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Full Length Research Paper

Growth performance of seed and air layered raised *Myrica esculenta* plants under field conditions.

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Myrica esculenta **trees are distributed throughout Garhwal and Kumaon regions of Himalayas. In India it is locally known as kaphal; fruits are edible, sourish in taste. It is a non - legume nitrogen fixing tree species, enriches the soil nitrogen status and generally grown via seeds but due to hard seed coat results in unreliable germination pattern. Therefore, vegetative propagation an alternative technique (air layering) was tried to enhance survival and reduce the nursery cost and time. Air layering was tried for two consecutive years (2010-11 and 2011-12). Side by side seedlings were also grown through seeds and both vegetative as well as seedlings raised plants were grown in the field to compare the growth and survival performance. In air layering trial it was observed that maximum rooting was recorded in Indole Butyric Acid 4000 ppm followed by 6000ppm; 2000ppm and minimum in 1000ppm however, no rooting was observed in control treatment. Rooting was only observed in the branches which were air layered either during post summer or rainy season whereas, no rooting during in winter or pre summer season. On field planting more than 73.68 percent in seedlings and 100 percent survival was recorded in vegetative grown plants after one year of growth.**

Keywords: Air layering, growth and survival, hormonal doses, *Myrica esculenta.*

INTRODUCTION

Myrica esculenta (*M. esculenta) tree* is distributed throughout in India, Nepal, China, Pakistan and Malaya Islands. The plant is commonly found in outer Himalayan region altitude range between 900 to 2,100 meters (Panthari *et al.,* 2002; Anonymous, 1962). In India *M. esculenta* has been reported from Punjab, Himachal Pradesh to Assam, including Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram, Bengal, Naga and Lushai hills. *M. esculenta* is one of the most common plants currently used in ayurvedic formulations for human health management. It is a medium to large woody, evergreen, dioecious, subtropical tree of family *Myricaceae*. The tree is commonly known as kaphal in Hindi, Kathphala in Sanskrit and Kaiphal in Urdu. Tree attains height of 12 to 15 meters. The peak flowering season is observed to occur during the first fortnight of March. However flowering season starts from the first fortnight of February and continues till the second fortnight of April.

Generally, *M. esculenta* trees are growing naturally in the forest edges at high elevation in rain fed areas. The species is generally propagated via seeds but physical dormancy caused by impermeable seed coat results in unreliable germination pattern (Bhatt *et al.,* 2000). This tree not only gives employment to rural peoples but also fixes atmospheric nitrogen in the soil and ultimately enriches the soil nitrogen status (Pokhriyal *et. al.,* 1993). This is one of the important trees in hill area with very poor natural regeneration. Considering the importance of this species the vegetative

propagation techniques were tried to reduce the time and cost spent in nursery period conditions. Therefore, an attempt was also made to compare the growth behavior of seedlings and vegetative grown plants under field conditions.

MATERIALS AND METHODS

In *M. esculenta* air layering technique was tried on the naturally grown trees at Khirsu, Garhwal Forest Division, Pauri Uttarkhand, India at monthly interval for two consecutive years i.e., July 2010 to June 2012. The observations were recorded in 2013 and 2014 respectively (Table 2; 3; 4). For this purpose new mature branches were selected in already existing available trees irrespective to male or female. In both the years approximately 5 mm area of the bark around the branch was peeled out and applied root hormonal powder in four different Indole Butyric Acid (IBA) concentrations i.e. 1000; 2000; 4000; 6000 ppm along with a control without hormone application. The dried moss grass dipped into fungicide (0.2 % Carbendazim) solution was applied around the peeled portion and tightly covered with polythene bags tide from both the ends. Healthy and matured branches were selected from each of the trees for air layering and total 120 twigs were air layered in each treatment for both years (Table 1). The fully rooted air layered branches were separated from the main tree and kept in the soil mixture filled with polythene bags for establishment of roots in the soil and extra length and foliage was cut to prevent the excessive loss of water. The following year some plants bear fruits which were marked and tagged for future record. The rooted branches later were also cut from the main stem and planted directly in the field together with previous air layered polythene grown plants. Seeds were also sown in the nursery beds and the seedlings after attaining the approximate height of 5-8 cm, were transplanted to the soil mixture filled polythene bags.

Seed grown plants as well as vegetative propagated plants were transplanted to the nursery of Field Research Station of Forest Research Institute, Dehradun at Khirsu during the peak rainy months (July-August). In the field, 50 seedlings and 39 rooted (air layered) cuttings were planted. At the time of planting in the field all morphological parameter i.e., plant diameter, height, number of leaves, number of branch were recorded (Table 2 & 3). Weeding was also done twice in February and August at the time of collection of data. No artificial irrigation and manure was applied. The periodic observations were recorded in August 2013 and February 2014. Similar growth parameters were taken earlier during field planting to compare the growth and survival (Table 4 & 5). The observations (i.e., diameter, height, number of leaves, number of branches and survival percent, classes) were made on the basis of highest and lowest value observed in each parameter. Thus, different groups/classes were made as per variation of data taken from the field (Table 2, 3, 4 & 5).

