

FARMERS' PRACTICES FOR AGAR PLANT WOUNDING AND PROCESSING TECHNIQUES TO IMPROVE OIL QUALITY IN MOULVIBAZAR DISTRICT

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Abstract

This research was carried out to evaluate existing agar wounding techniques and to identify viable wounding ways for farmers and other relevant stakeholders in agar plants in order to harvest the valuable end products of agarwood and agar oil, which are used as medicine and incense. The research was conducted in Barlekha Upazila, Moulvibazar district- from August 2017 to February 2018. To conduct the survey, a pre-designed, objective-oriented questionnaire was used, and information was collected from a total of 104 agar farmers, in Barlekha Upazilla, including agar processors, agar orchard owners, and agar tree chips and oil workers by questioning them personally. The study revealed that the respondents mostly utilized two types of wounding techniques; nailing and natural insect infestation. Between these two wounding procedures, the majority of the farmers (87%) practiced the nailing, while the remaining (13%) used to gather wood from natural insect infestation. About 83% of farmers thought that agarwood obtained from natural insect attacks was more profitable than artificial wounding through nailing. The majority of respondents nail the tree when they are 11 to 15 years old. About 86% of respondents in Barlekha Upazila chopped their trees within five years of nailing them. The majority (70%) of the farmers maintained a 2.1-3.0 inch distance for vertical nail pushing, while 64% of the farmers maintained a 1.0-1.5 inch distance for horizontal nail pushing. All the respondents of Barlekha Upazila used the distillation technique for collecting agar oil. Due to the fact that there were no modern techniques to collect agar oil from the wood and atar processing, they were fully dependent on sending the oil abroad for future processing purposes.

Keywords: Wounding techniques, Nailing, Agar oil, Barlekha.

Introduction

Agarwood is a valuable resin compound found solely in *Aquilaria* and *Gyrinops* species of the Thymelaeaceae family (e.g., Das et al., 2019; Blanchette, 2006). The genus *Aquilaria* has 17 species. It is a diseased tissue found in the heartwood that is a resultant substance of plant's defense against external attacks and impacts, such as (i) naturally wounding and pathological infection (insects, fungi, bacteria etc.), (ii) mechanical injury (by human being or external factors), (iii) wounding and pathological infection (artificial inducement), and (iv) floristic composition of vegetational cover (companion plants, insects) (Ba, 2010). To prevent these wounds, the plant first secretes a brown oleoresin to the affected area. It has turned a deep, dark hue over the years. When resin deposits increase in number and quality is ensured, valuable wood will be generated. It has been used for about 3000 years in China, India Japan, and especially in Arabian nations (Le, 2003). It is known by a variety of names according to location and culture, including Agar (Bangladesh, India), Eagle/Agilawood (Europe), Oud (Arabic), Aguru (Sanskrit) (e.g., Hayder et al., 2005; Akter et al., 2013).

Although agarwood has been used for medicinal purposes for thousands of years, it is still used in some countries such as Tibetan, traditional East Asian in the form of ayurvedic medicine (Chakrabarty et al., 1994), fragrance therapy (La Frankie, 1994), pharmaceutical scruples (Van Beek & Phillips, 1999), asthma, rheumatism as well as other body pain treatment (Hajar, 2013). It is used as meditation incense by many religious organizations to quit the mind and soul. It is a primary element in perfumery and cosmetics (Chaudhari, 1993). In the Middle East, agarwood oil and smoke are

