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Short communication

Stenting - A new technique for sweet cherry and pear propagation under polyhouse conditions

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ABSTRACT

Scion of sweet cherry genotypes were grafted onto non-rooted cuttings of clonal rootstock Colt as well as on rooted stock treated with different concentrations of IBA. While, scions of Baggugosha pear were grafted onto non-rooted cuttings of Quince A rootstock treated with different IBA concentrations as quick dip method. In sweet cherry, application of IBA at 5000 ppm to the non-rooted cuttings of clonal rootstocks was found to be the best treatment as it increased root formation and subsequent growth of stentlings. Stentlings attained saleble height at the end of growing season with well-developed roots. Maximum stentling height (181.8 cm) was observed in IBA application at 5000 ppm. Similarly, IBA application produced the maximum lateral shoots, internode length, root length and root number in both non-rooted and rooted stocks. Application of IBA at 5000 ppm had also resulted higher rooting and subsequent stentling growth till it attained the saleble size at the end of growing season. This technique could shorten the nursery production duration to one season, February to December under protected structures.

Key words: Auxin, pear, polyhouse, rootstock, stentling, sweet cherry.

'Stenting' is a vegetative method of plant propagation in which grafting and root formation take place simultaneously. This is a quick method of propagation in which scion is grafted onto cuttings of non-rooted rootstock and the formation of the union and adventitious roots on the rootstock occurs simultaneously. This technique is now being used worldwide for quick multiplication of pomegranate (Karimi, 6), plum (Sandhu, 9) *etc.* Recently, Hamed *et al.* (4) reported that IBA application increased the grafting success and root growth in *Ficus benjamina* var. Starlight an indoor plant when grafted onto non-rooted cuttings of *F. benjamina* var. Green Leaf.

In India sweet cherry (*Prunus avium* L.) is being multiplied on either seedling rootstocks such as Paja (*Prunus cerasoides* var. *majestica* Ingram), Mahaleb or clonal rootstocks Mazzard and Colt, which are easy-to-root, thus can be multiplied through cuttings (Chadha, 1). This conventional method of nursery production however, takes almost two years for all fruit plants to attain saleable, size, *i.e.* from seed sowing to raise seedling for grafting or budding. Thus, simultaneous rooting and grafting can be an innovative technique to reduce this duration of plant multiplication in those fruit crops where easy-to-root clonal rootstocks are available. Therefore, the present study was carried out to standardize the "stenting" method of propagation in sweet cherry and pear under polyhouse with the main objective is to reduce the nursery production duration.

The study was carried out at the Department of Horticulture, CSKHPKV, Palampur, Himachal Pradesh during 2013-14. The polyhouse was W-E oriented, equipped with exhaust fans with cooling pads. The temperature inside the polyhouse was maintained around 22 to 30^{0}C with the help of exhaust fans during summer (April-August). However, the day temperature remained 12 to 20^{0}C when the grafting was performed. The surface irrigation was applied twice in a week during summer months and once in a week during February-March. The soil was silty clay loam, slight acidic with pH 5.58. For this study non-rooted stocks of Colt (clonal) were grafted (tongue grafting) during second week of February, 2014 with scion of sweet cherry cv. CITH-I having atleast three nodes. After grafting, basal end of the stocks were treated with IBA at 2500, 3000 and 5000 ppm as quick dip method and were directly planted in well prepared nursery beds 12 cm apart. Similarly, the rooted stocks (with well-developed adventitious roots) of Colt were detached from mother stools and were grafted (tongue grafting) with same cultivar. The rooted portions were also treated with IBA at same concentration as applied in non-rooted cuttings and were planted for comparison. Similarly, the scion of pear cv. Baggugosha were grafted (tongue grafting) on non-rooted cuttings of Quince A and basal end of each stock was treated with IBA at 0 (control), 2000, 3000, 4000 and 5000 ppm as quick dip method. For each treatment, 15 non-rooted cuttings and rooted cuttings (in sweet cherry) were grafted and the treatments were replicated thrice.

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The experiment was laid out on Randomized Block Design (Factorial in cherry and simple RBD in pear). Data on bud sprout (in days), bud take (%), vegetative growth, fresh and dry weight of shoot, leaves and roots were taken as per standard methods. The data thus generated was analyzed by using DOS based software Assex at 5% level of significance.

The bud take percent and days to bud sprout in sweet cherry are presented in Table 1. Different IBA concentrations did not affect sprouting time and grafting success (bud take). However, the nature of stock used significantly affected the time taken to bud sprout and bud take. The non-rooted and rooted stocks took 13.00 and 8.67 days, respectively for bud sprout similarly, the bud take success was recorded maximum (99.45%) with rooted and 76.70 percent with non-rooted stocks. The interaction effect of IBA and rootstock was also non-significant for days to bud sprouting and grafting success, though in our study it was 99.45% with rooted and 76.70% with non-rooted stocks. The similar results were also reported by Piotr *et al*. (8) when rooted clonal rootstock Colt were grafted with sweet cherry cv. Regina recorded 86.5% bud take. Further, Janes and Pae (5) concluded that the success of bud take in sweet cherry was greatly influenced by rootstock genotype.