RESULTS

Maximum rooting was observed in the air layered branches during (June-July) post summer or rainy season whereas, no rooting was observed during winter or pre summer season. The maximum (15.83%) branches initiated root hairs in air layered branches due to IBA 4000 ppm followed by IBA 6000 ppm (9.17%), 2000 ppm (6.67%) and minimum in 1000 ppm (4.17%) treatments (Table 1). It shows

Table 1: Details of total air layered branches and their rooting performance under field conditions.

Year	Air layered branches of *M. esculenta* trees						
	IBA Treatments (ppm)	Total air layered	Rooted air layered	Rooting %	Year	Rooted air layered	Rooting %
2010-11	1000	120	05	4.17	2011-12	0.0	0.0
	2000	120	08	6.67		01	0.83
	4000	120	19	15.83		05	4.17
	6000	120	11	9.17		04	3.33
	Control	120	00	0.0		0.0	0.0
	Total	600	43	7.17		10	1.67

Table 2: *Myrica esculenta* seedlings raised planted in the field (August, 2013).

Initial growth data of seedlings									
Collar Diameter (mm)		Survival %	Height (cm)		Survival %	Number of leaves		Number of branches	
Diameter (mm)	Total plant		Height classes	Total plant		No. of classes	Total plant	Classes	Total plant
2.0 -3.0	11	90.90	4.0 -6.0	11	81.81	5-10	9	0-5	50
3.0-4.0	19	73.68	6.0-8.0	19	89.47	10-15	28		
4.0-5.0	14	85.71	8.0-10.0	14	64.28	15-20	11		
5.0-6.0	5	100	10.0-12.0	5	100	20-25	2		
6.0-7.0	0	-	12.0-14.0	0	-				
7.0-8.0	0	-	14.0-16.0	1	100				
8.0-9.0	1	100							

that *M. esculenta* was most effective at 4000 ppm of hormonal treatment for the rooting. In this experiment overall 7.17% rooting was recorded in first year (2010-11) and 1.67% in the second year (2011-12). In established Myrica vegetative multiplication garden (VMG) at F.R.I. Dehradun higher rooting percentage was also recorded due to 4000 ppm IBA treatment as compared to others. In both the altitudes no rooting was observed in control.

In one year old seedlings planted in the field, show cent- percent survival in 5.0 to 6.0 mm and 8.0 to 9.0 mm followed by 2.0 to 3.0 mm (90.90%) diameter of seedlings classes. On the height classes basis maximum (19) seedlings were under the height class of 6-8 cm followed by 8-10 cm (14), 4-6 cm (11), 10-12 cm (5) and only one in 14-16cm (Table 2). One year rooted branch in the field in August 2013 show cent percent survival in the entire diameter and height classes. Maximum 40-60 leaves were produced by 17 plants followed by 20-40 in 11 and minimum leaves were produced in rest of the classes. However, only 22 and 17 plants produced 0-5 and 5-10 branches respectively (Table 3).

In the month of February 2014 after attaining one

Table 3: *Myrica esculenta* air layered rooted cuttings planted in the field (August, 2013).

Initial growth data of air layered rooted branch cuttings									
Collar Diameter (mm)		Survival %	Height (cm)		Survival %	Number of leaves		Number of branches	
Diameter classes	Total plant		Height classes	Total plant		No. of classes	Total plant	No. of classes	Total plant
7.0 -9.0	7	100	35-45	11	100	0-20	2	0-5	22
9.0-11.0	11	100	45-55	14	100	20-40	11	5-10	17
11.0-13.0	13	100	55-65	8	100	40-60	17		
13.0-15.0	4	100	65-75	6	100	60-80	4		
15.0-17.0	4	100			100	80-100	4		
						100-120	1		

Table 4: *Myrica esculenta* seedlings planted in the field (February, 2014).

