I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3.03

Standardization of Macropropagation Technique of *Anogeissus Pendula* A Recalcitrant Tree Species Through Stem Branch Cuttings

S. K. Tiwari,* Amit Pandey, Maneesh Puri Goswami, and Pankaj Saini

ABSTRACT: *Anogeissus pendula belongs to family combrataceae and is commonly known as Kardhai. It is small tree found in hot and dry region in India. It is a very important tree species of the fragile ecosystem. In Madhya Pradesh it is mainly found in the northern parts of the state. It is highly recalcitrant tree species. Seeds are very small and germination takes about < 2 percent. In this paper an attempt has been made for standardizing the propagation technique of this species through stem branch cutting by optimizing the best concentration of IBA (root promoting hormone) for rooting of cuttings under mist chamber. Different sized cuttings were selected for optimizing rooting response. The best rooting response was obtained in hard wood cutting (20-25cm length and width .5-2.5cm) in 1000 ppm of IBA within 60-70 days during April to June.*

Keywords: *Anogeissus pendula, propagation, IBA, NAA.*

INTRODUCTION

The natural populations of some of the multipurpose forestry species are gradually declining day by day from the state mainly due to two basic reasons. The first one is their recalcitrant nature including poor seeding and seed germination, non availability of adequate amount of quality seeds/ planting stocks and limitations in other propagation methods. Another notable reason is insufficient regeneration due to heavy biotic pressure. Hence standardization of alternative techniques of propagation techniques are now very essential for such rare species.

Anogeissus pendula is a medium sized tree with short crooked bole and slender drooping branches belongs to family Combrataceae. It is found in Rajesthan, Gujarat, M.P. and South East Punjab (CSIR, 1948). The tree is essential an inhabitant of dry and hot region where the annual rainfall range 100mm to 300mm (Saxena *et al.* 2001). In Madhya Pradesh it is mainly found in Sheopur, Shivpuri, Guna, Gwalior and Bundelkh region, however in few pockets it also occur in other parts of the state. It is used for poles and rafters, making carts, tool handle, and toys. It is the major source of fodder used by the local community. Gum and tannin are also the byproduct of this species. The conventional propagation methods of this species are reported by seeds; however, the seed are very small and germinates less than 1 to 2 percent. Other propagation methods such stem branch cuttings are not documented well. However, propagation through root suckers is reported.

Due to over exploitation as a major source of fodder and fuel by local people , it is now gradually disappearing from the natural forest areas and due to these biotic factors the species becomes like a creeper in Madhya Pradesh.

Keeping under consideration of above situation of this valuable species, in this paper an attempt has been made for optimizing the induction of roots from stem branch cutting by standardizing the macropropagation technique. Different root promoting hormones (IBA, NAA) were tested in different concentrations ranging from 100 ppm to 2000 ppm. The different cutting size and seasonal rooting behavior are also highlighted in this paper.

MATERIAL AND METHODS

1. Collection of propagation material: Working plans of Sheopur, Shivpuri, Guna and Gwalior forest

* Forest Genetics Plant Propagation & Biotechnology Division, State Forest Research Institute, Jabalpur, India, *E-mail: drsktiwari1963@rediffmail.com*

division were referred for the identification of potential pockets. After this, tentative survey was made to find out the potentially rich areas as prescribed in the various working plans (Table 1). The propagation materials (stem branch cuttings) were collected from the natural population as the areas mentioned in table 1. The cuttings were properly packed in gunny bags so as to maintain the moisture around them (Fig. 1).

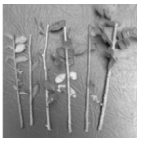
Table 1
Potentially rich areas

Name of working plan circles	*Potentially rich areas (ranges)*	*Season of collection*
Shivpuri	Pahori range, Karera range, Satanwada range,	September to June
Seopur	Sasipura range, Seopur range, Karahal, Budhara	
Guna	Kolaras range	
Gwalior	Gwalior range	

2. Preparation of cuttings for macropropagation

The cuttings were carefully brought in the mist nursery for further propagation. Different types and different sizes of cutting were prepared as mentioned in table 2 and Fig. 2, 3

Table 2
Type of cuttings

	Length	*Thickness*	*Fig*
Hard wood cutting	20-25 cm	0.5-2.5 cm	
Semi hard wood cutting	20-25 cm	0.5-2.5 cm	

3. Treatment of cuttings

Different concentration of root promoting hormones were prepared for optimizing the maximum root induction from the cuttings as mentioned in table 3.

