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Effect of IBA and rooting media for survival cutting of pomegranate under protected condition

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Abstract
The presented experiment entitled "Effect of IBA and rooting media for success and survival hardwood cutting of pomegranate under protected condition" were carried out during 2018-2019 at Instructional Cum Research Farm, Department of Horticulture, Collage of Agriculture, Badnapur.
The present experiment laid out in Factorial Randomized Block Design with 12 treatment, combination of two factor like, rooting media i.e. Red soil + FYM (2:1), Black soil + FYM (2:1), Sand + FYM (2:1) and Coco peat + FYM (2:1) and IBA i.e. 1500 ppm, 3000 ppm and 4500 ppm and replicated three times.
The study revealed that significant difference among all rooting media for different shooting parameters. Among all the four rooting media studied, mixture of coco peat + FYM performed superior in almost all parameters. *Viz.* number of days taken for first sprouting observation taken after planting of cutting. The success percentages of rooted cutting at 30 DAP. The percentage of rooted cutting,fresh weight of shoots, root to shoot ratio, at 90 DAP. The survival percentage of rooted cutting, number of shoot, length of longest shoot per cutting, number of leaves per cutting at 30, 60 and 90 DAP.
All the concentrations of IBA, 4500 ppm IBA recorded minimum number of days taken for first sprouting, maximum shooting parameters viz, The success percentage of rooted cutting at 30 DAP. The percentage of rooted cutting, fresh weight of shoots, root to shoot ratio, at 90 DAP. The survival percentage of rooted cutting, number of shoot, length of longest shoot per cutting, number of leaves per cutting at 30, 60 and 90 DAP. The interaction effect of IBA and rooting media was non-significant in all shooting parameters.
The present investigation it can be concluded that the cutting treated with IBA 4500 ppm and grown in mixture of coco peat + FYM gave maximum effect on shoot formation.

Keywords: IBA, rooting media, cutting, coco peat

Introduction
The present investigation entitled "Effect of IBA and rooting media for success and survival hardwood cutting of pomegranate under protected condition" was carried out during 2018-2019 at Instructional Cum Research Farm, Department of Horticulture, College of Agriculture, Badnapur. Tal. Badnapur, Dist. Jalna under Vasantrao Naik Marathwada KrishiVidyapeeth Parbhani. The details about material used and methods adopted during the course of investigation are given below.

Factor 1: Rooting media (A): 4 Levels. A1: Red soil + FYM (2:1). A2: Black soil + FYM (2:1). A3: Sand + FYM (2:1). A4: Coco peat + FYM (2:1)

Factor 2: Rooting Hormone (B): 3 Levels. B1: IBA - 1500 ppm. B2: IBA - 3000 ppm. B3: IBA - 4500 ppm. 3.2.3

Treatment Combination
A1B1: Red soil + FYM (2:1) + IBA @ 1500 ppm, A1B2: Red soil + FYM (2:1) + IBA @ 3000 ppm, A1B3: Red soil + FYM (2:1) + IBA @ 4500 ppm, A2B1: Black soil + FYM (2:1) + IBA @ 1500 ppm, A2B2: Black soil + FYM (2:1) + IBA @ 3000 ppm, A2B3: Black soil + FYM (2:1) + IBA @ 4500 ppm, A3B1: Sand + FYM + (2:1) + IBA @ 1500 ppm, A3B2: Sand + FYM + (2:1) + IBA @ 3000 ppm, A3B3: Sand + FYM + (2:1) + IBA @ 4500 ppm, A4B1: Coco peat + FYM (2:1) + IBA @ 1500 ppm, A4B2: Coco peat + FYM (2:1) + IBA @ 3000 ppm, A4B3: Coco peat + FYM (2:1) + IBA @ 4500 ppm. The experiment was conducted in Factorial Randomized Block design with twelve treatments which were replicated thrice. Five cuttings were selected randomly from each treatment of each replication. These five cuttings were labeled for recording observation through the study.

Result and Discussion

Observations were recorded on root parameters for five cuttings in each treatment and in each replication. The data recorded was subjected to statistical analysis to get information on mean performance.