Initial growth data of seedlings planted in the field									
Collar Diameter (mm)		Survival %	Height (cm)		Survival %	Number of leaves		Number of branches	
Diameter (mm)	Total plant		Height classes	Total plant		No. of classes	Total plant	Classes	Total plants
4.0 -6.0	8	87.5	10-20	16	100	0-20	14	0-5	32
6.0-8.0	7	100	20-30	9	88.88	20-40	20		
8.0-10.0	9	100	30-40	9	100	40-60	5		
10.0-12.0	13	100	40-50	5	100	60-80	2		
12.0-14.0	2	100	50-60	5	100				
14.0-16.0	1	100	60-70	1	100				
16.0-18.0	1	100							

and half year of age cent- percent survival was observed in the seedling diameter class between 6-8 mm to 16-18 mm. On the height class basis with the exception of 20-30 cm class all height classes show cent- percent survival. Maximum 20 seedlings produced between 20-40 number of leaves followed by 14 in 0-20; 40-60 leaves in 5 seedlings and only 2 seedling produced 60-80 number of leaves whereas, only 32 seedlings produced 0-5 number of branches (Table 4). In field planting after one and half years, more than 70 percent survival was observed in all diameter classes. Similar pattern was recorded in plant height also as shown in table 5. Maximum (60-80) leaves were produced in only 2 plants followed by (40-60) 6; (20-40) 11 and minimum (0-20) in 15 plants however, 0-5 branches were produced by 27 and 5-10 by 7 plants (Table 5).

Table 5: *Myrica esculenta* air layered rooted cuttings planted in the field (February, 2014).

Initial growth data of air layered rooted branch cuttings planted in the field									
Collar Diameter (mm)		Survival %	Height (cm)		Survival %	Number of leaves		Number of branches	
Diameter classes	Total plant		Height classes	Total plant		No. Of classes	Total plant	No. of classes	Total plant
7.0 -9.0	4	100	20-30	2	100	0-20	15	0-5	27
9.0-11.0	10	70	30-40	5	100	20-40	11	5-10	7
11.0-13.0	11	90.90	40-50	15	86.66	40-60	6		
13.0-15.0	4	100	50-60	7	71.42	60-80	2		
15.0-17.0	5	80	60-70	5	80				

DISCUSSION

Auxins play a significant role in stimulating adventitious rooting from stem cuttings of tree species (Tchoundjeu., et al., 2004 and Kesari et al., 2009). IBA is a non toxic auxin (Hartmann et al., 2002) and promote rooting of a large number of plant species (Teklehaimanot et al., 1996 and Henrique et al., 2006). Enhancing the rate of adventitious roots development, auxin application was found suitable to increase the number of roots initiated per rooted cutting in a variety of species (Mensen et al., 1997 and Palanisamy et al., 1998). *Myrica esculenta*, a commercially important and hard to rooting through stem/branch cuttings. So the air layering experiment was carried out in the naturally grown standing trees at forest Khirsu near Pauri for a period of 24 months with applications different doses of IBA. Purohit et al. (2004) also tried 100, 500 and 1000 ppm of auxin (IBA and IAA) and they observed best results in IBA 100 and 500 ppm. But in our case higher doses of IBA 4000 ppm was observed most effective. However, in both the studies no rooting was observed in control treatment. Singh (1995) reported 500 ppm NAA ideal for rooting while Rao et al. (2010) reported IBA 400 ppm ideal for rooting of Hippophae salicifolia under Himachal Pradesh conditions. Differences in species, altitude, agro climatic conditions may have attributed to this variation. It was observed that in some cases callus was developed but no rooting was initiated. The peeling of bark at the point of tree branch has restricted the movement of synthesized food materials from the leaves to root resulting in the formation of callus which promote the rooting at that place, but no root formation in some cases is again a subject of research. If hormone is reapplied over the callus portion the percentage of rooting can be increased more. Ishtiyak and Lokho Puni (2008) also suggested that instead of peeling of bark which stimulates phenols and prevents rooting, tie the branch with a plastic coated wire, which is a stretched out office file clip having approximately 2 mm diameter followed by tightening pressure with a plier, a small visible depression is made on the bark as a result of pressure. After smearing the depressed portion with rooting hormone, it was covered with handful amount of moss, wrapped with polythene strip and tight from both ends. Plastic coated wire check the secretion of phenols as well as the downwards movement of synthesized starch can be stopped. Air layered branch with well developed root system is essential, otherwise after planting in the field, it will die soon. Kesari et al. (2009) also suggested that profuse rooting of cutting is of practical importance especially when planting is done in denuded and marginal areas. The fact developing root system will lead to successful establishment of the plants.

In the seedling as well as air layered rooted plants, these results are the mile stone for further research in future. More research is required so that newly developed technique can be applied to increase the higher results. Though the time period of this project is completed (Chaukiyal, 2014) yet the recording of the data will be continued till they flowered. The female plants were also marked and identified in the field and its serial number was recorded in the data register for future reference. A separate study is required to confirm these results in future. It is again worth mentioning that after rooting these branches can be planted directly in the field during rainy season subject to the condition that branches must be rooted fully otherwise with few roots the plant cannot survive in the field due to inability of taking water and nutrients from the soil.

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