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EFFECT OF IBA ON VEGETATIVE GROWTH AND MULTIPLICATION RATE IN STEM CUTTINGS OF PEAR ROOTSTOCKS

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ABSTRACT : The present investigation was carried out in order to standardize the optimum IBA concentration for vegetative propagation of pear rootstocks Quince-C and BA-29 with reference to vegetative growth and multiplication rate, they were given different concentration of IBA. The treatment with IBA significantly influenced the parameters under study. The IBA treatment @ 1000 ppm was found to be the best in terms of most of the vegetative growth parameters and multiplication rate. The highest multiplication rate was achieved on Quince-C treated with 1000 ppm IBA. Study concluded that IBA treatments significantly influenced vegetative growth and multiplication rate in stem cuttings of pear rootstocks.

Keywords : *Pear, vegetative propagation, IBA, rootstock.*

The pear (*Pyrus communis* L.), belonging to family Rosaceae and sub-family Pomoideae, is an important temperate fruit crop which ranks after apple in importance, acreage, production and varietal diversity. Pear is a temperate deciduous fruit crop but some of the low chilling cultivars are also grown in subtropical regions. Pear plants are commercially perpetuated through grafting or budding on pear root suckers of Asian pear (*Pyrus pyrifolia*), Kainth (*Pyrus pashia*), Shaira (*Pyrus serotina*), Pyrus ussieuriensis Maxim, *Pyrus calleryana* Decne and Quince (*Cydonia oblonga*) rootstocks. These rootstocks are propagated vegetatively either by mound layering or by rooted cuttings. Increasingly, rootstocks with differing degrees of vigour, compatibility and methods of propagation are being used in the nursery production of almost all fruit species. Regulating vegetative growth is a major problem with an intensive orchard system and is multiplied manifold with rootstocks like *Pyrus pashia*, which produce large vigorous trees with upright growth habit. Control of vegetative growth can be achieved by means of dwarfing rootstock *viz.,* Quince-C and BA-29. However, the observations made until about the vegetative propagation of Quince are fragmented and often contrasting, but according to Bellini (1) the technique of vegetative propagation via shooting techniques gives great advantages due to its simplicity and economy. The present investigation reports the result of investigation on the effect of Indole-3-Butyric Acid (IBA) on the vegetative growth and multiplication rate in stem cuttings of pear rootstocks.

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MATERIALS AND METHODS

The present investigation was carried out at Horticultural Research Block, Govind Ballabh Pant University of Agriculture and Technology, Hill Campus, Ranichauri (Tehri Garhwal), Uttarakhand during 2012. The experimental material consisted of two rootstocks viz., Quince-C and BA-29, which were treated with six different IBA concentrations, *i.e.,* 0, 500, 1000, 1500, 2000 and 2500 ppm. The solutions of above concentrations have been prepared by dilution method in distilled water and finally pH maintained at 7.0 with the help of 0.1 N KOH or HCl in presence of digital pH meter. The method used for IBA application was the quick dip method at ambient room temperature and the cuttings of 25 cm length and 1.5 cm diameter, with a slant cut made at the bottom of each cutting. The experiment consisted of total 6 treatment combinations *viz.,* T_1 as control (distilled water only), T_2 as 500 ppm IBA, T_3 as 1000 ppm IBA, T_4 as 1500 ppm IBA, T_5 as 2000 ppm IBA and T_6 as 2500 ppm IBA. Cuttings from the bottom were dipped for 10-15 seconds in different concentrations of IBA. The experiment was laid out in Factorial Randomized Block Design (Cochran and Cox, 2), with 4 replications. Each replication denotes a plot which contains 20 cuttings. Cuttings were planted in a well prepared open field and regular cultural practices and irrigations were given during the whole period of experiment. Data on sprouting percentage, days to sprouting, length and girth of sprout, number of leaves, leaf area per plant, canopy spread, fresh and dry weight of sprouts were recorded as per standard procedures. Data were subjected to ANOVA and treatment means were separated by Fisher's least significance difference test (p = 0.05) (Fisher, 5).