4. Placement of cuttings under polypropagators

The treated cuttings were placed in polypropagators on medium grade pure sand with following congenial physical conditions:

Table 3
Hormonal Concentrations

Name of root promoting hormones	*Ranges*	*Name of the Manufacturing comp.*	*duration of Time for treatment*
Indol-3 butyric acid-(IBA)	100 ppm to 2000ppm	Sigma	10 to 40 min
α-Naphthalene acetic acid (NAA)	100 ppmto 2000ppm	Sigma	10 to 40 min

a. Temperature: 35^0 to 45^0C.

b. Humidity: 80 to 90% with intermittent spraying of water.

c. Spraying frequency 3 to 4 times in summer and 2 to 3 times in other seasons.

Table 4
Experimental designs

Hormonal group Treatments		*Sub-treatments (Time of treatment in min.)*				*No. of replications for each sub treatments*			*No. of cuttings / Sub treatment*	*No. of cuttings / treatments*
Control						*R1*	*R2*	*R3*	*50*	*150*
IBA	100 PPM (T1)	10(T1a)	20 (T1b)	30 (T1c)	40 (T1d)	R1	R2	R3	50	200
	200 PPM(T2)	10(T2a)	20 (T2b)	30 (T2c)	40 (T2d)					
	500 PPM(T3)	10(T3a)	20 (T3b)	30 (T3c)	40 (T3d)					
	1000 PPM(T4)	10(T4a)	20 (T4b)	30 (T4c)	40 (T4d)					
	1500 PPM(T5)	10(T5a)	20 (T5b)	30 (T5c)	40 (T5d)					
	2000 PPM(T6)	10(T6a)	20 (T6b)	30 (T6c)	40 (T6d)					
NAA	100 PPM (T7)	10(T7a)	20 (T7b)	30 (T7c)	40 (T7d)	R1	R2	R3	50	200
	200 PPM(T8)	10(T8a)	20 (T8b)	30 (T8c)	40 (T8d)					
	500 PPM(T9)	10(T9a)	20 (T9b)	30 (T9c)	40 (T9d)					
	1000 PPM(T10)	10(T10a)	20 (T10b)	30 (T10c)	40 (T10d)					
	1500 PPM(T11)	10(T11a)	20 (T11b)	30 (T11c)	40 (T11d)					
	2000 PPM(T12)	10(T12a)	20 (T12b)	30 (T12c)	40 (T12d)					

Observations

The rooting responses from the cuttings were recorded at an weekly interval as presented in the result and discussion part.

Transfer and shifting of Stacklings

After the successful rooting from the cuttings, the rooted cuttings were sifted in 1:1:1 mixture of soil, sand and FYM and were maintained initially in partial shade and then transfer in open place.

RESULTS AND DISCUSSIONS

The experiments were conducted from Oct.2012 to Aug.2013.The rooting response were recorded in the cuttings which were collected in different growing season. The inductions of roots from the cuttings are presented in table 5,6,7 and 8.

The result of the present study are given in table 5,6,7 and 8 which reveal that the auxin (IBA and NAA) concentration and time differed of significantly from each other in respect of percentage of rooting of cuttings. The rooting initiation in the cutting was started within 25 to 30 days in the month of May to June. It was noticed that during Feb to April the rooting was initiated after 40 day. The rooting responses in both sizes of cuttings are given in table 5, 6, 7 and 8 respectively. It was observed that the Hard wood cutting given better rooting response than the Semi hard wood cutting. The maximum rooting response was observed as 23% in hard wood cutting while 20% in semi hard wood cutting were treated in IBA 1000 ppm solution for 20 minutes. Poor rooting found in both size of cuttings at NAA ppm solution. (Table 5, 6, 7 and 8). Other concentration of IBA and NAA showed moderate to poor rooting response in both size of cuttings. Timing of treatment is very important for the more rooting percentage response in cuttings.20 minutes treatment are optimum rooting response for both size of cuttings.(table 5,6,7 and 8)

During the experiment observed the planting month was also varied for rooting responses. Rooting percentage during April- Jun in Hard wood cutting is 20, 23 and 22 percentage and 12, 15 and 14 percentage of rooting found in Semi hard wood cutting. A large number of worker s reported that hardwood species are difficult to propagate by vegetative means (Anon,1988; Barnes and Busly1987; Charturvedi, 1983 and Tiwari; *et. al.* 1998, Ram Prakash *et al.* 2014).