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often used as perfumes (Chakrabarty et al., 1994). In the worldwide agarwood market, price volatility is a prevalent word. It was sold up to \$42.5 a kilogram in the 1970s, and then straight up to \$1250 and \$2500 per kilogram in 2000 and 2005, respectively (Abdin, 2014). First-grade agarwood is one of the most costly natural raw sources on the globe. Each year, Singapore trades \$1.2 billion in agarwood (Hansen, 2000). Natural agar oil has a market worth of \$30,000 to 40,000 per kilogram (Abdin, 2014). Two agarwood chips are sold for \$30 to \$10,000 per kilogram according on the amount of resin (Babatunde, 2015). Agarwood development is difficult in nature, and harvesting wood from those trees has a significant influence on the near-extinction of natural stands (Blanchette, 2006). The study area has 111 of Bangladesh's 121 registered agar-based enterprises, considerably adding to regional employment and GDP (Talucder et al., 2016). Despite the fact that agar was designated as an industrial crop in Bangladesh in 2016 and that agar trees are widely planted, agarwood farmers are unable to reap the full benefits owing to a lack of understanding about suitable wounding procedures or the inoculation process. They are used to practicing the time-consuming nailing procedure, which has a low yield. There is another approach called aeration that may be used. Because it is simple to inoculate and accumulate, this approach has certain benefits over the others. Aside from a very few persons, the majority of people are unaware of the agarwood inoculation/wounding methods (Talucder et al., 2016). In light of the foregoing, the current study was conducted with the following objectives: to explore farmers' attitudes regarding agar wounding techniques and to document the limitations of existing conventional agar wounding techniques.

Materials and Methods

This section comprises of geographical location, methods of investigation, site selection, data collection, processing, and analyses. The study area was Barlekha Upazila of Moulvibazar district. Barlekha Upazila is situated between 24°33' and 24°50' north latitude and between 92°20' and 92°18' east longitude. The farmers of Bangladesh do not usually maintain records and accounts of their farm operations. So, the survey questionnaire method was followed to achieve the objectives of the study. To minimize errors, several repeated visits were made to collect the data properly. One hundred & four respondents in relation to owners and workers of agarwood and agar oil processing and production from Sujanager and Dakshin Dakshinbhag union under Barlekha Upazila were selected for the study. During August 2017 to February 2018, the survey was carried out. It was generally not possible to do survey covering all the respondents. For this reason, a stratified random sampling technique was followed to select the sample farmers. A structured questionnaire was used to collect information on agar processing from the selected respondents. On the basis of the pre-test of this schedule, necessary modifications, addition, and alteration were made to improve the validity and applicability of the schedule. The data were collected by the researcher herself by following the personal interview with both the agar farmers and owners. Before going to do an actual interview, a brief introduction of the aims and objectives of the study were explained to each respondent. After completion of each interview, the schedule was checked and verified to be ensured that the answers were correct in order to minimize errors. The data were collected in the local units. The local units were converted into standard units for the preparation of final tables. All the collected data were recapitulated and analyzed carefully. Finally, a few relevant tables were prepared according to the necessity of analysis & interpretation and to meet the purpose of the study. Data were averaged, and standard deviation was calculated wherever necessary.

Results & Discussion

Wounding techniques and nailing practices

The investigation showed two main types of wounding techniques: by nailing and by natural insect attack. The majority of farmers (87%) used the nailing technique, while the remainder (13%) used it to collect wood from natural insect attacks. In Barlekha Upazila, 83% farmers thought that agarwood obtained from natural insect attacks was more profitable, while the remaining 17% of farmers supported the nailing technique system. From the analysis, it was clear that the majority of the farmers believed that insect attack on agarwood was more profitable than other techniques. Most of the farmers (97%) knew about the wounding technique from their forefathers, and only 3% of farmers knew from neighbors. The nail was pushed onto the agar plant at 1-5, 6-10, 11-15, and >15 years. According to our observations, farmers typically nail their agar trees between 11 and 15 years. On the other hand, Ahmed (2010) reported that at the age of 7-8 years of agar plant, farmers generally pushed nails into the tree. According to the observed data at Barlekha Upazila, most farmers (86%) cut their trees after five years of nailing, but Ahmed (2010) reported that farmers generally cut their trees after 6-7 years of nailing.