RESULTS AND DISCUSSION

Present investigation revealed that IBA had a significant influence on days to sprouting and sprouting percentage (Table 1). The days to sprouting were recorded to be the lowest (28.00 days) in BA-29. As far as the IBA is concerned the minimum number of days (28.00 days) was recorded under 1000 ppm IBA. Sprouting was observed to be the earliest (28 days) in two treatment combinations *i.e.,* Quince-C treated with 1000 ppm IBA and BA-29 treated with 1000 ppm IBA. The earliest sprouting on BA-29 might possibly be due to more absorption of nutrients and water from roots to shoots, contrary to Quince-C wherein the absorption was less as dwarf rootstocks have a high proportion of bark to wood ratio in the lateral roots. The minimum number of days for sprouting ascertained with IBA is in accordance with the findings of Mohammad *et al.* (7). The sprouting percentage was the highest (97.50%) in Quince-C. The treatment with IBA @ 1000 ppm led to the highest sprouting percentage in BA-29 (95.00%). The treatment combination, comprising of Quince-C treated with 1500 ppm IBA recorded the maximum sprouting percentage (97.50%), which is in agreement with the findings of Singh and Pandey (11). The application of IBA, which initiates root formation by increasing internal free IBA, or synergistically modifying the action of IAA or endogenous synthesis of IAA, could be a reason for high sprouting percentage.

The length and girth of sprouts was significantly influenced by IBA (Table 2). The highest length (108.81 cm) and girth (11.15 mm) of sprout was recorded on BA-29. This might be due to earliest sprouting in BA-29. The maximum length (108.81 cm) and girth (11.15 mm) of sprouts was recorded under 1000 ppm and 1500 ppm IBA, respectively while the least under control (Table 2). These results are in line with Singh (10).

Among the interaction effect the maximum length and girth of sprout were measured under BA-29 treated with 1000 ppm IBA and BA-29 treated with 1500 ppm IBA, respectively. Root formation on Le Conte pear as influenced by auxin treatments, El-Shazly and El-Sabrout (3) found IBA to induce the maximum length of sprouts.

Table 1 : Effect of IBA application on days to sprouting and sprouting percentage of pear rootstocks.

Treatment IBA conc.		Rootstock			
		Days to sprouting		Sprouting percentage	
		Quince-C	BA-29	Quince-C	BA-29
T_1 : Control		37.25	35.75	81.25 (64.38)*	75.00 (60.06)
T_2 : 500 ppm		35.00	32.00	87.50 (69.39)	85.00 (67.36)
T_3 : 1000 ppm		28.00	28.00	92.50 (74.32)	95.00 (78.93)
T_4 : 1500 ppm		30.00	29.00	97.50 (83.54)	86.25 (68.30)
T_5 :2000 ppm		33.50	30.75	86.25 (68.44)	82.50 (65.32)
T_6 : 2500 ppm		36.50	34.00	80.00 (63.52)	77.50 (61.72)
CD (P=0.05)	Rootstock	0.50		2.06	
	IBA	0.87		3.57	
	Rootstock × IBA	2.66		5.05	

*Figures in parenthesis are angular transformed values.

Table 2 : Effect of IBA application on length (cm) and girth of sprout (mm) of pear rootstocks

Treatment IBA conc.	Rootstock			
	Length of sprout (cm)		Girth of sprout (mm)	
	Quince-C	BA-29	Quince-C	BA-29
T_1 : Control	84.52	88.47	9.31	9.54
T_2 : 500 ppm	89.16	101.16	9.62	10.79
T_3 : 1000 ppm	102.25	108.81	11.05	11.14
T_4 : 1500 ppm	99.14	108.31	10.50	11.15
T_5 : 2000 ppm	91.65	101.64	9.50	10.71
T_6 : 2500 ppm	87.66	94.20	9.39	10.67
CD (P=0.05)	1.41		0.16	
	2.45		0.27	
	3.47		0.39	