Table 5
Effect of different ppm concentration of IBA and time on the rooting percentage in hard wood cutting

TreatmentsIBA	*Time of treatment*	*No. of cuttings / treatment*	*No. of days for root induction*	*No.of root/ cutting*	*Root length (in cm)*	*% of rooting*
T1	T1a	50	65-70	Nil	Nil	Nil
	T1b	50	65-70	Nil	Nil	Nil
	T1c	50	65-70	Nil	Nil	Nil
	T1d	50	65-70	Nil	Nil	Nil
T2	T2a	50	65-70	Nil	Nil	Nil
	T2b	50	65-70	Nil	Nil	Nil
	T2c	50	65-70	Nil	Nil	Nil
	T2d	50	65-70	Nil	Nil	Nil
T3	T3a	50	65-70	1	2	4
	T3b	50	65-70	2	4	6
	T3c	50	65-70	1	1	3
	T3d	50	65-70	Nil	Nil	Nil
T4	T4a	50	65-70	Nil	Nil	Nil
	T4b	**50**	**65-70**	**25-30**	**30-35**	**23**
	T4c	50	65-70	4-6	20-25	14
	T4d	50	65-70	2-4	2-6	9
T5	T5a	50	65-70	Nil	Nil	Nil
	T5b	50	65-70	Nil	Nil	Nil
	T5c	50	65-70	Nil	Nil	Nil
	T5d	50	65-70	Nil	Nil	Nil
T6	T6a	50	65-70	Nil	Nil	Nil
	T6b	50	65-70	Nil	Nil	Nil
	T6c	50	65-70	Nil	Nil	Nil
	T6d	50	65-70	Nil	Nil	Nil

Table 6
Effect of different ppm concentration of IBA and time on the rooting percentage in Semi hard wood cutting

Treatments IBA	*Time of treatment*	*No. of cuttings / treatment*	*No. of days for root induction*	*No. of root/ cutting*	*Root length (in cm)*	*% of rooting*
T1	T1a	50	65-70	Nil	Nil	Nil
	T1b	50	65-70	Nil	Nil	Nil
	T1c	50	65-70	Nil	Nil	Nil
	T1d	50	65-70	Nil	Nil	Nil
T2	T2a	50	65-70	Nil	Nil	Nil
	T2b	50	65-70	Nil	Nil	Nil
	T2c	50	65-70	Nil	Nil	Nil
	T2d	50	65-70	Nil	Nil	Nil
T3	T3a	50	65-70	2	2-4	3
	T3b	50	65-70	2	4-6	6
	T3c	50	65-70	1	2	4
	T3d	50	65-70	Nil	Nil	Nil
T4	T4a	50	65-70	Nil	Nil	Nil
	T4b	**50**	**65-70**	**6-8**	**8-10**	**20**
	T4c	50	65-70	4-6	4-6	12
	T4d	50	65-70	2-4	2-6	8
T5	T5a	50	65-70	Nil	Nil	Nil
	T5b	50	65-70	Nil	Nil	Nil
	T5c	50	65-70	Nil	Nil	Nil
	T5d	50	65-70	Nil	Nil	Nil
T6	T6a	50	65-70	Nil	Nil	Nil
	T6b	50	65-70	Nil	Nil	Nil
	T6c	50	65-70	Nil	Nil	Nil
	T6d	50	65-70	Nil	Nil	Nil

Table 7
Effect of different ppm concentration of NAA and time on the rooting percentage in Hard wood cutting