Table 1: Wounding techniques & nailing practiced at Barlekha Upazila of Moulvibazar district

Category	Related percentage
Wounding techniques practiced by the respondents	
By nailing	87
Insect attack	13
Profitable wounding techniques	
By nailing	17
Insect attack	83
Source of information about the wounding techniques	
Forefather	97
Neighbour	3
Age of plants for nailing (year)	
1-5	2
6-10	33
11-15	64
>15	1
Time of agar tree cutting after nailing (Range of year)	
Within 5 years	86
6-10 years	13
11-15 years	1

Table 2: Size, amount & frequency of reusing nail practiced at Barlekha upazila of Moulvibazar district

Category	Related percentage
Size of nail (cm)	
≤5	2
6-10	55
11-15	43
Nail used per tree (kg)	
<10	1
11-25	17
26-40	44
41-55	37
>55	1
Use of old/new/both nail	
New	32
Old	39
Both (New & old)	29
Frequency of reusing nail	
1	2
2	81
3	16
>4	1

Table 3: Wounding techniques & nailing practiced at Barlekha upazila of Moulvibazar district

Category	Related percentage
Techniques used for pushing nail	
Climbing in the tree	31
Using ladder	16
Using bamboo trellis	53
Vertical distance of nail to nail (inch)	
1.0-2.0	10
2.1-3.0	70
>3.0	20
Horizontal distance of nail to nail (inch)	
1.0-1.5	64
1.6-3.0	19
>3.0	17

Technique of collecting agar oil		
Distillation		100
	Period of fermentation (days)	
1-10		26
11-20		72
21-30		2
	Yes	No
Choice of changing nailing techniques	2	98
Choice of reusing of nail	97	3

Size and frequency of nail implementation

Metallic rods of different sizes (<5, 6-10 and 11-15 cm.) were used by 2%, 55%, and 43% of the respondents, respectively. In the area, most of the farmers (44%) opined that they used 26-40 kg of nails per tree. The amount of nail depends on the size of the tree and nail. Some farmers (32%) used new nails, some farmers (39%) used old nails, and the rest, 29% of farmers used both new and old nails. The use of old nails was more than new or both (new and old) nails. 2% of farmers used nails one time, 81% of farmers used nails two times, 16% used nails three times, and only 1% of farmers used their nails more than four times. From the data analysis, it can be said that most of the farmers' choices were to reuse the nail twice.