Effect of IBA and rooting media on number of days taken for first sprouting.

Effect of rooting media

The data in respect to number of days taken for first sprouting were found to be significantly minimum number of days taken for first sprouting in treatment A4 (7.62) cuttings grown in a mixture of coco peat + FYM and significantly followed by cuttings grown in a mixture of black soil + FYM recorded in treatment A2 (8.48) and significantly maximum number of days taken for first sprouting recorded in treatment A1 (10.16) was found in cuttings grown in red soil + FYM.

The above result conformity by Baghel and Saraswat (1989) [4] in pomegranate.

Effect of IBA

The data indicated (table 1) that there were significant differences among the IBA concentrations for number of days taken for first sprouting. The cuttings treated with IBA 4500 ppm recorded significantly minimum number of days taken for first sprouting in treatment B3 (8.46) and significantly followed by cuttings treated with IBA 3000 ppm in treatment B2 (8.74) and maximum number of days taken for first sprouting with IBA 1500 ppm in treatment B1 (9.24).

This might be due to presence of endogenous auxins in cuttings might have brought early breakage of bud dormancy and results in early bud sprouting (Iqbal *et al*. 1999) [7]. Above result conformity by Amanveer Kaur *et al.* (2017) [3] in Fig cutting.

Table 1: Effect of IBA and rooting media on number of days taken for first sprouting

Rooting Media (A)	IBA Concentrations			Mean
	1500 (B1)	3000 (B2)	4500 (B3)	
A1. (Red Soil + FYM)	10.63	10.00	9.83	10.16
A2. (Black Soil +FYM)	9.27	8.37	7.80	8.48
A3. (Sand + FYM)	9.20	9.07	8.73	9.00
A4. (Coco peat +FYM)	7.87	7.53	7.47	7.62
Mean	9.24	8.74	8.46	
Factors	A	B	A X B	
SEm±	0.19	0.17	0.34	
CD at 5 %	0.57	0.50	NS	

Effect of IBA and rooting media on number of shoots per cuttings

Effect of rooting media

The data regarding significant differences were observed between rooting media treatments for number of shoots per cuttings after 30, 60 and 90 days of planting are respectively (table 2). The cuttings grown in a mixture of coco peat + FYM recorded in treatment A4 (4.24, 4.91 & 6.12) was significantly superior followed by cuttings grown in a mixture of black soil + FYM recorded in treatment A2 (3.56,4.16 & 5.59) and significantly lowest number of shoots per cuttings recorded in treatment A1 (2.49, 3.23 & 3.71) was found in cuttings grown in red soil + FYM.

The cuttings grown in a mixture of coco peat + FYM showed maximum number of shoots which might be due to decomposition of lignin present in coco peat results in the formation of humic fractions (Kadalli *et al.*, 2001a) [9] which imparts coco peat to retain more nutrients and helps in increasing the number of shoots per cuttings. The results are in agreement with the earlier finding by Baghel and Saraswat (1989) [4] in pomegranate, Alikhani *et al*. (2011) [2] in pomegranate.

Effect of IBA

The data regarding significant differences were observed between IBA treatments for rooting of cuttings after 30, 60 & 90 days after planting are respectively. The cuttings treated with IBA 4500 ppm recorded significantly higher number of shoots per cuttings in treatment B3 (3.78, 4.35 & 5.47) and significantly followed by cuttings treated with IBA 3000 ppm in treatment B2 (3.33, 4.06 & 5.08) and lowest number of shoots per cutting with IBA 1500 ppm in treatment B1 (2.94, 3.65 & 4.59).

This might be due to presence of endogenous IBA is synthetic plant hormone. It is active inhibiting auxiliary bud break on developing shoot, and stimulates the root initiation. The results are in agreement with the earlier findings by Navjot Kahlon (2002) [11] in pomegranate.

