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RHIZOGENESIS IN WEST INDIAN CHERRY UNDER GODAVARI ZONE OF ANDHRA PRADESH, INDIA

Goudappa T. Patil, A. V. D. Dorajeerao, V. Sudhavani and D. R. S. Salomi Suneetha

College of Horticulture, Venkataramannagudem, West Godavari District - 534 101 (Andhra Pradesh), India.

Abstract

In an investigation to attempt for propagation of West Indian cherry through cuttings, it was observed that the root and shoot parameters were significantly influenced by month of planting, type of cuttings, IBA concentration as well as their interactions at 90 days after the planting. Percentage of rooted cuttings, length of longest root, leaf area per cutting and survival percentage was recorded maximum in those cuttings planted in the month of July and treated with IBA at the rate of 3000 ppm belonging to hard wood type. Delayed planting late in the month of October and treatment of IBA at 1500 ppm as well as semi hard wood type cuttings exhibited the minimum survival.

Key words : Cuttings, IBA, West Indian cherry.

Introduction

The West Indian cherry (*Malpighia puncifolia* L.) is a tropical fruit-bearing shrub or small tree in the family Malpighiaceae. The fruit is commonly known as Acerola, Barbados cherry and West Indian cherry. Acerola is native from South of Mexico, Central and South America, but now it is also grown in the regions as far north as Texas and in sub-tropical areas of Asia and India. In India, it is widely grown in coastal regions of the country. It is successfully grown in tropical and subtropical areas and naturally adapted to both medium and low rainfall regions. The crop is known for its ability to tolerate long periods of drought. The cherry is a large, densely branched shrub or a small tree with slender branches and shiny light to deep green leaves that vary in size from one to three inches and ovate in shape. Flowers are small, attractive in colour ranging from pale pink to rose. The fruits are soft, juicy, thin skinned and are light to deep crimson coloured when mature. The three-lobed fruits are borne on leaf axils, singly or in clusters of two or three. The flesh is yellowish orange and is a rich source of vitamin C (ascorbic acid), proteins and minerals. In Andhra Pradesh very few West Indian cherry plantations are available with known sources of planting material, on account of deficiency of suitable and popular method of propagation. Vegetative propagation in West Indian cherry is utmost desirable in order to propagate true-to-type plants. West Indian cherry can be propagated by air – layering, cleft or modified crown grafting but the most common method of propagation is by stem cutting. Propagation of this crop by stem cuttings is known to give a well-developed and strong frame work in considerably less time. This type of vegetative propagation is inexpensive, rapid and simple and does not require the special techniques as in case other methods.

Materials and Methods

A study on rhizogenesis in West Indian cherry. (*Malpighia puncifolia* L.) was carried out during 2015-2016 at Horticulture College and Research Institute, Dr. Y.S.R. Horticultural University, Venkataramannagudem, West Godavari District, Andhra Pradesh, India. The experiment was laid out in factorial completely randomized design with three factors *viz*., month of planting (4 levels), type of cutting (2 levels) and IBA concentration (2 levels), making sixteen treatment combinations, which were replicated thrice. Semihard wood and hard wood cuttings were planted during the months of July, August, September and October after treating with IBA at 1500 ppm and 3000 ppm levels. After the treatment with IBA the cuttings were planted in the normal potting mixture consisting of soil, sand and FYM in 2:1:1 proportion and the observations on various parameters were recorded as presented below.

Results and Discussion

Percentage of rooted cuttings (%)

The percentage of rooted cuttings was significantly influenced by month, type of cutting, IBA concentration as well as their interactions at 90 days after planting the cuttings (table 1 and fig. 1). At 90 DAP the July planted cuttings were found to record maximum percentage of rooting (58.36%) on par with those cuttings planted in August (54.28%). The minimum percentage of rooting was observed in the cuttings planted during the month of October (35.86%).

The hard wood cuttings showed significantly higher percentage of rooting (50.91%) whereas the semi hard wood cuttings recorded minimum percentage of rooting (46.50%). Among IBA treatments, IBA at 3000 ppm performed best with 50.32 per cent rooted cuttings as compared to the application of IBA at 1500 ppm (47.09%)

Length of longest root (cm)

Significant influence of month, type of cuttings and IBA concentration was observed on length of longest root (table 2) in West Indian cherry cuttings at 90 DAP. The cuttings planted in the month of July were found to record the maximum length of longest root (23.58 cm) on par with August (22.46 cm). Minimum length of longest root (16.51 cm) was observed in October planted cuttings. Hardwood cuttings showed significantly higher maximum length of root (20.86 cm) as compared to semi hardwood cuttings recorded root length (20.01 cm).

