results were obtained by Kamalakar (2013); Gite (2015); Venkataramana *et al.* (2010); Uppar (2011).

#### Number of leaves per plant

The data pertaining on number of leaves per plant of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum number of leaves per rooted cuttings were recorded with T4 vermiwash @100% (83.88) followed by T6 seaweed extract @100% (79.21) and T5 vermiwash @75% (69.10). While the minimum number of leaves per plant (16.55) was obtained with T9 CPP @75%. The similar trend of increase in leaves were obtained by Kamalar (2013); Gite (2014); Venkataramana *et al.*, (2010); Karthikairaj and Isaiarasu (2013); Gurung *et al.*, (2014).

#### Average Leaf Area (cm<sup>2</sup>)

The data pertaining on average leaf area of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum average leaf area was recorded with T4 vermiwash @ 100% (6.64) followed by T8 CPP @ 100% (6.36) and T7 seaweed extract @ 75% (6.30). However, the minimum leaf area was recorded with T9 CPP@75% (3.89). Similar trend of increase in leaf area was recorded by Kamalakar (2013); Gite (2015); Uppar (2011); Kumar and Kumar (2014).

#### Average Shoot Girth (cm)

The data pertaining on average shoot girth of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum average shoot girth was recorded with T4 vermiwash @ 100% (3.24) followed by T6 seaweed extract @ 100% (2.84) and T7 seaweed extract @75% (2.48). While the minimum shoot girth was recorded with T9 CPP @ 75% (1.22).

#### Average Shoot fresh Weight (g)

The data pertaining to the average shoot fresh weight of pomegranate cuttings influenced by

**Table 1.** Effect of IBA and Natural substances on days to first shoot initiation and shoot parameters of pomegranate cuttings

S.No	Treatment	Days to first shoot initiation	Shoot length (cm)	Number of leaves per plant	Average leaf area (cm <sup>2</sup> )	Average shoot girth	Average shoot fresh weight(g)	Average shoot dry weight (g)		
T1	Water (Control)	14.55	26.89	26.89	44.2222	3.57	3.57	1.74	14.39	7.89
T2	IBA @ 1000 ppm	12.66	29.44		57.56	3.69		2.47	15.22	8.67
T3	IBA @ 750 ppm	13.55	27.11		53.00	3.27		2.03	14.50	7.83
T4	Vermiwash @ 100%	11.00	35.78		83.89	7.01		3.31	18.89	9.89
T5	Vermiwash @ 75%	13.11	25.45		69.11	4.03		2.56	16.05	8.00
T6	Seaweed extract @ 100%	11.07	30.00		79.22	5.53		2.84	17.11	8.72
T7	Seaweed extract @ 75%	12.00	23.67		60.67	5.42		2.36	15.17	7.33
T8	Cow pat pit @ 100%	15.66	12.00		24.00	3.25		1.31	12.22	6.28
T9	Cow Pat Pit @75%	16.78	10.00		18.56	3.27		1.23	10.22	5.16
	F test	S	S	S	S	S	S	S	S	S
	S.Ed(±)	0.49	3.47	6.16	0.78	0.16	0.83	0.42		
	CD at 5%	1.01	7.12	12.66	1.60	0.32	1.70	0.86		

growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum average shoot fresh weight were recorded with T4 vermiwash@100% (18.88) followed by T6 seaweed extract@100% (17.10) and T5 vermiwash@75% (16.05). While, the minimum shoot fresh weight was recorded with T1 @ water (control) (10.22).

### Shoot dry Weight (g)

The data pertaining to the shoot dry weight of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum shoot dry weight was recorded with T4 vermiwash @ 100% (9.89) followed by T6 seaweed extract@100% (8.72) and T2 IBA @ 1000 ppm (8.67). While the minimum shoot dry weight was recorded with T9 CPP@75% (5.16). The similar trends were recorded by Kamalakar (2013); Gite (2015); Gurung *et al.*, (2014).

### Root Parameters

#### Root length (cm)

The data pertaining to the root length of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum root length was recorded with T4 vermiwash@ 100% (24.88) followed by T6 seaweed extract @ 100% (21.44) and T7 seaweed extract @75%

(18.88). While the minimum root length was recorded with T9 CPP@75% (7.55). Similar results were also obtained by Kamalakar (2013) in Jamun cv. Konkan Bahadoli and Gite (2015) in Jamun grafts.