Table 2: Effect of IBA and rooting media on nimber of shoots per cutting

Rooting Media (A)	30 DAP				60 DAP				90 DAP			
	IBA Concentration (ppm) (B)			Mean	IBA Concentration (ppm) (B)			Mean	IBA Concentration (ppm) (B)			Mean
	1500 (B1)	3000 (B2)	4500 (B3)		1500 (B1)	3000 (B2)	4500 (B3)		1500 (B1)	3000 (B2)	4500 (B3)	
A1. (Red Soil + FYM)	2.27	2.50	2.70	2.49	2.83	3.27	3.60	3.23	3.07	3.73	4.33	3.71
A2. (Black Soil + FYM)	3.10	3.63	3.93	3.56	3.93	4.13	4.40	4.16	5.07	5.53	5.87	5.49
A3. (Sand + FYM)	2.63	2.93	3.73	3.10	3.43	3.73	4.17	3.78	4.37	4.90	5.33	4.87
A4. (Coco peat + FYM)	3.77	4.23	4.73	4.24	4.40	5.10	5.23	4.91	5.87	6.17	6.33	6.12
Mean	2.94	3.33	3.78		3.65	4.06	4.35		4.59	5.08	5.47	
Factors	**A**	**B**	**A X B**		**A**	**B**	**A X B**		**A**	**B**	**A X B**	
SEm±	0.07	0.06	0.12		0.07	0.06	0.12		0.07	0.06	0.13	
CD at 5 %	0.21	0.18	NA		0.21	0.18	NA		0.22	0.19	NA	

Effect of IBA and rooting media on length of longest shoots per cuttings

Effect of rooting media

The data regarding significant differences were observed between rooting media treatments for length of longest shoot per cuttings after 30, 60 and 90 days of planting are respectively. The cuttings grown in a mixture of coco peat + FYM recorded in treatment A4 (20.17, 28.88 & 37.26 cm) was significantly superior followed by cuttings grown in a mixture of black soil + FYM recorded in treatment A2 (19.27, 28.43 & 30.28 cm) and significantly lowest length of longest shoot per cuttings recorded in treatment A1 (16.67, 20.29 & 25.21 cm) was found in cuttings grown in red soil + FYM.

It could be attributed to adequate supply of oxygen, water and nutrients by the coir pith for the proper functioning of root (Jeyaseeli and Paul Raj, 2010) [8] which ultimately helps in absorption of more moisture and nutrients resulted in length of longest shoot. The results are in agreement with the earlier finding by Baghel and Saraswat (1989) [4] in pomegranate, Batista *et al.* (2011) [5] in pomegranate.

Effect of IBA

Data were observed significant differences between IBA treatments for rooting of cuttings after 30, 60 & 90 days after planting are respectively. The cuttings treated with IBA 4500 ppm recorded significantly maximum length of longest shoot per cuttings in treatment B3 (20.50, 28.88 & 35.11 cm) and significantly followed by cuttings treated with IBA 3000 ppm in treatment B2 (18.61, 25.60 & 32.45 cm) and minimum length of longest shoot per cuttings are observed with IBA 1500 ppm in treatment B1 (16.72, 22.78 & 27.45 cm).

Auxins activated shoot growth which might have resulted in elongation of stems and leaves through cell division accounting for more number of leaves and length of longest shoot per cuttings. Above result clearly indicates that, cuttings gave highest length of shoot. The results are conformity with Purohit and Shekharappa (1985) [12] in pomegranate.

Table 3: Effect of IBA and rooting media concentration length of longest shoot per cuttings

Rooting Media (A)	30 DAP				60 DAP				90 DAP			
	IBA Concentration (ppm) (B)			Mean	IBA Concentration (ppm) (B)			Mean	IBA Concentration (ppm) (B)			Mean
	1500 (B1)	3000 (B2)	4500 (B3)		1500 (B1)	3000 (B2)	4500 (B3)		1500 (B1)	3000 (B2)	4500 (B3)	
A1. (Red Soil + FYM)	16.00	16.47	17.53	16.67	17.60	19.87	23.40	20.29	21.50	26.00	28.13	25.21
A2. (Black Soil + FYM)	16.60	19.63	21.57	19.27	25.00	28.80	31.50	28.43	29.50	35.57	36.73	33.93
A3. (Sand + FYM)	16.17	18.60	20.23	18.33	21.17	24.47	26.87	24.17	25.33	30.87	34.63	30.28
A4. (Coco peat + FYM)	18.10	19.73	22.67	20.17	27.37	29.27	33.77	30.13	33.47	37.37	40.93	37.26
Mean	16.72	18.61	20.50		22.78	25.60	28.88		27.45	32.45	35.11	
Factors	A	B	A X B		A	B	A X B		A	B	A X B	
SEm±	0.56	0.49	0.98		0.57	0.50	1.00		0.65	0.57	1.13	
CD at 5 %	1.67	1.45	NA		1.70	1.47	NA		1.93	1.68	NA	