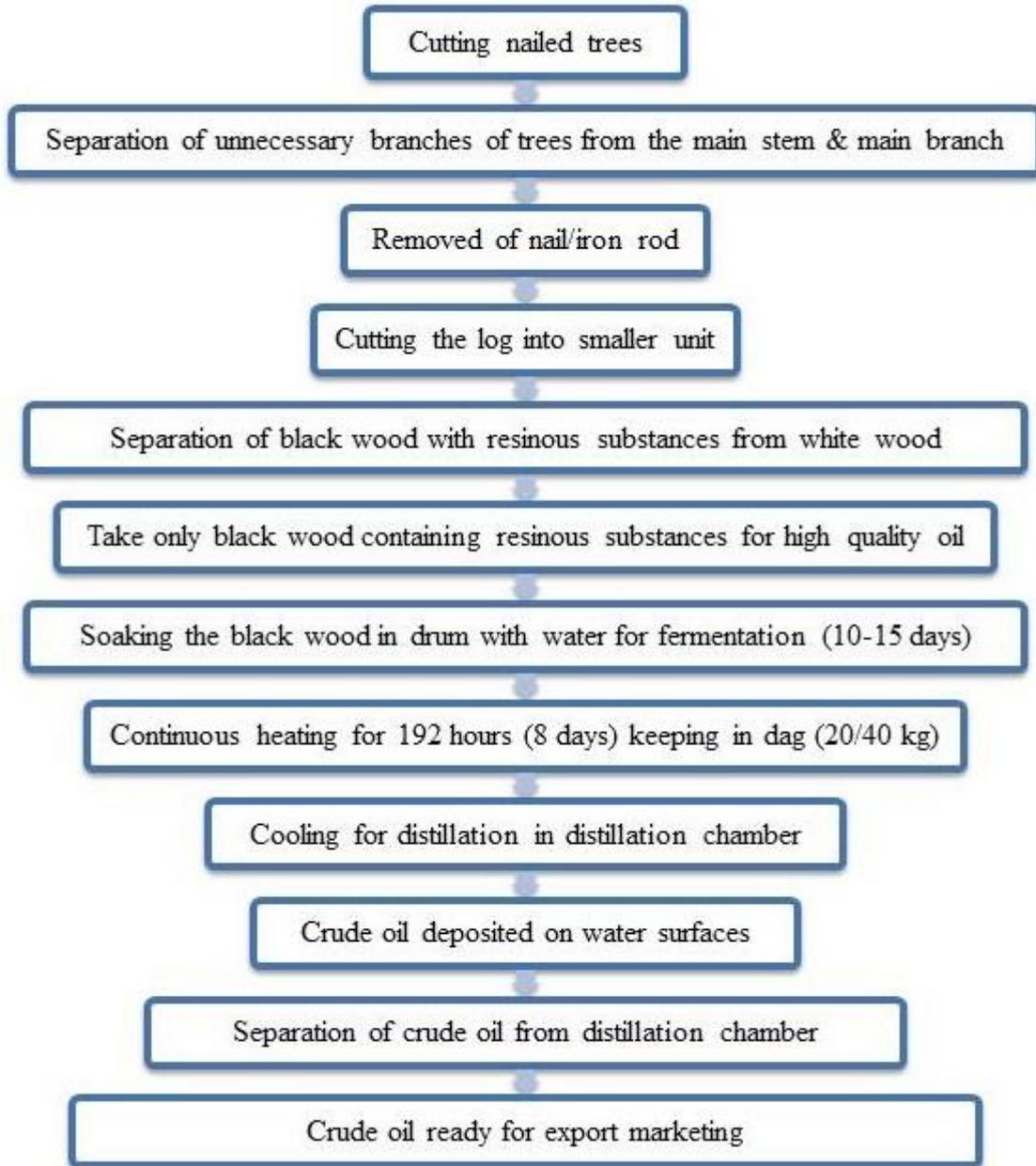
Distance kept between nail to nail and nail pushing approaches

Farmers used different techniques to drive nails into agar trees. 31% of farmers pushed nails by climbing on the tree, while 16% of farmers used ladders, and the rest 53% of farmers used bamboo trellis for nail pushing. Most of the farmers' preferred bamboo trellis for nailing on agar trees. The majority of farmers (70%) kept a vertical nail pushing distance of 2.1-3.0 inches, 20% kept a distance of more than 3.0 inches, and the rest kept a distance of fewer than 3.0 inches. In the case of vertical distance, Ahmed (2010) reported in his report that it is 2 inches (5.08) from one nail to another. Most of the farmers (64%) maintained a 1.0-1.5 inch distance for horizontal nail pushing, 19% of the farmers maintained a 1.6-3.0 inch distance, and the rest of the 17% of farmers maintained a distance of more than 3.0 inches. Present study, conducted in Barlekha upazila, it was observed that the distillation method was used by the farmers. Ahmed (2010) also reported in his report that after cutting, farmers collect agar oil by the distillation method. From the observed data, it can be said that most of the farmers (72%) soaked their agar chips for 11-20 days, 26% of the farmers soaked them for 1-10 days, and the rest 2% of the farmers did it for 21-30 days. Ahmed (2010) reported in his report that farmers generally fermented agar chips for approximately 30 days. In Barlekha Upazila, only 2% of farmers wanted to change the technique, but 98% of farmers didn't want to change the technique. Most of the farmers didn't want to change the technique for agar wounding because they were satisfied with it.

