



RESEARCH ARTICLE

EFFECT OF DIFFERENT CONCENTRATION OF INDOLE BUTYRIC ACID ON SURVIVAL AND ROOTING PERFORMANCE OF POMEGRANATE (*PUNICA GRANATUM L.*)

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ARTICLE INFO

Article History:

Received 18th August, 2022
Received in revised form
09th September, 2022
Accepted 25th October, 2022
Published online 30th November, 2022

Key words:

Indole-butyric acid,
Pomegranate, Ganesh,
Bhagwa,
Mridula, Rooting.

ABSTRACT

The experiment was carried out during the year 2021-22 at Department of Fruit Science, Guru Kashi University Talwandi Sabo, Bathinda, Punjab, India. The cuttings were taken from hardwood cutting arising on tree of pomegranate cv. Bhawga, Ganesh, Mridula during the month of January. The experiment was conducted in Randomized block design with 6 treatment and 3 replication. Treatments were consisted of control (0), 1000ppm, 1500ppm, 2000ppm, 2500ppm, 3000ppm. Result showed that the IBA 3000ppm concentration solution for dip in 10 seconds gives shows highest number of primary roots per cutting was recorded in Bhagwa (38.98), Ganesh (37.40) and Mridula (35.87). The maximum survival percentage was recorded with IBA 3000ppm Bhagwa (96.33%), Ganesh (84.67%) and Mridula (80.67%). The maximum number of days taken for first sprouting was recorded in IBA 3000ppm Mridula (13.20), Bhagwa (11.53) and Ganesh (12.47). The maximum leaf area per cutting was recorded in IBA 3000ppm Bhagwa (301.17 cm), Ganesh (259.70 cm) and Mridula (282.97 cm). The highest plant height was observed in IBA 3000ppm Bhagwa (56.97 cm), Ganesh (52.93cm) and Mridula (55.87 cm).

INTRODUCTION

Punica granatum L., pomegranate, important fruit crop of arid and semiarid regions is belongs to family, Punicaceae (Kandylis and Kokkinomagoulos, 2020). *Punicagranatum* is derived from the word Pomum (apple), granatus (grainy), or seeded apple (Deshpande, 2008; da Silva *et al.* 2013). It is shrub grows up to 1 to 10m depend on different cultivars (Rana *et al.* 2010). It is listed in the oldest cultivated fruits, along with the olive, grape, date palm and fig (Aslanova and Magerramov, 2012). It is originated from Iran then widespread in India, China, Afghanistan, Pakistan, India, Mediterranean Europe and North Africa (Chandra *et al.* 2010). In world with respect to area for cultivation and production of pomegranate, India ranks first followed by china and Iraq. It is cultivated on 1.12 lakh hectares area i.e. 1.7% of the area under fruits in India (Kumar and Singh, 2021; Pachpor *et al.* 2021). It is grown in Himachal Pradesh, Jammu & Kashmir, Uttarakhand, Gujarat, Maharashtra, Karnataka, Rajasthan, Andhra Pradesh, and Tamil Nadu (Pal *et al.* 2014). It is having cultural, nutritional and medicinal values. In different cultures, pomegranate is considered as auspicious symbol, mostly of life, luck, abundance and fertility (Gunjan *et al.* 2012). The edible portion in the fruit (68 percent) contains 78 percent moisture, 1.6 percent protein, 14.5 percent carbohydrate.

Every 100g consist of 100 mg calcium, 70mg phosphorus, 0.3mg iron, 0.10 mg vitamin B2 and 16 mg vitamin C. Pomegranate peels are source of phenolics, minerals and complex polysaccharides, while arils, apart from water (85 percent), contain sugars, pectin, organic acids, phenolics, and flavonoids-principally anthocyanins (Elango *et al.* 2011). Seeds contain proteins, crude fibers, vitamins, minerals, pectin, sugars, polyphenols, isoflavones, linolenic, linoleic acids, punicic acid, oleic acid, stearic acid, and palmitic acid (Viuda-Martos *et al.* 2010). Pomegranate is used for the prevention of cardiovascular disease (Noda *et al.* 2002; Fuhrman *et al.* 2005). It is also having anti-cancerous property i.e. it prevent lung cancer (Khan *et al.* 2007), colon cancer (Smith *et al.* 2020), prostate cancer (Koyama *et al.* 2010), and breast cancer (Sturgeon *et al.* 2010). It is also having anti-microbial and Anti-fungal properties (Pagliarulo *et al.* 2016; Nicosia *et al.* 2016). It is used as a functional food for the prevention of obesity, and diabetes (Les *et al.* 2018; Bellesia *et al.* 2015). It is helpful in slowing down Alzheimer's disease (Velagapudi *et al.* 2016). It is also act as antibacterial leads to dental care (Gulube and Patel, 2016). Peel extract helps in treatment of giardiasis of the human small intestine (Al-Megrin, 2017). It shows anti-inflammatory and prevents liver injury (Makled *et al.* 2016; Zhai *et al.* 2018). It has been also used as additive in meat products (Smaoui *et al.* 2019). There are around 500 different cultivars of pomegranate present in world. In which non-acidic cultivars are favoured in India. In India, Ganesh, Mridula, Bhagwa, Ruby, Alandi, Muskat and Bassein Seedless varieties of pomegranates are present (Vasanth Kumar, 2009;