Effect of IBA and rooting media on number of leaves per cuttings.

Effect of rooting media

The data regarding significant differences were observed between rooting media treatments for number of leaves per cuttings after 30, 60 and 90 days of planting are respectively. The cuttings grown in a mixture of coco peat + FYM recorded in treatment A4 (74.84, 163.26 & 204.86) was significantly superior followed by cuttings grown in a mixture of black soil + FYM recorded in treatment A2 (70.96, 157.41 & 186.07) and significantly minimum number of leaves per cuttings recorded in treatment A1 (64.36, 103.94 & 141.71) was found in cuttings grown in red soil + FYM.

The maximum number of leaves was produced in cuttings grown in a mixture of coco peat + FYM might be due to superior root development in this medium. It could be attributed to higher moisture retention capacity, porosity and nutrient status of coco peat (Nagarajan *et al.* 1985) [10]. The results are in agreement with the earlier finding by Baghel and Saraswat (1989) [4] in pomegranate, Alikhani *et al*. (2011) [2] in pomegranate.

Effect of IBA

Data were observed significant differences between IBA treatments for rooting of cuttings after 30, 60 & 90 days after planting are respectively. The cuttings treated with IBA 4500 ppm recorded significantly maximum number of leaves per cutting in treatment B3 (73.14, 152.09 & 185.58) and significantly followed by cuttings treated with IBA 3000 ppm in treatment B2 (70.02, 147.86 & 178.28) and minimum number of leaves per cuttings are observed with IBA 1500 ppm in treatment B1 (65.82, 131.28 & 166.86).

The increase in number of leaves under the cutting treated with 4500 ppm might be due to the absorption of more nutrients along with moisture as compared to cutting in all other treatments which in turn increase the production of more number of leaves. A similar result clearly indicates that, cutting gave highest number of leaves. The results are conformity with Alam *et al.* (2007) [1] in pomegranate.

Table 4: Effect of IBA and rooting media on number of leaves per cuttings

Rooting Media (A)	30 DAP				60 DAP				90 DAP			
	IBA Concentration (ppm) (B)			Mean	IBA Concentration (ppm) (B)			Mean	IBA Concentration (ppm) (B)			Mean
	1500 (B1)	3000 (B2)	4500 (B3)		1500 (B1)	3000 (B2)	4500 (B3)		1500 (B1)	3000 (B2)	4500 (B3)	
A1. (Red Soil + FYM)	59.30	64.77	69.00	64.36	95.17	106.20	110.47	103.94	131.50	142.00	151.63	141.71
A2. (Black Soil + FYM)	67.77	71.20	73.90	70.96	141.83	168.20	162.20	157.41	177.53	186.40	194.27	186.07
A3. (Sand + FYM)	64.17	69.53	71.73	68.48	135.80	155.53	159.73	150.36	166.70	177.23	181.03	174.99
A4. (Coco peat + FYM)	72.03	74.57	77.93	74.84	152.30	161.50	175.97	163.26	191.70	207.50	215.37	204.86
Mean	65.82	70.02	73.14		131.28	147.86	152.09		166.86	178.28	185.58	
Factors	A	B	A X B		A	B	A X B		A	B	A X B	
SEm±	1.06	0.92	1.84		2.00	1.73	3.47		2.37	2.05	4.10	
CD at 5 %	3.14	2.72	NA		5.91	5.12	NA		7.00	6.06	NA	

Effect of IBA and rooting media on fresh weight of shoots.