TreatmentsIBA	*Time of treatment*	*No. of cuttings / treatment*	*No. of days for root induction*	*No. of root/ cutting*	*Root length (in cm)*	*% of rooting*
T1	T1a	50	65-70	Nil	Nil	Nil
	T1b	50	65-70	Nil	Nil	Nil
	T1c	50	65-70	Nil	Nil	Nil
	T1d	50	65-70	Nil	Nil	Nil
T2	T2a	50	65-70	Nil	Nil	Nil
	T2b	50	65-70	Nil	Nil	Nil
	T2c	50	65-70	Nil	Nil	Nil
	T2d	50	65-70	Nil	Nil	Nil
T3	T3a	50	65-70	Nil	Nil	Nil
	T3b	50	65-70	2	3-4	2
	T3c	50	65-70	1	1	3
	T3d	50	65-70	Nil	Nil	Nil
T4	T4a	50	65-70	Nil	Nil	Nil
	T4b	**50**	**65-70**	**3-4**	**4-5**	**15**
	T4c	50	65-70	2-3	2-3	8
	T4d	50	65-70	Nil	Nil	Nil
T5	T5a	50	65-70	Nil	Nil	Nil
	T5b	50	65-70	Nil	Nil	Nil
	T5c	50	65-70	Nil	Nil	Nil
	T5d	50	65-70	Nil	Nil	Nil
T6	T6a	50	65-70	Nil	Nil	Nil
	T6b	50	65-70	Nil	Nil	Nil
	T6c	50	65-70	Nil	Nil	Nil
	T6d	50	65-70	Nil	Nil	Nil

Table 8
Effect of different ppm concentration of NAA and time on the rooting percentage in Semi hard wood cutting

Treatments IBA	*Time of treatment*	*No. of cuttings / treatment*	*No. of days for root induction*	*No. of root/ cutting*	*Root length (in cm)*	*% of rooting*
T1	T1a	50	65-70	Nil	Nil	Nil
	T1b	50	65-70	Nil	Nil	Nil
	T1c	50	65-70	Nil	Nil	Nil
	T1d	50	65-70	Nil	Nil	Nil
T2	T2a	50	65-70	Nil	Nil	Nil
	T2b	50	65-70	Nil	Nil	Nil
	T2c	50	65-70	Nil	Nil	Nil
	T2d	50	65-70	Nil	Nil	Nil
T3	T3a	50	65-70	Nil	Nil	Nil
	T3b	50	65-70	2	4-5	4
	T3c	50	65-70	1	1	3
	T3d	50	65-70	Nil	Nil	Nil
T4	T4a	50	65-70	Nil	Nil	Nil
	T4b	**50**	**65-70**	**2-3**	**2-4**	**12**
	T4c	50	65-70	4-6	2-3	6
	T4d	50	65-70	Nil	Nil	Nil
T5	T5a	50	65-70	Nil	Nil	Nil
	T5b	50	65-70	Nil	Nil	Nil
	T5c	50	65-70	Nil	Nil	Nil
	T5d	50	65-70	Nil	Nil	Nil
T6	T6a	50	65-70	Nil	Nil	Nil
	T6b	50	65-70	Nil	Nil	Nil
	T6c	50	65-70	Nil	Nil	Nil
	T6d	50	65-70	Nil	Nil	Nil

