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Popularization of Artificial Agar Resin Deposition and Oil Extraction Techniques Among Bangladeshi Agarwood Planters

M. Jakir Hossain*, M.S. Rahman, S.C. Nath

Forest Chemistry Division, Bangladesh Forest Research Institute, Chittagong 4211, Bangladesh

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Abstract

Agar is a highly priced non-timber forest product traded internationally which is extremely rare. Due to the nature of its very low formation, artificial inoculation technologies are becoming more popular. However, due to the international and governmental subsidies and measurements, a lot of plantation sites are available in most all hilly areas of Bangladesh. Most of the planters do not know its inoculation and oil extraction process. In this study, total fifteen hands on training were arranged in different locations of Bangladesh. On an average, a total of thirty five new planters and around five to ten participants from local government representatives, representatives from the Forest Department, Bangladesh Forest Industries Development Corporation, other government officials and NGOs representatives were present in each training. The planters were able to know the artificial agarwood inoculation techniques by traditional iron nailing method, oil extraction process, and their marketing along with garden management.

* **Corresponding Author:** Mohammad Jakir Hossain ✉ smjakir080@gmail.com

Introduction

Agarwood, a non-timber forest product used as fragrance, medicine, incense, aromatherapy and religious ceremonies from the ancient time (Blanchette 2006, Wyn *et al.* 2005, Anon 1999, Barden *et al.* 2000). The healthy agarwood is a white, soft, even-grained, and not scented when freshly cut (Alam *et al.* 2015, Akter *et al.* 2013). Under certain external factors or pathological conditions, the heart wood becomes saturated with resin, and eventually becomes hard to very hard (Blanchette *et al.* 2009, Pojanagaroon *et al.* 2005, Persoon 2007). The process of agar-resin deposition is not fully understood yet, but the existence of an exposed, open wound seemed to be of more important for the formation of resin which is accelerated by the presence of iron or iron oxides (Blanchette *et al.* 2006, Blanchette *et al.* 2009, Barden *et al.* 2000, Rahman 1980). It was also observed that period and way of nailing, nail size and their pretreatment could affect the yield and quality of agar formation (Blanchette *et al.* 2009, Ito *et al.* 2005, Jalaluddin 1977).

The natural production of agar requires a long time (Gibson 1977). The traditional iron nailing technique is still popular in Bangladesh and is commercially profitable according to different reports. Even though agarwood plantation is rapidly increasing, however most of the new planters hardly know either its inoculation or extraction process. Forest Chemistry Division of Bangladesh Forest Research Institute (BFRI) modified the existing agar oil extraction technique. Following this technique the extraction yield was increased by ~50% as well as the distillation time was decreased from 30 days to 10 days.

The present study is undertaken to inform and train up the new planters across Bangladesh on: (a) Inoculation of agarwood plants by iron nailing method following a better technique, (b) harvesting and oil extraction process from resin-rich wood, and (c) gradation of agarwood and agar-oil according to their resin deposition/quality by physical testing. Moreover, there is no exact data of the agarwood plantations in Bangladesh. This study was undertaken considering these points of view.

Materials and methods

Most of the new agarwood planters hardly know either its inoculation or extraction process, however agarwood plantation is rapidly increasing for captivating higher profit. Although, iron nailing process does not produce better quality agar, but it produces agar almost all trees. The research on iron nailing explored that nailing technique, nailing time, nail size and pretreatment strongly affect the yield and quality of the produced agar.

To train and teach new planters across the country- (a) hands-on training on agar-inoculation by iron nailing method, (b) Processing and oil extraction by hydrodistillation, and (c) Quality determination of produced agar and oil by physical testing were carried out by arranging day long training workshops.

The training areas were selected based on demand. The trainings were carried out in 2016-2017 to 2018-2019 fiscal years.

Results and discussions

Agarwood is dark resinous fragrant heartwood that is extremely rare. Although Bangladesh and part of India were the primary source of agar in ancient time, however over exploitation make this genera extinct in the natural forest globally. Due to various initiatives from government and private sector, there are a large numbers of plantations in various locations of Bangladesh, especially in hilly areas. Unfortunately, most of the cultivators have no idea of its artificial inoculation, extraction, quality assessment and marketing process. Interestingly, they never saw agar or its derivatives directly. They only know that it is a profitable forest species.

From 2016–17 fiscal year to 2018–19 fiscal year we arranged total 15 day-long workshops across the country, especially in the newly planted areas as shown in the table-1. Although all workshops had two sessions- (a) *Lecture session*: Consists of three lectures with multimedia presentation on prospect, plantation, management, artificial inoculation, harvesting, oil extraction and marketing; and (b) *Open discussion session*: Plantation problem, paste management, inoculation technologies. However, in addition to open

discussion we provided five lectures on- (1) Agarwood: An Overview, Problems and Prospect with Respect to Bangladesh; (2) Cultivation and Management of Agarwood Garden; (3) Pest Management of Agarwood Garden; (4) Artificial Inoculation (Proper Nailing), Harvesting and Extraction Oil; and (5) Agar Products Marketing, Rules and Regulations.

Table 1. List of arranged day-long workshops on agarwood across the country.

