Influence of Appropriate Age of Seedlings and Suitable Plant Growth Regulator to Sustain Transplanting Shock in Simarouba Seeds (*Simarouba glauca* DC.)

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Abstract - The present investigation entitled "Influence of appropriate age of seedlings and suitable plant growth regulator to sustain transplanting shock in simarouba seeds (Simarouba glauca DC.)" was carried out during kharif 2014-15 at Agricultural Research Station, Hanumanamatti, Haveri (Dist.). The pot experiment consisted of two factors having four levels of age of seedling for transplanting (A) as factor - I and three levels of growth regulator spray (G) as factor-II with overall 12 treatment combinations replicated four times were tested for seedling height, number of leaves per branch, number of branches per seedling and seedling mortality. Among the age of seedlings significantly maximum seedling height (14.70 cm and 15.37 cm), number of leaves per branch of 15.10 and 17.08 and number of branches per seedling of 8.26 and 9.05 before and after transplanting respectively were recorded by 100 days old seedling (A_4) with minimum seedling mortality of 2.38 per cent. Among the growth regulators, maximum of 13.54 and 13.90 cm seedling height, 14.10 and 15.91 number of leaves per branch and 7.80 and 8.20 number of branches per seedling were recorded by GA_3 50 ppm concentration (G_1) before and after transplanting respectively with minimum seedling mortality of 4.02 per cent.

Keywords: Growth regulator, Age of seedlings, Seedling mortality.

I. INTRODUCTION

Simarouba (*Simarouba glauca* DC.) belongs to family Simaroubaceae. It is an ever green multipurpose tree, native of EL Salvador, Central America. National Bureau of Plant Genetic Resources first introduced it in 1960's to India and was grown in Research Station at Amravathi, Maharashtra. This was brought to the University of Agricultural Sciences, Bangalore in 1986 and systematic research and developmental activities began from 1992 onwards exclusively for soil conservation purpose especially earmarked for waste lands, bald hills and degraded lands. In recent years, it has attained greater importance in terms of its potential for edible oil, industrial vegetable oil and biofuel production. It is a versatile oil tree with productivity potential as high as 2000 kg edible oil per hectare per year with ability to establish well even in marginal and wastelands (Syamasundar and Hiremath, 2001).

Major problem in forestry seeds is the poor establishment of seedlings. Some trees produce seeds once in a life time, having dormancy and uneven emergence of seedlings, as these are an essential prerequisite for increased survival and quality in nursery. The main goal of nurseries is to produce quality seedlings with target morphological and physiological features that guarantee crop success after transplanting. Increasingly, nursery stock is produced in containers due to market demands and numerous production advantages including greater production per unit surface, faster plant growth, higher plant quality and lack of dependence on arable land.

Simarouba glauca DCseeds have hard seed coat physical dormancy and hence exhibit poor germination. Even fresh seeds have germination problems as only 60 per cent of seeds are able to produce normal seedlings. Propagation is mainly through seeds and like other oil seeds these seeds can be stored only for a limited period. Dipping of nursery raised seedling roots in different growth regulators (Gibberillic acid, NAA and 2, 4-D) before transplanting to improve the seedling establishment and reduce the seedling mortality is a common practice in many crops. It has been widely demonstrated that extremely minute concentrations of plant growth substances have the potential to regulate several phases of plant growth and development spanning from seed germination, plant growth, flowering, fruiting and seed formation through senescence and development. Growth regulators stimulate and promote seed germination in a wide variety of tree crops.

The non-availability of proper nursery management technique in some forest tree species is the main problem in establishing good planting material. So, in the present study, it is planned to find out the suitable appropriate age of seedlings and suitable plant growth regulator to sustain transplanting shock in simarouba seeds.

II. MATERIAL AND METHODS

Experiment was undertaken at Biofuel Information and Demonstration Centre (BIDC), College of Agriculture, Hanumanamatti, Haveri, Dist. Karnataka state during 2014-2015 to study the appropriate age of seedlings and suitable plant growth regulator to sustain transplanting shock in simarouba seeds (*Simarouba glauca* DC.).The experiment was laid out as pot culture experiment under Factorial Randomized Complete Block Design (RCBD) with two factors.The pot experiment consisted of two factors having four levels of age of seedling for transplanting (A) as factor-I and three levels of growth regulator dipping (G) as factor-II with overall 12 treatment combinations replicated three times as detailed below.Factor 1: Age of seedling for transplanting (A)A_1:70 days old seedling, A_2:80 days old seedling, A_3:90 days old seedling, and A_4:100 days old seedling. Factor 2: Growth regulator dipping (G), G_1: GA_3 @ 50 ppm, G_2: NAA @ 40 ppm, and G_3: 2-4 D @ 2 ppm. Treatment combination:T_1- A_1G_1, T_2- A_1G_2, T_3- A_1G_3, T_4- A_2G_1, T_5- A_2G_2, T_6- A_2G_3, T_7- A_3G_1, T_8- A_3G_2, T_9- A_3G_3, T_{10}- A_4G_1, T_{11}- $A_4G_2$and T_{12}- A_4G_3.