### Number of roots per cutting

The data pertaining to the number of roots per cutting of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum number of roots per cutting T4 vermiwash @ 100% (38.22) followed by T6 seaweed extract @100% (36.88) and T7 seaweed extract @75% (28.66). While the minimum number of roots per cutting were recorded with T9 CPP @ 75% (5.21). The similar trends was recorded by Kamalakar (2013) and Gite (2015) observed similar results in Jamun grafts cv. Konkan Bahadoli.

### Root Fresh Weight (g)

The data pertaining to the root fresh weight of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum root fresh weight were recorded with T4 vermiwash @ 100% (7.57) followed by T6 seaweed extract@100% (6.77) and T7 seaweed extract@75% (6.60). While the minimum root fresh weight was recorded with T9 CPP @ 75% (1.60). The fresh weight of the roots is directly proportional to number of roots in each cutting. The increase in

**Table 2.** Effect of IBA and Natural substances on survival percentage and root parameters of pomegranate cuttings

S.No	Treatment	Survival percentage	Root length(cm)	Number of roots per cutting	Average root fresh weight(g)	Average root dry weight (g)
T1	Water (Control)	77.78%	16.00	16.00	3.06	1.56
T2	IBA @ 1000 ppm	91.67%	17.33	57.56	4.33	1.72
T3	IBA @ 750 ppm	81.82%	13.67	53.00	3.72	2.05
T4	Vermiwash @ 100%	93.75%	25.55	83.89	7.36	3.78
T5	Vermiwash @ 75%	80.00%	18.22	69.11	4.50	2.28
T6	Seaweed extract @ 100%	78.57%	21.44	79.22	6.78	3.78
T7	Seaweed extract @ 75%	76.92%	18.89	60.67	6.61	3.32
T8	Cow pat pit @ 100%	71.43%	09.56	24.00	2.47	1.25
T9	Cow Pat Pit @75%	60.00%	07.55	18.56	1.67	0.91
	F test		S	S	S	S
	S.Ed (±)		1.60	6.16	0.58	0.34
	CD at 5%		3.29	12.66	1.19	0.70

number of roots per cutting might have directly influenced the fresh weight of the roots.

### Root Dry weight (g)

The data pertaining to the root dry weight of pomegranate cuttings influenced by growth regulator and natural substances are presented in Table 1, it is clear that there are significant difference among the treatments.

The maximum root fresh weight were recorded with T4 vermiwash @ 100% (3.77) followed by T6 seaweed extract @ 100% (3.39) and T7 seaweed extract@ 75% (3.32). While, the minimum root dry weight was recorded with T9 CPP@75% (0.91). The similar trends was recorded by Kamalakar (2013) and Gite (2015) noticed similar trend of results in Jamun grafts; Gunasundari and Kumar (2009) in Tea; Gurung *et al.* (2014) in Passion fruit.

### Survival Percentage of Pomegranate Cuttings After Transplanting In The Field

The data pertaining to the effect of growth regulator (IBA) and natural substances on survival percentage (%) of pomegranate cuttings have been presented in Table 3. Highest survival (93.75%) was observed in the treatment T4 vermiwash @100% which was at par with treatments T2 IBA @1000 ppm (91.67%), T3 IBA @750ppm (81.82%), while lowest survival percentage of rooted cutting (60.00%) recorded in cuttings grown in T4 CPP @75%.

The highest survival percentage was recorded in cuttings treated with T4 vermiwash@100%, it might be due to development of effective root system and increase in number and length of roots per cutting as influenced by the uptake of nutrients and water. The cuttings treated with vermiwash resulted in development of effective root system and increased in number and root length due to increasing mitotic index. (Jandaik *et al.*, 2015). This might be due to influenced the uptake of nutrients and water and thereby enhanced more survival per cent of pomegranate cutting. Present results were analogous to the findings recorded by Gawas *et al.* (2019) in black pepper, Pawar *et al.* (2020) in bush pepper, Yelleshkumar *et al.* (2007) in Mango grafts, Kamalakar (2013) in Jamun grafts and Shreesty *et al.* (2019) in karonda.

### Conclusion

From the present investigation, it is concluded that

among the two concentrations of IBA, T2 IBA@1000ppm has got the best result in terms of all the vegetative parameters, and also survival percentage was high. While in the case of natural substances used T4 vermiwash @100% has got the best result in case of all vegetative parameters. In the case of survival percentage, the highest survival rate was for plants treated with T4 vermiwash @100% while the lowest was for plants with T9 CPP @75%. The maximum survival was found for plants that were treated with T4 vermiwash@100% (93.75%).

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