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Pande *et al.* 2016; Kumar and Singh, 2021). Out of these varieties following three are used for current study: a) Ganesh is the soft seed variety its fruits are medium sized, yellow, smooth surface and red tinge; b) Mridula is dwarf plant with rind smooth, dark red in colour fruit; c) Bhagwa is predominant variety with attractive red rind and red arils (Waskar *et al.*, 2003). Pomegranate can be propagated by stem cuttings, layering and grafting in less time. The exposure of Indole-3-butyric acid (IBA) which is synthetic plant hormone induce root development in crops (Rymbai and Reddy 2010). It helps in root development by increasing the apical meristem size, root hair elongation, lateral root development, and formation of adventitious roots (Frick and Strader, 2018). Many research works was conducted on using these plant growth promoters in different crops. Limited research works was reported from Punjab on Pomegranate.

MATERIAL AND METHODS

The experiment was conducted during the January in the Department of fruit science, Guru Kashi University, Talwandi Sabo, Bathinda. The investigation aimed to study the different concentrations of IBA on survival and rooting performance of pomegranate. The hardwood cuttings were taken from the trees of pomegranate cv Ganesh, Bhagwa and Mridula. The hardwood cuttings of about pencil thickness and 20-25 cm in length having 3-5 buds were taken from healthy pomegranate trees. The IBA solution was applied by quick dip method. In this method, the cuttings were dipped in the solution of IBA for 10 seconds just before the planting.

Treatments used for present experiments

Treatment Number	Treatment Name
T1	Control
T2	IBA: 1000 ppm
T3	IBA: 1500 ppm
T4	IBA: 2000 ppm
T5	IBA: 2500 ppm
T6	IBA: 3000 ppm

The cuttings were planted in the beds. While planting about the 2/3th length of cutting was buried in soil, leaving 1/3th portion expose to the environment. The cutting were planted 10cm apart with a row to row distance of 30 cm.

RESULT AND DISCUSSION

Number of days taken for first sprouting: The data given in Table 4.1 revealed that in T6: IBA @3000 ppm (12.47, 11.53 and 13.20) minimum numbers of days taken for first sprouting in Ganesh, Bhagwa and Mridula, respectively. This is followed by T5: @2500ppm (13.00, 12.60, 13.93) in Ganesh, Bhagwa and Mridula respectively. Whereas in T1: control (18.67, 18.27, 18.27) maximum numbers of days taken for first sprouting in Ganesh, Bhagwa and Mridula, respectively. The IBA at all different dose showing significantly positive results on all three cultivars of pomegranates and reduces the number of days taken for first sprouting. Similarly the minimum number of days required for first sprouting of cuttings (11.63) was recorded in cuttings grown in a mixture of Coco peat + Vermiculite + Perlite + 2000 ppm of IBA (Tanwar *et al.* 2020).

Survival percentage: The data presented in Table 4.2 revealed that in T6: IBA @3000 ppm (84.67, 96.33 and 80.67) per cent maximum survival percentage was recorded in cvs. Ganesh,

Bhagwa and Mridula, respectively. In T1: Control cvs. Ganesh (66.00 per cent), Bhagwa (66.00 per cent) and Mridula (67.33 per cent) were showing minimum survival percentage compared to all other treatments of IBA.

Table 4.1. Number of days taken for first sprouting using different treatments of IBA on Pomegranate cutting

Treatment Number	Treatment Name	Number of days taken for first sprouting		
		Ganesh	Bhagwa	Mridula
T1	Control	18.67	18.27	18.27
T2	IBA: 1000 ppm	16.27	16.53	17.47
T3	IBA: 1500 ppm	15.33	14.53	16.53
T4	IBA: 2000 ppm	13.87	13.07	15.13
T5	IBA: 2500 ppm	13.00	12.60	13.93
T6	IBA: 3000 ppm	12.47	11.53	13.20
CD		0.91**	0.69**	0.52*
SE±		0.43	0.23	0.25

All dose of IBA showing significantly positive results on survival percentage in all three pomegranate cultivars cuttings. There is gradual increase in survival percentage with increase in IBA dosage. Similarly Tanwar *et al.* (2020) reported the 93.78 per cent survival percentage of rooted cuttings treated with 2000 ppm IBA.