Effect of rooting media

The data in respect to fresh weight of shoot per cuttings were found to be significantly maximum treatment A4 (9.00g) cuttings grown in a mixture of coco peat + FYM and significantly followed by cuttings grown in a mixture of black soil + FYM recorded in treatment A2 (8.19g) and significantly minimum fresh weight of shoot per cuttings recorded in treatment A1 (6.84g) was found in cuttings grown in red soil + FYM.

The cuttings planted in a mixture of coco peat + FYM gave the maximum fresh weight of shoots per cuttings. This could be attributed to the fact that when coco peat added to other media, it might increased the aeration, water holding capacity, nutrient retention found to be essential in early growth of plants (Cresswell, 1997) [6] resulting in increased number of leaves, length and number of shoots which helps in increase in fresh weight of shoots. The above result conformity by Ranawana and Eswara (2009) [13] in pineapple.

Effect of IBA

The data respects to fresh weight of shoots per cuttings were found significant difference among the IBA concentrations. The cuttings treated with IBA 4500 ppm recorded significantly maximum fresh weight of shoots per cuttings in treatment B3 (8.34g) and significantly followed by cuttings treated with IBA 3000 ppm in treatment B2 (7.81g) and minimum fresh weight of shoots per cuttings with IBA 1500 ppm in treatment B1 (7.49g). Maximum fresh weight of shoots per cuttings was recorded when cuttings treated with IBA 4500 ppm than other IBA concentrations.

This could be attributed to the increase in number of leaves, length and number of shoots which helps in increase in fresh weight of shoots. The above result conformity by Y. Ahmad Seiar (2017) [14] in pomegranate.

Table 5: Effect of IBA and rooting media on fresh weight of shoots

Rooting Media (A)	IBA Concentrations			Mean
	1500 (B1)	3000 (B2)	4500 (B3)	
A1. (Red Soil + FYM)	6.51	6.75	7.25	6.84
A2. (Black Soil + FYM)	7.72	8.26	8.59	8.19
A3. (Sand + FYM)	7.31	7.45	7.70	7.49
A4. (Coco peat + FYM)	8.39	8.78	9.83	9.00
Mean	7.49	7.81	8.34	
Factors	A	B	A X B	
SEm±	0.11	0.09	0.19	
CD at 5 %	0.33	0.29	NS	

Effect of IBA and rooting media on ratio of root: shoot (fresh weight basis)

Effect of rooting media

The data in respect to ratio of root to shoot were found to be significantly maximum in treatment A4 (0.27) cuttings grown in a mixture of coco peat + FYM and significantly followed by cuttings grown in a mixture of black soil + FYM recorded in treatment A2 (0.25) and significantly minimum ratio of root to shoot recorded in treatment A1 (0.21) was found in cuttings grown in red soil + FYM.

The highest root to shoot ratio (fresh weight basis) was recorded in cuttings grown in a mixture of coco peat + FYM might be due to well development of root system relative to shoot system.

Effect of IBA

The data indicate that there were significant differences among the all IBA concentrations for ratio of root: shoot. The cuttings treated with IBA 4500 ppm recorded significantly maximum ratio of root: shoot in treatment B3 (0.25) and significantly followed by cuttings treated with IBA 3000 ppm in treatment B2 (0.24) and minimum ratio of root: shoot with IBA 1500 ppm in treatment B1 (0.22).

Table 6: Effect of IBA and rooting media on ratio of root: shoot (fresh weight basis)

Rooting Media (A)	IBA Concentration			Mean
	1500 (B1)	3000 (B2)	4500 (B3)	
A1. (Red Soil + FYM)	0.20	0.21	0.22	0.21
A2. (Black Soil + FYM)	0.25	0.25	0.26	0.25
A3. (Sand + FYM)	0.21	0.23	0.25	0.23
A4. (Coco peat + FYM)	0.25	0.29	0.28	0.27
Mean	0.22	0.24	0.25	
Factors	A	B	AXB	
SEm±	0.005	0.005	0.009	
CD at 5 %	0.016	0.014	NS	

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