J Krishi Vigyan 2023, 11 (Supple) : 51-54 DOI : 10.5958/2349-4433.2023.00084.3

Effect of Environment and Growth Regulators on Rooting of Cuttings in Cocoa (*Theobroma cacao* L.)

V Jegadeeswari*, B Senthamizh Selvi, M Mohanalakshmi and K R Vijayalatha
Dept. of Fruit Science, Horticulture College and Research Institute for Women
Tamil Nadu Agricultural University, Tiruchirappalli – 620 027, India.

ABSTRACT

Cocoa is one of the important beverage crops showed variability in seed propagation owing to its self-incompatibility. Hence, vegetative propagation method through cutting was attempted with different environments to produce genetically uniform planting materials. Out of various treatment combinations tried, the plagiotropic shoots treated with IBA 7500 ppm and kept under automated mist chamber condition recorded early sprout initiation 13.27 days and more sprouting (28 %) and rooting percentage (50.50 %).

Key Words: Cocoa, vegetative propagation, environment, cuttings, growth regulators.

INTRODUCTION

Cocoa (*Theobroma cacao* L.) belonging to the family 'Malvaceae' is one of the world's most important perennial crop, explored exclusively for chocolate manufacturing. It is third important beverage crop in the world, next to tea and coffee. In India, cocoa is largely multiplied through seed and seedlings are used as the planting material. As it is a highly cross pollinated and heterozygous crop the seedling progenies exhibit higher variability. This prompts to resort to propagation of high yielding superior trees. Among the three vegetative propagation methods, stem cutting is the simplest one.

Rooting of cuttings can be easily achieved under mist chamber wherein, relative humidity is maintained artificially at high level which facilitates better root initiation and cooling effect prevents the cutting from drying out. This method results in faster rooting of the cuttings, create optimum microclimate for better root initiation and development and higher success rate in propagation of cuttings. Temperature and humidity control in the mist chamber is affected through automated control systems. IBA-derived auxin has strong roles in various aspects of root development, including regulation of root apical meristem size, root hair elongation, lateral root development and formation of adventitious roots. Hence, in the present study, the different concentration of IBA was used to treat the cuttings and the same cuttings were subjected for two environments to have better results.

MATERIALS AND METHODS

The investigation was undertaken at Department of Spices and Plantation crops, TNAU, Coimbatore to analyse the performance of cuttings treated with the growth regulator at different concentrations in two environment conditions. The experimental design adopted was CRD with three replications

Preparation of Cuttings

Procuring of semi hard wood plagiotropic scion shoots from well grown identified healthy mother plants was done and the scions were collected after a week. Scions of (0.8-1.0 cm diameter) were given a slant cut at the base and the leaf lamina at 1/3 of their original size. Four leaves were retained and two leaves were removed from the base of the long cuttings for inserting into the rooting media.

Corresponding Author's Email: jegadeeswari.v@tnau.ac.in

Environment

At TNAU, Coimbatore, fully automated mist chamber (E_2) was used for the assessment of the rooting ability of the cuttings. The dimension of mist chamber was 40 × 10 ft and was covered with 200 guage of UV stabilized poly sheets. In automated mist chamber the misting was set from 7.00 AM to 5.00 PM at 1 minute mist for every 10 minutes, thus having 61cycles/ day for maintaining 90 % relative humidity. At Cocoa nursery, Anaimalai, mini poly tunnel (E_1) was constructed using the locally available raw materials and was covered with 200 gauge transparent polythene sheet. One side of the tunnel was sealed while the other side was temporarily sealed and could be opened for observation. The micro climate was maintained such that to ensure 100 per cent relative humidity and good light penetration and gas diffusion. Watering was given once in three days and the rooting ability of the cuttings was assessed.

Growth regulator

Different IBA concentrations *viz.,* 5000 ppm (G_1), 7500 ppm (G_2) and 10000 ppm (G_3) were used for rooting of cuttings. Growth regulator solutions were prepared by dissolving 5 g, 7.5g and 10g of the powder in 50 per cent ethanol and made upto 1 litre. Quick dip method was followed by dipping the base of cuttings 1-1.5 cm in the growth regulator solution for 10 seconds. The potting mixture consisted of

Table. 1 Effect of environment and growth regulators on shoot characters

Treatment		Shoot characters			
		No. of days taken for sprouting	Shooting percentage (%)	Fresh weight of shoots (g)	Dry weight of sprouts (g)
E_1	G_1	16.34	7.00	3.78	1.58
	G_2	14.37	15.50	7.50	2.95
	G_3	16.73	8.50	3.95	1.78
Mean		15.82	10.33	5.08	2.10
E_2	G_1	Nil	Nil	Nil	Nil
	G_2	13.27	28.00	1.56	0.73
	G_3	16.02	12.00	1.44	0.58
Mean		13.65	13.33	1.00	0.43

	Interactions	E	G	E×G
No. of days taken for sprouting	SE(d)	0.51	0.63	0.88
	CD (P=0.05)	1.11**	1.36**	1.93**
Sprouting percentage	SE(d)	1.15	1.41	1.99
	CD (P=0.05)	2.50*	3.06**	4.33**
Fresh weight of shoots (g)	SE(d)	0.38	0.47	0.67
	CD (P=0.05)	0.84**	1.02**	1.44**
Dry weight of sprouts (g)	SE(d)	0.19	0.24	NS
	CD (P=0.05)	0.43**	0.52**	-
NS - non significant, * - Significant, ** - highly significant				
E_1 - Mini poly tunnel E_2 - Automated mist chamber		G_1 - IBA 5000ppm G_2 - IBA 7500ppm G_3 - IBA 10000ppm		

sand, red soil and well decomposed FYM in the ratio of 1:2:1 were used as rooting media.