The overall growth of stentlings and grafted plants were taken at the end of growing season and observed that IBA and nature of stock significantly affected stentling height, internode length, number of shoots, root length and number of roots per plant (Table 1). Sweet cherry on rooted stock attained average height of 222.4 cm, whereas, on non-rooted stock, it was 163.1 cm. However, the IBA application at 5000 ppm registered maximum plant height, *i.e.* 208.1 cm and minimum (170.2 cm) was observed with IBA at 2500 ppm. The interaction effect of IBA and the nature of rootstock also significantly affected the stentling height (Table 1). Similarly, the internode length, number of shoots, root length and number roots were also significantly affected by IBA concentration, nature of rootstock used and their interaction effect in sweet cherry (Table 1). It is clear from the table that all these parameters were maximum in rooted stocks, which were treated with higher concentration of IBA, *i.e.* 5000 ppm and minimum with lower IBA concentration, *i.e*. 2500 ppm. Although, the values of all these parameters were significantly lower in non-rooted stocks but stentlings were healthy enough and produced lateral shoots with well-developed root systems. The maximum number (3.00/ stentling) of laterals was observed with IBA at 5000 ppm, which was statistically at par with 3000 ppm. Root length was maximum in IBA at 5000 ppm (69.52 cm), however, it was statistically at par with 3000 ppm (62.79 cm). In

Table 1. Effect of IBA concentration on sprouting time (days), grafting success (%) and various growth parameters in sweet cherry grafted onto rooted and non-rooted clonal rootstock Colt under polyhouse conditions.

IBA conc. (ppm)	Sprouting time (days)		Mean	Bud take (%)		Mean	Plant height (cm)		Mean	Internodal length (cm)		Mean	No. of shoots/ plant		Mean	Root length (cm)		Mean	No. of roots/ plant		Mean	Diameter above graft union (mm)		Mean	Diameter below graft union (mm)		Mean
	Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock	
2500	8.33	13.00	10.67	99.63	76.53	88.08	202.2	138.2	170.2	3.90	3.15	3.52	6.66	1.33	3.99	62.50	43.33	52.91	18.33	6.00	12.16	25.35	12.23	18.84	25.79	13.69	19.74
3000	9.00	13.00	11.00	98.72	76.35	87.53	230.7	169.2	199.9	3.99	3.50	3.75	7.00	3.00	5.00	67.25	58.33	62.79	23.33	12.33	17.83	26.96	15.07	21.01	26.53	16.81	21.67
5000	8.66	12.99	10.83	100.0	77.22	88.61	234.5	181.8	208.1	4.40	3.97	4.18	7.33	3.00	5.16	74.18	64.94	69.52	27.62	14.00	20.81	29.93	21.64	25.78	32.14	23.23	27.68
Mean	8.67	13.00		99.45	76.70		222.4	163.1		4.10	3.54		7.00	2.44		67.98	55.54		23.11	10.78		26.08	16.31		28.15	17.91	
$CD_{0.05}$																											
T (IBA)	NS			NS			14.90			0.45			1.01			7.87			4.23			1.20			1.79		
S (Rootstock)	0.60			1.47			12.72			0.31			1.24			9.75			5.63			0.98			1.46		
T × S	NS			NS			18.03			1.20			5.28			19.24			6.79			2.95			4.41		

case of the nature of rootstock used, rooted ones had the maximum root length (67.98 cm), which is obvious as when grafting was done they had well developed adventitious roots. The plants which were grafted onto rooted stocks had the maximum root number (23.11/ plant), whereas, number of roots on non-rooted stocks was found to be 10.78. Interaction of IBA and rootstock was also significant. It was found maximum (27.62/ plant) number of roots on plants which were grafted onto rooted stock of Colt. The application of IBA at 2500 ppm to the non-rooted stock recorded minimum (6.00) number of roots, while maximum number was in plants grafted onto non-rooted rootstocks. Similarly, the radial growth of the stock as well as the scion portion was also found significantly affected by IBA application and rootstock used. Initially all the stocks (rooted or non-rooted) were of same thickness but at the end of growing season, the diameter of the rootstock and scion portion (*i.e.* above and below graft union) was more in case plants on rooted stocks (Table 1). In sweet cherry, fresh and dry weight of stentlings, leaves and roots were also significantly affected by IBA treatments, stock used and their interaction (Table 2). Plants/ stentlings, which had the maximum height had more number of shoots and roots, the corresponding fresh and dry weights were also more on them (Tables 1 & 2). A comparison between IBA concentrations indicated that application of IBA at 5000 ppm resulted in increasing the fresh and dry weight of plants and their roots and leaves also. The direct rooting and grafting is a complex process since graft union must be formed before that root initiation (Karimi, 6). The IBA might have supplemented in root initiation and as synthetic and natural auxin is necessary for root formation on stem. Hamed *et al*. (4) also reported the application of IBA at 4000 and 6000 ppm for *Ficus benjamina* var. Starlight significantly increased root initiation, graft union formation and increased dry and fresh weight of roots when grafted onto non-rooted cuttings of *Ficus benjamina* var. Green Leaf.