Among IBA treatments, the concentration of 3000 ppm performed best with the highest value (21.13 cm) of longest root length as compared to the same treatment at lower concentration of 1500 ppm IBA (19.75 cm).

Leaf area per cuttings (cm^2)

In the present investigation, month of planting, types of cutting and IBA concentration as well as their interactions have significantly influenced the leaf area per cutting (table 3). The mean leaf area was only 63.40 cm^2 at 30 DAP and it grew up to 597.58 cm^2 at 90 DAP.

The cuttings planted in the month July showed significantly maximum leaf area per cutting (741.72 cm^2) at 90 DAP, which was on par with the cuttings planted in the month of August (649.71 cm^2) and significantly minimum (464.59 cm^2) leaf area was recorded by the cuttings planted in the month of October. Hardwood cuttings showed the maximum leaf area (635.71 cm^2) whereas the minimum leaf area was recorded in semi hardwood cuttings (559.44 cm^2). Significantly the highest leaf area per cutting (616.77 cm^2) was noticed in the cuttings treated with IBA 3000 ppm as compared to the cuttings treated with IBA 1500 ppm (578.39 cm^2).

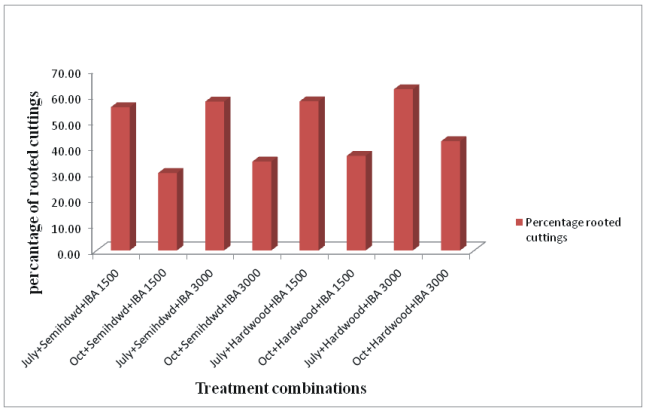

Fig. 1 : Effect of time, type of cuttings and IBA concentration on percentage of rooted cuttings in West Indian cherry at 90 DAP.

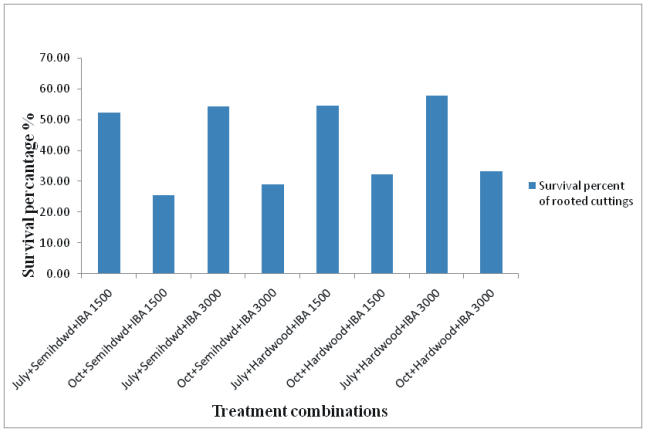

Fig. 2 : Effect of time, type of cuttings and IBA concentration on survival percentage of rooted cuttings (%) in West Indian cherry at 90 DAP.

The cuttings treated with IBA 3000 ppm recorded the highest leaf area than the cuttings treated with IBA 1500 ppm. Production of high number of roots and also shoots as well sustaining them over a period of time between 30 and 90 days after planting of cutting is indicative that energy metabolism is active in such cuttings. Nutrient uptake with healthy and strong root system could have led to expanded leaf area under successful cuttings (Ismail and Asghar, 2007). This in turn could have boosted the rate of photosynthesis gaining much more stronger position to nurture the growing leaves and expanding them leading to a maximum leaf area per cutting.

These results are in accordance with Pinheiro *et al.* (1971), Bhat *et al.* (2004) in pomegranate and Khayyat *et al.* (2007) in pothos.

Survival percentage of rooted cuttings (%)

There were significant differences in respect of survival percentage of rooted cuttings among the different

Table 1 : Percentage of rooted cuttings as influenced by time, type of cutting and IBA concentration in west Indian cherry (at 90 DAP).