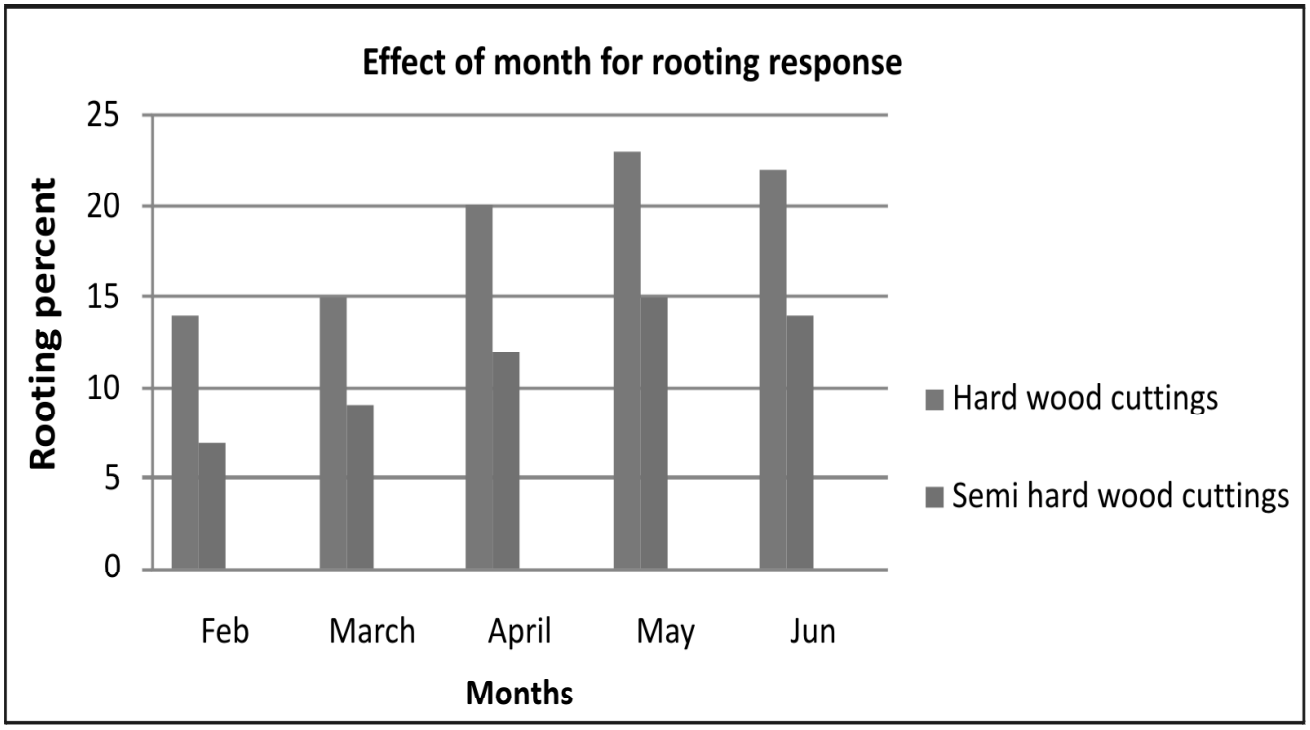


Figure 4: Effect of different month for rooting response

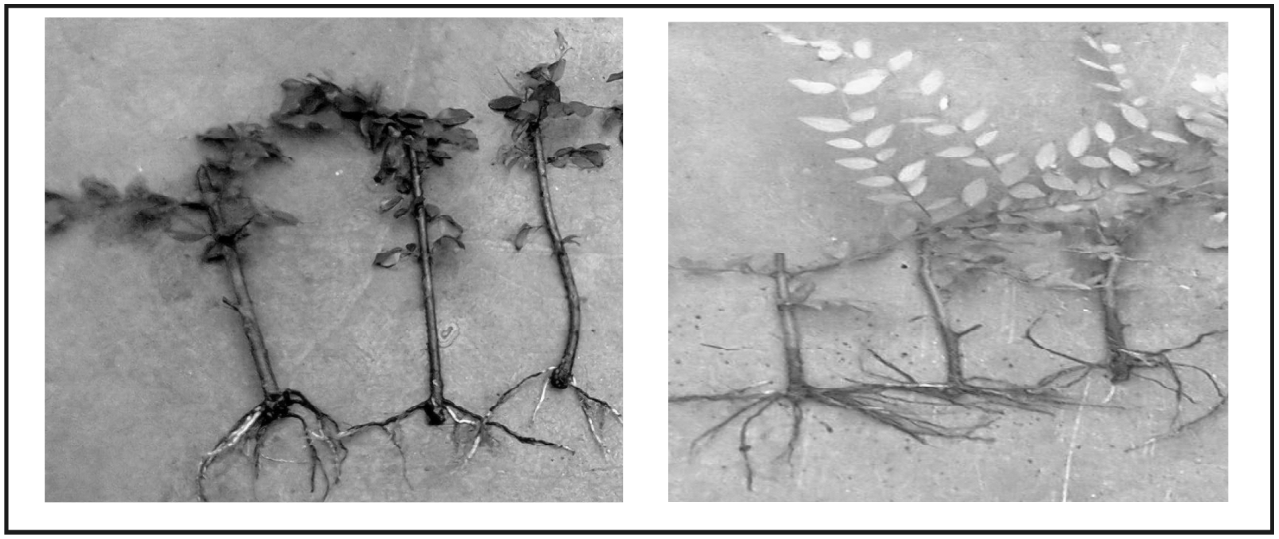


Figure 5: Rottings in Semi hard wood cutting

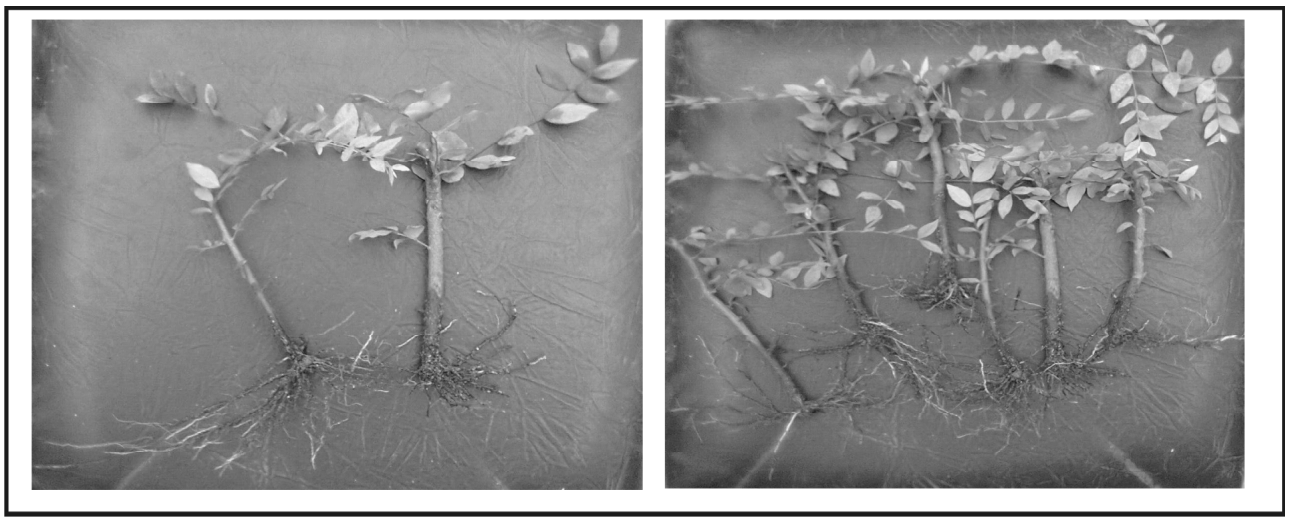


Figure 6: Rottings in Hard wood cutting

CONCLUSION

From the above study it is found the season of cuttings planted from April to Jun and IBA 1000 PPM concentration for 20 minutes was optimum rooting response in hard wood cutting.

REFERENCES

Anon, (1988), The Eucalyptus Dilemma, pp 4-5 food & Agriculture Organization of the united nations, Rome.

Barnes R; Dand Burley, J.D; (1987), Vegetative propagation for improved Tropical Forest Trees, In: Improving Crops (A.J. Abbott and Atkin eds.) pp211-227, Academic Press Limited, London.

Chaturvedi, A.N. (1983), Application of Biotechnology in forestry, and rural Development, Commonwealth Forestry Review, 66(4), 1987.

CSIR, (1948). The wealth of India, New Delhi.

Gasper, T. and M. Hofinger, (1989), Auxin metabolism during rooting IN: Davic, T.D. Haissig, B.E. and Sankhla, N.(eds.). Adventitious root formation in cuttings, Portland, Oreg,: Dioscorides Press, 1989.

Ram Prakash, Tiwari, S. K. and Amit Pandey (2014), **वानिकी में मेक्रोक्लोनल प्रोपेगेशन तकनीक द्वारा वृक्ष एवं औषधीय प्रजातियों के क्लोनल पौधे तैयार करने की विधियां** Technical Bulletin No. 59, SFRI, Jabalpur.

Sexena. Sanjay and Dhawan. V. (2001), Large scale production of *Anogeissus pendula* and *A. latifolia* by micropropagation, *In vitro* cell Dev. pp 587-589.

Tiwari, K.P; Tiwari S.K. and Sharma, M.C. (1998), Macropropagation protocol of some tree and medicinal plant species, Technical Bulletin No. 38, SFRI, Jabalpur.