RESULTS AND DISCUSSION

The effect of environment and different concentration of growth regulator on rooting ability of cocoa cuttings from plagiotropic shoots was assessed in mini poly tunnel and automated mist chamber.

Sprout parameters such as number of days for sprout initiation, percentage of sprouting, fresh and dry weight of shoot were recorded. The cuttings recorded better performance under automated mist chamber condition as sprout initiation was early (13.65 days) and the sprouting percentage was also high (13.33%). Miller (2000) also reported that single and few node cuttings efficiently rooted under intermittent fog and the success percent was 68 to 74 %. The reason for successful rooting in automated mist chamber may be due to maintenance of 100% relative humidity, 12-15% of actual sunlight and temperature not exceeding 30^0 C. Similarly, Amitha Kunikullaya (2014) reported success under polythene sheet. The reason could be that the value of polythene sheet in rooting of cutting lies in its ability to conserve moisture while allowing diffusion of gases.

Among the growth regulators applied IBA 7500ppm (G_2) was found to be highly effective in producing higher fresh and dry weight (7.50g and 2.95g respectively) of shoots and roots (4.88 and 3.35g respectively). High shooting percentage

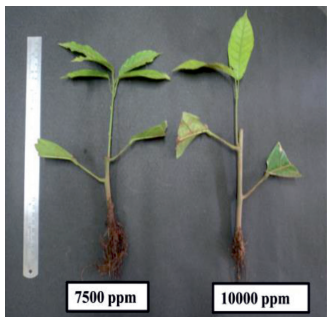
Table. 2 Effect of environment and growth regulators on rooting of cocoa cuttings

Treatment		Root characters		
		Rooting percentage (%)	Fresh weight of Roots (g)	Dry weight of Roots (g)
E_1	G_1	5.50	3.00	2.53
	G_2	10.00	4.88	3.35
	G_3	7.50	3.53	1.78
Mean		7.67	3.80	2.22
E_2	G_1	Nil	Nil	Nil
	G_2	50.50	2.93	1.30
	G_3	8.00	1.22	0.38
Mean		19.50	1.38	0.56

	Interactions	E	G	E×G
Rooting %	SE(d)	1.20	1.47	2.08
	CD (P=0.05)	2.61**	3.19**	4.52**
Fresh weight of roots	SE(d)	0.29	0.36	NS
	CD (P=0.05)	0.64**	0.78**	
Dry weight of roots	SE(d)	0.21	0.26	NS
	CD (P=0.05)	0.46**	0.56**	
NS - non significant, * - Significant, ** - highly significant				
E_1 - Mini poly tunnel E_2 - Automated mist chamber		G_1 - IBA 5000ppm G_2 - IBA 7500ppm G_3 - IBA 10000ppm		

Mini Polytunnel

Automated Mist Chamber



Performance of cuttings at different growth regulator combination maintained under automated mist chamber

(28%), early sprout initiation (13.27 days) and high rooting percentage (50.50%) was also observed in the cuttings treated with IBA 7500 ppm. IBA is still probably the best hormone for general use as it is non-toxic to plants over a wide range of concentration levels (Hartmann *et al,* 1990). The increase in concentration of IBA influence the activity of the vacular cambium in the stem and induce the formation of a larger number of adventurous roots in the stem cuttings. IBA induces more roots and greater length of roots was due to higher levels of IBA (Rout, 2006).

The interaction between environment and growth regulators was highly significant in this study and found that minimum number of days taken for sprouting (13.27 days) and high shooting percentage (28%) was under automated mist chamber in the cuttings treated with 7500 ppm, whereas fresh (7.50 g) and dry weight (2.95g) was maximum in mini poly tunnel condition in the cuttings treated with IBA 7500 ppm. Among the root parameters rooting percentage was high under automated mist chamber with IBA 7500 ppm (50.50%), while high fresh dry weight of root was recorded under mini poly tunnel condition with IBA 7500 ppm (4.88 g & 3.35g).

CONCLUSION

The effect of environment and different concentration of growth regulator on rooting ability of cocoa cuttings from plagiotropic shoots was assessed in mini poly tunnel and automated mist chamber. The interaction between environment and growth regulators was highly significant in this study and it was found that minimum number of days taken for sprouting (13.27 days) and high shooting percentage (28%) and the rooting percentage was high under automated mist chamber with IBA 7500 ppm (50.50%). Though the success percentage was low, this technology can be adopted for germplasm multiplication and maintenance as it avoids the rootstock sprouts.

REFERENCES

Amitha Kunikullaya G (2014). *Standardization of vegetative propagation of cocoa through cuttings.* M.Sc. (Hort.) Thesis submitted to Tamil Nadu agricultural University, Coimbatore

Rout G R (2006). Effect of auxins on adventitious root development from single node cuttings of Camellia sinensis (L.) Kuntze and associated biochemical changes. *Pl Growth Reg* 48:111-117.

Hartmann H T, Kester D E and Davies F T (1990). *Plant Propagation: Principles and Practices.* 5th Edition. Prentice-Hall, Englewood Cliffs, New Jersey.

Miller C (2000). *An integrated in vitro and greenhouse orthotropic clonal propagation system for Theobroma cacao* L. M.Sc. Thesis, The Pennsylvania State University.

Received on 12/9/2023 Accepted on 18/11/2023