Type of cutting (B)	IBA Concentration (C)	Month of Planting (A)				
		July	**August**	**September**	**October**	**Mean**
Semi hard wood	1500 ppm	55.55	51.33	44.44	30.00	**45.33**
	3000 ppm	57.66	52.22	46.33	34.44	**47.66**
	Mean	**56.61**	**51.78**	**45.39**	**32.22**	**46.50**
Hard wood	1500 ppm	57.77	55.33	45.66	36.66	**48.86**
	3000 ppm	62.44	58.22	48.88	42.33	**52.97**
	Mean	**60.11**	**56.78**	**47.27**	**39.50**	**50.91**
For comparing month of planting (A) and IBA concentration(C)						
1500 ppm		56.66	53.33	45.05	33.33	**47.09**
3000 ppm		60.05	55.22	47.61	38.39	**50.32**
Mean		**58.36**	**54.28**	**46.33**	**35.86**	**48.70**

Comparing means of	SE(m)	C.D
A	1.65	5.05
B	0.52	1.59
C	0.38	1.16
A x B	2.06	6.31
B x C	0.86	2.61
A x C	1.93	5.90
A x B x C	2.42	7.41

Table 2 : Length of longest root per cutting (cm) as influenced by time, type of cutting and IBA concentration in west Indian cherry (at 90 DAP).

Type of cutting (B)	IBA Concentration (C)	Month of Planting (A)				
		July	**August**	**September**	**October**	**Mean**
Semi hard wood	1500 ppm	22.03	20.25	18.14	16.67	**19.27**
	3000 ppm	24.53	22.93	18.73	16.83	**20.76**
	Mean	**23.28**	**21.59**	**18.44**	**16.75**	**20.01**
Hard wood	1500 ppm	23.06	22.85	19.53	15.46	**20.23**
	3000 ppm	24.68	23.80	20.46	17.06	**21.50**
	Mean	23.87	23.33	20.00	16.26	**20.86**
For comparing month of planting (A) and IBA concentration(C)						
1500 ppm		22.545	21.55	18.84	16.07	**19.75**
3000 ppm		24.61	23.37	19.60	16.95	**21.13**
Mean		**23.58**	**22.46**	**19.22**	**16.51**	**20.44**

Comparing means of	SE(m)	C.D
A	0.53	1.63
B	0.10	0.31
C	0.16	0.50
A x B	0.60	1.84
B x C	0.25	0.76
A x C	0.66	2.02
A x B x C	0.76	2.31

Table 3 : Leaf area per cuttings (cm^2) as influenced by time, type of cuttings and IBA concentration in West Indian Cherry at 90 DAP.

Type of cutting (B)	IBA Concentration (C)	Month of Planting (A)														
		30 DAP					60 DAP					90 DAP				
		Jul.	Aug.	Sep.	Oct.	Mean	Jul.	Aug.	Sep.	Oct.	Mean	Jul.	Aug.	Sep.	Oct.	Mean
Semi hard wood	1500 ppm	62.56	61.94	62.87	62.56	**62.48**	312.77	309.32	186.14	145.53	**238.44**	708.28	604.26	461.60	386.40	**540.14**
	3000 ppm	64.72	65.03	65.81	65.81	**65.34**	318.73	308.90	218.86	175.16	**255.41**	721.80	613.26	519.60	460.34	**578.75**
	Mean	**63.64**	**63.48**	**64.34**	**64.18**	**63.91**	**315.75**	**309.11**	**202.50**	**160.34**	**246.92**	**715.04**	**608.76**	**490.60**	**423.37**	**559.44**
Hard wood	1500 ppm	61.63	61.94	64.26	64.26	**63.02**	334.56	335.62	247.81	201.38	**279.84**	756.56	668.90	550.25	490.86	**616.64**
	3000 ppm	61.16	63.48	65.03	61.32	**62.75**	376.20	375.67	288.21	214.61	**313.67**	780.23	712.43	605.73	520.74	**654.78**
	Mean	**61.39**	**62.71**	**64.65**	**62.79**	**62.88**	**355.38**	**355.64**	**268.01**	**207.99**	**296.76**	**768.40**	**690.67**	**577.99**	**505.80**	**635.71**
For comparing month of planting (A) and IBA concentration(C)																
1500 ppm		62.09	61.94	63.56	63.41	**62.75**	323.66	322.47	216.98	173.45	**259.14**	732.42	636.58	505.93	438.63	**578.39**
3000 ppm		62.94	64.26	65.42	63.56	**64.05**	347.46	342.28	253.53	194.88	**284.54**	751.02	662.85	562.67	490.54	**616.77**
Mean		**62.52**	**63.10**	**64.49**	**63.48**	**63.40**	**335.56**	**332.38**	**235.26**	**184.17**	**271.84**	**741.72**	**649.71**	**534.30**	**464.59**	**597.58**
Comparing means of		SE(m)		C.D			SE(m)		C.D			SE(m)		C.D		
	A	0.55		NS			12.45		38.05			20.45		62.49		
	B	0.48		NS			5.87		17.94			8.99		27.46		
	C	0.61		NS			2.99		9.15			4.52		13.82		
	A x B	0.99		NS			17.41		53.19			27.97		85.46		
	B x C	1.04		NS			8.42		25.73			12.84		39.22		
	A x C	1.11		NS			14.67		44.84			23.73		72.50		
	A x B x C	1.57		NS			20.25		61.88			32.27		98.58		