SL	FY	No. of participants	Location	Fig. No.
01	2016-17	>35	UP Office Auditorium, Kaptai, Rangamati	Fig. 2
02		>35	BFIDC Auditorium, Heyanko, Fatikchhari, Chittagong	Fig. 3
03		>35	DFO Office, Lama, Bandarban	Fig. 4
04	2017-18	>35	Talukderpara, Marishya, Baghaichhari, Rangamati	Fig. 5
05		>35	Babupara, Marishya, Baghaichhari, Rangamati	
06		>35	UAO Office, Matiranga, Khagrachhari	Fig. 6
07		>35	Gazni, Jhinaigati, Sherpur	Fig. 7
08		>35	Kulaura, Moulovibazar	Fig. 8
09	2018-19	>35	Quantum Foundation, Lama, Bandarban	Fig. 9
10		>35	Quantum Foundation, Lama, Bandarban	
11		>35	Keochia, Satkania, Chittagong	Fig. 10
12		>35	Charaljani, Modhupur, Tangail	Fig. 11
13		>35	DFO Office, Mymensingh	Fig. 12
14		>35	UAO Office, Manikchhari, Khagrachhari	Fig. 13
15		>35	UP Office Auditorium, Gulshakhali, Longadu, Rangamati	Fig. 14

In each workshop, more than 35 planters, local government representatives, representatives from Forest Department, Bangladesh Forest Industries Development Corporation, other government officials and NGOs representatives were participated. The pictures during training workshops, we visited nearby agarwood gardens and factories. We also made one-to-one discussion of their problem. Most of the cultivators and factories are dependent on iron nailed agars.

Interestingly, natural infestation of agar producing pest were found almost every hilly areas of Chittagong Hill Tracts which is very promising and suitable for high quality agar formation.

Table 2. Number of insect holes observed in a five year aged garden. The trees were selected randomly.

SL	Seed collection period	Plantation period	Age (yr)	GBH (inch)	Height (ft)	Max. height at insect attack (ft)	Number of insect holes (no.)
1.	2012	2013	05	7.5	15.1	10.5	49
2.	2012	2013	05	9.0	15.3	10.2	33
3.	2012	2013	05	10.0	14.2	8.1	52
4.	2012	2013	05	7.2	12.4	9.0	54
5.	2012	2013	05	8.5	14.1	9.2	76
6.	2012	2013	05	8.2	14.3	9.1	43

After Borolekha, Baghaichhari is the second largest agarwood planted area. Here most of the tress are naturally infected/ inoculated by agar producing plants although they are cultivated forest. As a result, this tree is omnipresent all over the Bagaichhari and surrounding Upazillas. Lack entrepreneur, marketing and structural problem there are only two factories are set up until now. Lack of proper processing knowledge and buyers brought frustration to the factory owners. It's high time, the government should

realize the current impediments to proper processing and marketing for local community and take immediate initiative to recover locale interest by patronizing this potential sector.

Fig. 1. Artificial agar inoculation experiments at Sherpur brought from Indonesia.

For natural inoculation, stem boring insect plays the vital role for the formation of high quality agar. Although insect attack is seldom found even in Sylhet areas, however each and every tree in Bagaichhari area is attacked by agar forming insects. During our visit, we observed maximum 76 insect holes in a five year aged agarwood tree which is a good symptom for natural agar formation as shown in table-2.

Due to limitation of iron nailing technique and low formation of poor quality agar, peoples are searching for other high yielding artificial inocula across the globe. During visit at Sherpur, we found that one person brought inocula from Indonesia doing experiments there by himself as shown in figure-1. We have similar news from other areas also.

Fig. 2. Day-long workshop at Kaptai, Rangamati.

Fig. 3. Day-long workshop at Heyanko, Fatikchhari, Chattogram.

Fig. 4. Day-long workshop at Lama, Bandarban.

Fig. 5. Day-long workshop at Talukderpara&Babupara, Marishya, Baghaichhari, Rangamati.

Fig. 6. Day-long workshop at Matiranga, Khagrachhari.

Fig. 7. Day-long workshop at Gazni, Jhinaigati, Sherpur.

Fig. 8. Day-long workshop at Kulaura, Moulovibazar.

Fig. 9. Day-long workshop at Quantum Faundation, Lama, Bandarban.

Fig. 10. Day-long workshop at Keochia Forest Research Center, Satkania, Chattogram.

Fig. 11. Day-long workshop at Charaljani Forest Research Cenrer, Modhupur, Tangail.

Fig. 12. Day-long workshop at Manikchhari, Khagrachhari.

Fig. 13. Day-long workshop at Gulshakhali, Longudu, Rangamati.

Fig. 14. Day-long workshop at Mymenshingh DFO Office, Mymenshingh.

Conclusion

Agarwood is a potential forest product for the development of Bangladesh. Its success depends on the proper inoculation and marketing. There are lots of plantations across the country. Due to the lack of artificial inoculation, even the iron nailing process most of the planters are frustrated. We should arrange training workshop for hands-on training of such inoculation and oil extraction techniques to teach and guide them. We should also take care of their products marketing facilities. Otherwise, development of sector will be difficult.

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