Table 4.2 Survival percentage of using different treatments of IBA on Pomegranate cutting

Treatment Number	Treatment Name	Survival percentage		
		Ganesh	Bhagwa	Mridula
T1	Control	66.00	66.00	67.33
T2	IBA: 1000 ppm	74.67	79.33	63.67
T3	IBA: 1500 ppm	76.33	81.67	68.33
T4	IBA: 2000 ppm	78.33	91.33	73.67
T5	IBA: 2500 ppm	81.67	95.00	78.67
T6	IBA: 3000 ppm	84.67	96.33	80.67
CD		1.80	1.59	0.98
SE±		0.85	0.76	0.46

Plant height (cm): The result revealed that T6: IBA @ 3000 ppm showing maximum plant height in all cultivars i.e. Ganesh (52.93 cm), Bhagwa (56.97 cm) and Mridula (55.87 cm). This is followed by T5: @2500ppm (52.25, 55.63, 54.87 cm) in Ganesh, Bhagwa and Mridula respectively. Whereas T1: Control Ganesh (37.73 cm), Bhagwa (36.77 cm) and Mridula (36.89 cm) was showing minimum plant height (Table 4.3). All the dosage of IBA was showing significantly positive results on plant height in all three cultivars. There was gradual increase in plant height with increase in dosage of IBA.

Table 4.3 Plant height (cm) using different treatment of IBA on Pomegranate cutting

Treatment Number	Treatment Name	Plant height (cm)		
		Ganesh	Bhagwa	Mridula
T1	Control	37.73	36.77	36.89
T2	IBA: 1000 ppm	45.23	48.93	47.33
T3	IBA: 1500 ppm	49.80	52.03	50.07
T4	IBA: 2000 ppm	50.80	53.77	51.97
T5	IBA: 2500 ppm	52.85	55.63	54.87
T6	IBA: 3000 ppm	52.93	56.97	55.87
CD		0.70	1.29	0.56**
SE±		0.33	0.61	0.27

Leaf area per cutting (cm²): The result revealed that T6: IBA @ 3000 ppm showing maximum Leaf area per cutting (cm²) in all cultivars i.e. Ganesh (259.70), Bhagwa (301.17) and

Mridula (282.97). This is followed by T5: IBA @ 2500ppm (254.90, 292.90, 271.17) in Ganesh, Bhagwa, Mridula respectively. Whereas T1: Control Ganesh (58.60), Bhagwa (58.37) and Mridula (57.83) was showing minimum Leaf area per cutting (cm²) (Table 4.4).

Table 4.4 Leaf area (cm²) using different treatment of IBA on Pomegranate cutting

Treatment Number	Treatment Name	Leaf area per cutting (cm ²)		
		Ganesh	Bhagwa	Mridula
T1	Control	58.60	58.37	57.83
T2	IBA: 1000 ppm	216.52	242.37	220.93
T3	IBA: 1500 ppm	230.33	254.00	245.67
T4	IBA: 2000 ppm	247.30	275.83	262.07
T5	IBA: 2500 ppm	254.90	292.90	271.17
T6	IBA: 3000 ppm	259.70	301.17	282.97
CD		3.60**	17.02**	4.98**
SE±		1.71	8.07	2.36

Table 4.5 Number of primary roots / cutting using different treatments of IBA on Pomegranate cutting

Treatment Number	Treatment Name	Number of primary roots / cutting		
		Ganesh	Bhagwa	Mridula
T1	Control	15.83	15.50	15.53
T2	IBA: 1000 ppm	29.53	32.33	28.07
T3	IBA: 1500 ppm	31.47	34.40	29.33
T4	IBA: 2000 ppm	33.87	37.40	32.00
T5	IBA: 2500 ppm	35.00	38.07	34.07
T6	IBA: 3000 ppm	37.40	38.98	35.87
CD		0.53	1.00	1.40
SE±		0.25	0.48	0.66

All the dosage of IBA was showing significantly positive results on Leaf area per cutting (cm²) in all three cultivars. There was gradual increase in Leaf area per cutting (cm²) with increase in dosage of IBA.

Number of primary roots / cutting: The data presented in Table 4.5 revealed that T6: IBA @3000 ppm highest number of primary roots per cutting was recorded in Ganesh (37.40), Bhagwa (38.98) and Mridula (35.87) respectively. This is followed by T5: @ 2500ppm (35.00, 38.07, 34.07) in Ganesh, Bhagwa and Mridula respectively. Whereas in T1: Control cultivar Ganesh (15.83), Bhagwa (15.50) and Mridula (15.53) were showing minimum number of primary roots per cutting. All dose of IBA showing significantly positive results on number of primary roots per cutting in all three pomegranate cultivars cuttings. There is gradual increase in number of primary roots with increase in IBA dosage. In similar kind of study using IBA reported the significant increase in number of root (41.50) (Tanwar *et al.* 2020). The maximum number of primary roots (16.00) was recorded with 500 ppm IBA (Mehta *et al.* 2018). The increase in number of roots are due to the action of IBA which might cause hydrolysis and translocation of carbohydrates as well as nitrogenous substances at the base of cuttings and resulted in enhanced elongation and division of root cell (Hartmann *et al.*, 2007).

CONCLUSION

Among the various concentrations of IBA at @ 3000ppm was effectively in increasing the Number of days taken for first sprouting, Survival percentage, Plant height, Leaf area per

cutting and Number of primary roots per cutting. From the overall results, it was concluded that the increasing dose of IBA was positively affecting the survival and rooting parameters of pomegranate cuttings.

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