In Baggugosha pear, IBA concentrations showed non-significant difference on bud sprout and bud take (Table 3). However, the IBA treatment significantly affected the various growth parameters (height and radial growth) of the stentlings (Table 3). IBA application at 5000 ppm resulted in maximum stentling height (52.73 cm) and minimum in untreated (14.61 cm). Similarly, internodal length (2.20 cm) and radial growth (1.42-1.74 cm) was also significantly affected by 5000 ppm IBA treatment. Similarly, the application of IBA significantly increased root length and their number (Table 3). The higher concentration of IBA resulted in the maximum root growth and number, *i.e*. the stocks treated with IBA at 5000 ppm had the maximum root length (25.74 cm) with average 52.75 roots and

Table 2. Effect of IBA concentration on fresh and dry weight of plant, leaf and root in sweet cherry grafted onto rooted and non-rooted clonal rootstock Colt under polyhouse conditions.

IBA conc. (ppm)	Fresh weight (g)		Mean	Dry weight (g)		Mean	Leaf fresh weight (g)		Mean	Leaf dry weight (g)		Mean	Root fresh weight (g)		Mean	Root dry weight (g)		Mean
	Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock		Rooted stock	Non-rooted stock	
2500	156.2	125.0	140.6	75.03	65.18	70.10	1.91	1.60	1.75	0.85	0.72	0.78	136.41	103.01	119.7	68.20	53.32	60.75
3000	180.0	140.5	160.2	85.02	71.02	78.02	1.98	1.73	1.86	0.90	0.76	0.83	144.75	116.45	130.3	75.31	61.40	68.31
5000	198.9	145.9	171.9	99.48	74.74	87.11	2.13	1.81	1.97	1.20	0.82	1.01	167.58	128.10	147.8	88.56	65.95	77.25
Mean	178.3	137.1		86.51	70.31		2.00	1.71		0.98	0.77		115.72	149.5		60.19	77.35	
$CD_{0.05}$																		
T (IBA)		4.71			4.12			0.13			0.06			4.36			4.30	
S (Rootstock)		3.84			3.56			0.10			0.03			3.56			3.51	
T × S		11.76			10.08			0.31			0.17			8.91			7.23	

Table 3. Effect of IBA concentration on bud take, sprouting time and growth parameters in pear cv. Bagugosha grafted onto non-rooted cuttings of clonal stock Quince A under polyhouse conditions.

IBA conc. (ppm)	Bud take (%)	Sprouting (days)	Stentling height (cm)	Internode length (cm)	Radial growth (cm)		Root length (cm)	No. of roots / stentling	Shoot weight		Root weight	
					Above graft union	Below union			Fresh weight (g)	Dry weight (g)	Fresh weight (g)	Dry weight (g)
2500	20.48	14.67	14.61	0.93	0.72	0.94	6.99	11.25	13.78	7.07	13.28	9.54
3000	19.90	14.00	26.94	1.18	0.88	1.00	10.24	32.25	14.94	9.82	13.92	10.25
5000	20.97	14.67	31.96	1.75	0.97	1.09	14.38	40.75	25.42	11.45	16.92	12.39
Mean	19.96	15.00	36.53	2.01	1.08	1.54	20.81	46.00	29.23	14.96	19.00	14.53
2500	20.13	15.33	52.73	2.20	1.42	1.74	25.74	52.75	33.80	18.63	22.55	17.71
$CD_{0.05}$	NS	NS	2.08	0.084	0.084	0.051	2.74	2.85	0.63	0.42	0.43	0.41

minimum was recorded in control (6.99 cm and 11.25 roots/ stentling). Like in this study the role of auxin in inducing rooting and root growth in hardwood cuttings has also been demonstrated by Necas and Kosina (7) who concluded that the application of IBA to cuttings of pear rootstock significantly increased callusing and root growth. Dvin *et al*. (2) also reported similar observation when the cuttings of clonal rootstocks of apple were treated with IBA. The application of IBA to the non-rooted stocks (Quince A) significantly affected fresh and dry weights of shoot and root (Table 3). It is clear from the data that like in sweet cherry, Baggugosha pear stentlings, also had the maximum height and dry mass as compared to stentlings.

From the present study, it can be concluded that stenting technique of propagation can be practiced on both sweet cherry and pear clonal rootstocks (Colt and Quince A) since both responded well to this technique. There was simultaneous rooting and healing of graft union with proper growth and development of stentlings when the stocks were treated with IBA. In cuttings of cherry stock the bud take percent was quite high but in Quince A it was bit less, however, the stentlings, which have developed root system along with graft union formation the growth was promising and attained maximum height (181.8 and 53.71 cm) at the end of growing season. Further, this technique needs to standardize the ideal IBA concentration and best time of grafting in open field conditions also.

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