Seedlings were raised in polythene bags as per the requirement of treatments and the observations on seedling height, number of leaves per branch, number of branches per seedling and seedling mortality were recorded.The data were subjected to the analysis of variance by adopting the appropriate methods as outlined by Panse and Sukhatme (1978) and Sundararajet *al.* (1972). The critical difference were calculated at five per cent level of significance whenever `F` test was significant.

RESULTS AND DISCUSSION

Influence of appropriate age of seedlings and suitable plant growth regulator to sustain transplanting shock on seedling height (Table 1), number of leaves per branch (Table 2), number of branches per seedling (Table 3) and seedling mortality (Table 4) in simarouba.

In the present investigation, 100 days old seedling (A_4) recorded significantly maximum seedling height of 14.70cm and 15.37cm, number of leaves per branch of 15.10 and 17.08 and number of branches per seedling of 8.26 and 9.05 before and after transplanting respectively and with lesser seedling mortality of 2.38 per cent after transplanting. This may be because the younger seedlings were susceptible to transplanting shock which is evident from the observation on higher seedling mortality of 6.84 per cent recorded by 70 days old seedling while seedling mortality was less in 100 days old seedling hence it showed better performance compared to others. The present results are in agreement with the findings of Radomiljac (1998) wherein he reported that 17 weeks older seedlings and supplementary nursery nutrition gave higher levels of *Santalum album* field survival and final height was significantly greater with increased nursery seedling age. Further, Zidaet *al.* (2008) also reported that older seedlings (nine months) were morphologically distinct from younger ones (three months), particularly in the case of *Pterocarpuserinaceus*.

Growth regulators GA_3 50ppm concentration (G_1) recorded maximum 13.54cm and 13.90cm seedling height, 14.10 and 15.91 numbers of leaves per branch and 7.80 and 8.20 number of branches per seedling, before and after transplanting respectively and with lesser seedling mortality of 4.02 per cent, after transplanting. It may be due to Gibberellic acid affect growth by its effect on cell growth and cell elongation and such effects are often seen in stem growth as well as root growth. Stem and inter nodal lengths can be increased and better more extensive root systems develop. Increases in cell division can also sometimes be seen in the production of large leaves. GA leads to bigger plants with bigger shoots and leaves in many plants.

The present results are in agreement with the findings of Heidmann (1982) in southwestern ponderosa pine seedlings due to the application of selected naturally occurring and synthetic plant growth regulators applied as a root soak to revealed that only gibberellins (GA_3 and $GA_{4/7}$) significantly increased seedling height while, the effect of gibberellins on root growth was variable. Further Manjunathaet *al.* (2005) in a study to accelerate the early growth and to produce vigorous and sturdy seedlings of rattans, they applied gibberellic acid, an endogenous growth hormone, exogenously to the seedlings of rattans for 3 months at intervals of one week at concentrations of 200 and 300 ppm. The per cent increase in clump height and dry weight in GA treated seedlings was to the extent of 50 - 80 per cent, because gibberellins promotes cell division in the shoot apex especially in the basal meristematic cells from which long files of cortex and pith cells develop leading to the rapid stem growth.

The interaction effect between age of seedling and growth regulator was non significant. However 100days old seedling with GA_3 at 50ppm concentration (A_4G_1) and 70days old seedling with 2,4-D at 2ppm (A_1G_3) recorded numerically more and less values on seedling height, number of leaves per branch, number of branches per seedling respectively and seedling mortality.

III. CONCLUSION

Application of growth regulator GA_3 at 50 ppm to 100 days aged seedling helps in establishment of quality seedling with better morphological and physiological character by reducing transplanting shock in simarouba.

REFERENCES

[1] Heidmann, L. J., Effect of selected natural and synthetic growth regulators on the growth of ponderosa pine seedlings. *Forest Sci*., 28: 1982, pp.156-160.

[2] Manjunath, K.C., Suresh babu, D.K., Mohan raju, B., Devakumar, A.S. and Uma shanker, R., Growth response of rattons seedlings to gibberellic acid. *Ann. For.*, 13(1): 2005, pp.72-78.

[3] Panse, V. G. and Sukhatme, P. V., *Stat. Methods of Agril. Workers*, Indian Council of Agril. Res., New Delhi, 1978,pp. 162- 174.

[4] Radomiljac, A. M., The influence of pot host species, seedling age and supplementary nursery nutrition on *Santalum album* Linn. (Indian sandalwood) plantation establishment within the ord river irrigation area, Western Australia. *Forest Ecol. Manage.*, 102: 1998, pp.193-201.

[5] Sundararaj, N., Nagaraj, S., Venkataramu, A. N. and Jagannath, N. K., Design and analysis of field experiments, Univ. of Agril. Sci., Hebbal, Bangalore, Karnataka (India).1972.

[6] Syamasundar, J. and Hiremath, S., Simarouba oil tree. Booklet published by UAS, Bangalore in association with National Oilseeds and Vegetable oils Development Board (ICAR), Gurgoan. 2001.