months, type of cuttings and IBA concentrations at 90 DAP in West Indian cherry (table 4 and fig. 2).

The cuttings planted in the month of July were found to have maximum survival percentage of rooted cuttings (54.67%) on par with August (52.10%) whereas, the minimum percentage of rooting (30.00%) was observed in October month. The hard wood cuttings showed the best survival percentage of rooting (47.55%) compared to those semi hardwood cuttings (44.00%). Similarly, cuttings treated with IBA at 3000 ppm recorded the highest survival percentage (46.74%) as compared to those treated by IBA at 1500 ppm (44.81%).

The superior performance of July planted cuttings can be attributed to the fact that the ability to produce callus, parenchyma and to differentiate the vascular systems with respect to the prevailing season of operation, that might ultimately influence the bud sprouting and their eventual growth as well as survival. Initially, there was a lesser values of shoot sprouts, leaves etc in the July planted and hard wood cuttings, but they were sustained without mortality till the end of their polybag life. On the other hand, the initial surge on shoot sprouts was not balanced with root growth in the other treatments. Thus, the hard wood cuttings planted in July were more successful in achieving the highest survival percentage.

There were warm and humid conditions after July month prevailing up to September. The rainy days and quantum of rainfall was significantly more during the period from July to September and therefore humidity was also maintained at high level. Since the

Table 4 : Survival percentage of rooted cuttings as influenced by time, type of cuttings and IBA concentration in West Indian Cherry (90 DAP).

Type of cutting (B)	IBA Concentration (C)	Month of Planting (A)				
		July	**August**	**September**	**October**	**Mean**
Semi hard wood	1500 ppm	52.22	50.00	44.60	25.55	**43.09**
	3000 ppm	54.26	51.20	45.30	28.88	**44.91**
	Mean	**53.24**	**50.60**	**44.95**	**27.22**	**44.00**
Hard wood	1500 ppm	54.44	52.66	46.80	32.22	**46.53**
	3000 ppm	57.77	54.55	48.66	33.33	**48.58**
	Mean	**56.11**	**53.61**	**47.73**	**32.78**	**47.55**
For comparing month of planting (A) and IBA concentration(C)						
1500 ppm		53.33	51.33	45.70	28.89	**44.81**
3000 ppm		56.02	52.88	46.98	31.11	**46.74**
Mean		**54.67**	**52.10**	**46.34**	**30.00**	**45.78**

Comparing means of	SE(m)	C.D
A	1.85	5.64
B	0.42	1.28
C	0.23	0.70
A x B	2.15	6.58
B x C	0.61	1.88
A x C	1.97	6.02
A x B x C	2.37	7.24

experiment was conducted under shade net the temperatures were not very harsh as in open conditions. Thus, the prevailing weather parameters might be congenial for callus formation and further sustenance of the sprouted shoots so as to have maximum success. During and after the month of October, the humidity was in a decreasing trend and also the ambient temperatures exhibited lower values which could have not supported proper formation of root primordial and their nourishment for sustained growth.

Similar results were reported by Bharad *et al.* (1999) in Tamarind. Temperature, relative humidity, bright sunshine has exhibited moderately correlation related to survival percentage of rooted cuttings but in negative direction. A better auxin concentration favoured good growth of roots as well shoots. The performance of IBA at 3000 ppm appeared to have favoured good root as well as shoot growth.

The possible explanation to these findings lies in better development of root systems with more number of roots, greater root length, fresh and dry weight of roots might have enabled the rooted cuttings to survive till the end in the polybag study thereby recording the highest survival. These findings are supported by Navaneetha *et al.* (1991), Sun and Bassuk (1991), Pratima and Rana (2014) and Sivudu *et al.* (2014).

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