The maximum numbers of leaves per plant (126.01) at the final stage were counted on Quince-C (Table 3). The IBA concentration @ 1000 ppm was found to be the best in terms of number of leaves per plant, while the lowest (82.49) was reported under control. As far as interaction effects are concerned, Quince-C when treated with 1000 ppm IBA leads to maximum number of leaves (126.01). Present results are in accordance with Sharma *et al.* (8). The leaf area was recorded to be the highest (1330.23 cm^2) under BA-29. The maximum leaf area and canopy spread was noticed under 1000 ppm IBA (Table 3). The treatment combination comprising of BA-29 and 1000 ppm IBA resulted in maximum leaf area (1330.23 cm^2). This may be possibly due to IBA which leads to formation of root initials and thus root formation and finally into absorbance of more amount of nutrient from soil led to higher leaf area. Jawanda *et al.* (6) and Diwakar and Katiyar (4) had also reported IBA to promote leaf area.

The mean fresh and dry weight of shoot was significantly affected by IBA (Table 4). The BA-29 rootstock recorded the highest fresh and dry weight of shoot. As far as the IBA treatments are concerned, application of 1000 ppm recorded the maximum fresh (35.84 g) and dry (22.55 g) while the minimum (19.42 g and 14.55 g, fresh and dry weight, respectively) with control. Among the different treatment combinations, BA-29 treated with 1000 ppm IBA attained the highest fresh (35.84 g) and dry weight (22.55 g) of shoot. The improvement in fresh weight and dry weight of shoot in BA-29 treated with 1000 ppm IBA might be due to increased length, girth, leaf area and canopy spread, which resulted in greater amount of dry matter accumulation as a consequence of high photosynthates. These results are in accordance with the findings of Shukla and Bist (9).

Table 3 : Effect of IBA application on number of leaves and leaf area per plant of pear rootstock.

Treatment IBA conc.	Rootstock			
	Number of leaves per plant		Leaf area per plant (cm^2)	
	Quince-C	BA-29	Quince-C	BA-29
T_1 : Control	82.49	89.26	694.40	827.83
T_2 : 500 ppm	89.83	103.93	840.19	1186.10
T_3 : 1000 ppm	126.01	107.25	1330.23	1489.50
T_4 : 1500 ppm	118.27	103.55	1200.74	1334.22
T_5 : 2000 ppm	98.72	96.48	932.45	1113.38
T_6 : 2500 ppm	90.57	93.92	829.03	878.57
CD (P=0.05) Rootstock	1.50		21.51	
IBA	2.60		37.27	
Rootstock × IBA	3.68		52.71	

Table 4 : Effect of IBA application on fresh and dry weight of shoot (g) of pear rootstocks.

Treatment (IBA conc.)		Rootstock			
		Fresh weights of shoot (g)		Dry weight of shoot (g)	
		Quince-C	BA-29	Quince-C	BA-29
T_1 : Control		19.42	21.51	13.09	14.55
T_2 : 500 ppm		24.19	28.32	15.40	17.19
T_3 : 1000 ppm		31.23	35.84	18.18	22.55
T_4 : 1500 ppm		25.66	32.24	16.86	20.18
T_5 : 2000 ppm		21.38	29.55	14.32	18.00
T_6 : 2500 ppm		21.24	22.54	14.11	14.84
CD (P = 0.05)	Rootstock	0.34		0.31	
	IBA	0.59		0.53	
	Rootstock × IBA	0.84		0.76	

The numbers of graftable shoots per plant were also influenced significantly by IBA concentrations (Table 5). The highest numbers of graftable shoots per plant (7.15) were observed in Quince-C. The IBA application @ 1000 ppm showed maximum number of graftable shoots (7.15). The possible reason for this could be increased number of roots and leaves.

Table 5: Effect of IBA application on number of graftable shoots per plant of pear rootstocks

Treatment (IBA conc.)		Rootstock	
		No. of graftable plants	
		Quince-C	BA-29
T_1	Control	5.00	5.15
T_2	500 ppm	6.40	5.60
T_3	1000 ppm	7.15	6.65
T_4	1500 ppm	6.60	5.50
T_5	2000 ppm	6.00	5.60
T_6	2500 ppm	5.65	5.00
CD (P=0.05)	Rootstock	0.40	
	IBA	0.69	
	Rootstock × IBA	NS	

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