[7] Zida, D., Tigabu, M., Sawadogo, L. and Oden, P. C., Initial seedling morphological characteristics and field performance of two Sudanian savanna species in relation to nursery production period and watering regimes. *Forest Ecol. Manage*.,2008,pp.255: 2151-2162.

Table 1 Influence of age of seedling and growth regulator on seedling height (cm) in simarouba

Treatments			Seedling height (cm)							
			Before transplanting				After transplanting			
			Growth regulator (G)			Mean of A	Growth regulator (G)			Mean of A
			G_1 - GA_3 50 ppm	G_2- NAA 40 ppm	G_3- 2-4 D 2 ppm		G_1 - GA_3 50 ppm	G_2- NAA 40 ppm	G_3- 2-4 D 2 ppm	
Age of seedling (A) in days	A_1	70	11.90	10.70	10.20	10.93	12.00	12.20	11.00	11.73
	A_2	80	12.65	12.00	12.05	12.23	13.00	12.50	12.45	12.65
	A_3	90	14.50	14.45	13.75	14.23	14.80	15.07	14.00	14.62
	A_4	100	15.10	14.55	14.45	14.70	15.80	15.53	14.77	15.37
Mean of G			13.54	12.93	12.61	13.02	13.90	13.64	13.10	13.59
For comparing means of			S.Em ±		CD at 5%		S.Em ±		CD at 5%	
Age of seedling (A)			0.10		0.28		0.10		0.29	
Growth regulator (G)			0.08		0.25		0.09		0.25	
A x G			0.17		NS*		0.17		NS	

*NS - Non significant

Table 2 Influence of age of seedling and growth regulator on number of leaves per branch in simarouba

Treatments	Number of leaves per branch							
	Before transplanting				After transplanting			
	Growth regulator (G)			Mean of A	Growth regulator (G)			Mean of A
	G_1 - GA_3	G_2- NAA 40	G_3- 2-4 D 2 ppm		G_1 - GA_3 50	G_2- NAA 40 ppm	G_3- 2-4 D 2 ppm	

			50 ppm	ppm			ppm			
Age of seedling (A) in days	A_1	70	12.97	12.33	12.00	12.43	14.33	14.07	13.53	13.98
	A_2	80	13.33	13.00	13.00	13.11	15.33	15.00	14.67	15.00
	A_3	90	14.33	14.00	13.67	14.00	16.43	16.03	15.67	16.04
	A_4	100	15.50	14.99	14.67	15.10	17.53	17.00	16.73	17.08
Mean of G			14.10	13.58	13.34	13.66	15.91	15.53	15.15	15.53
For comparing means of			S.Em ±		CD at 5%		S.Em ±		CD at 5%	
Age of seedling (A)			0.40		1.16		0.24		0.71	
Growth regulator (G)			0.34		NS*		0.21		NS	
A x G			0.69		NS		0.42		NS	

*NS - Non significant

Table 3 Influence of age of seedling and growth regulator on number of branches in simarouba

Treatments			Number of branches							
			Before transplanting				After transplanting			
			Growth regulator (G)			Mean of A	Growth regulator (G)			Mean of A
			G_1 - GA_3 50 ppm	G_2- NAA 40 ppm	G_3- 2-4 D 2 ppm		G_1 - GA_3 50 ppm	G_2- NAA 40 ppm	G_3- 2-4 D 2 ppm	
Age of seedling (A) in days	A_1	70	7.20	7.17	6.80	7.05	7.30	7.20	7.10	7.20
	A_2	80	7.60	7.40	7.38	7.46	7.80	7.60	7.50	7.63
	A_3	90	8.00	7.80	7.70	7.83	8.20	8.00	7.90	8.03
	A_4	100	8.40	8.37	8.00	8.26	9.50	8.97	8.70	9.05
Mean of G			7.80	7.69	7.47	7.65	8.20	7.94	7.80	7.98
For comparing means of			S.Em ±		CD at 5%		S.Em ±		CD at 5%	
Age of seedling (A)			0.05		0.15		0.12		0.36	
Growth regulator (G)			0.04		0.13		0.11		0.31	
A x G			0.09		NS*		0.21		NS	

*NS - Non significant

Table 4 Influence of age of seedling and growth regulator on seedling mortality (%) in simarouba

Treatments			Per cent seedling mortality after transplanting			
			Growth regulator (G)			Mean of A
			G_1 -GA_3 50 ppm	G_2- NAA 40 ppm	G_3- 2-4 D 2 ppm	
Age of seedling (A) in days	A_1	70	6.27	6.80	7.47	6.84
	A_2	80	4.47	4.87	5.03	4.79
	A_3	90	3.17	3.37	3.63	3.39
	A_4	100	2.17	2.40	2.57	2.38
Mean of G			4.02	4.36	4.68	4.35
For comparing means of			S.Em ±		CD at 5%	
Age of seedling (A)			0.081		0.237	
Growth regulator (G)			0.070		0.205	
A x G			NS*		NS	

*NS - Non significant