Procedure of agar oil processing

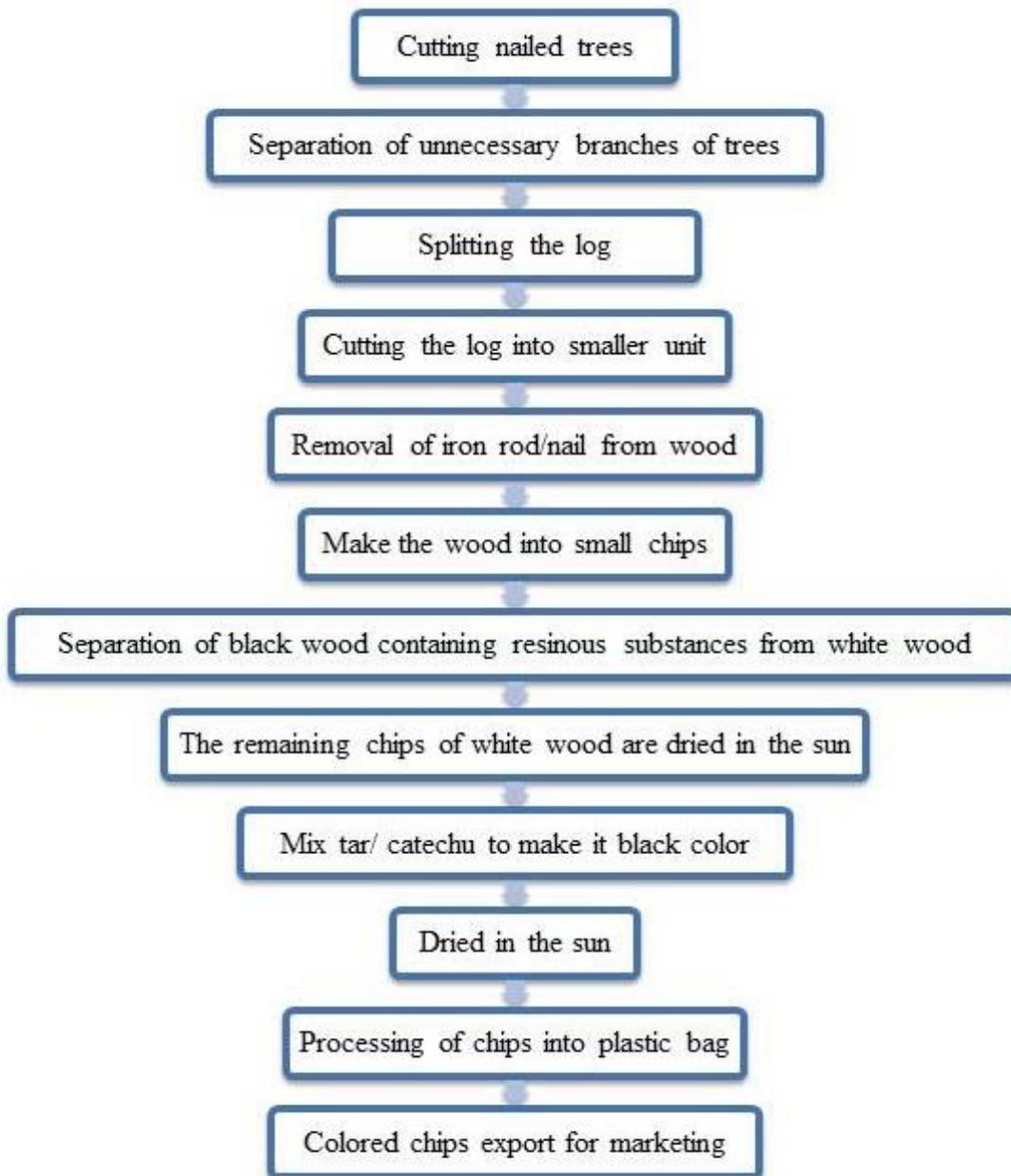
The general procedure of agar oil processing is shown in the following two flow charts.

Techniques of agar oil processing from agar tree (for high-quality oil)



Flowchart 1: Technique of producing high quality agar oil *National population trends*

Techniques of agar oil processing from agar tree (for low-quality oil)



Flowchart 2: Technique of producing low quality agar oil

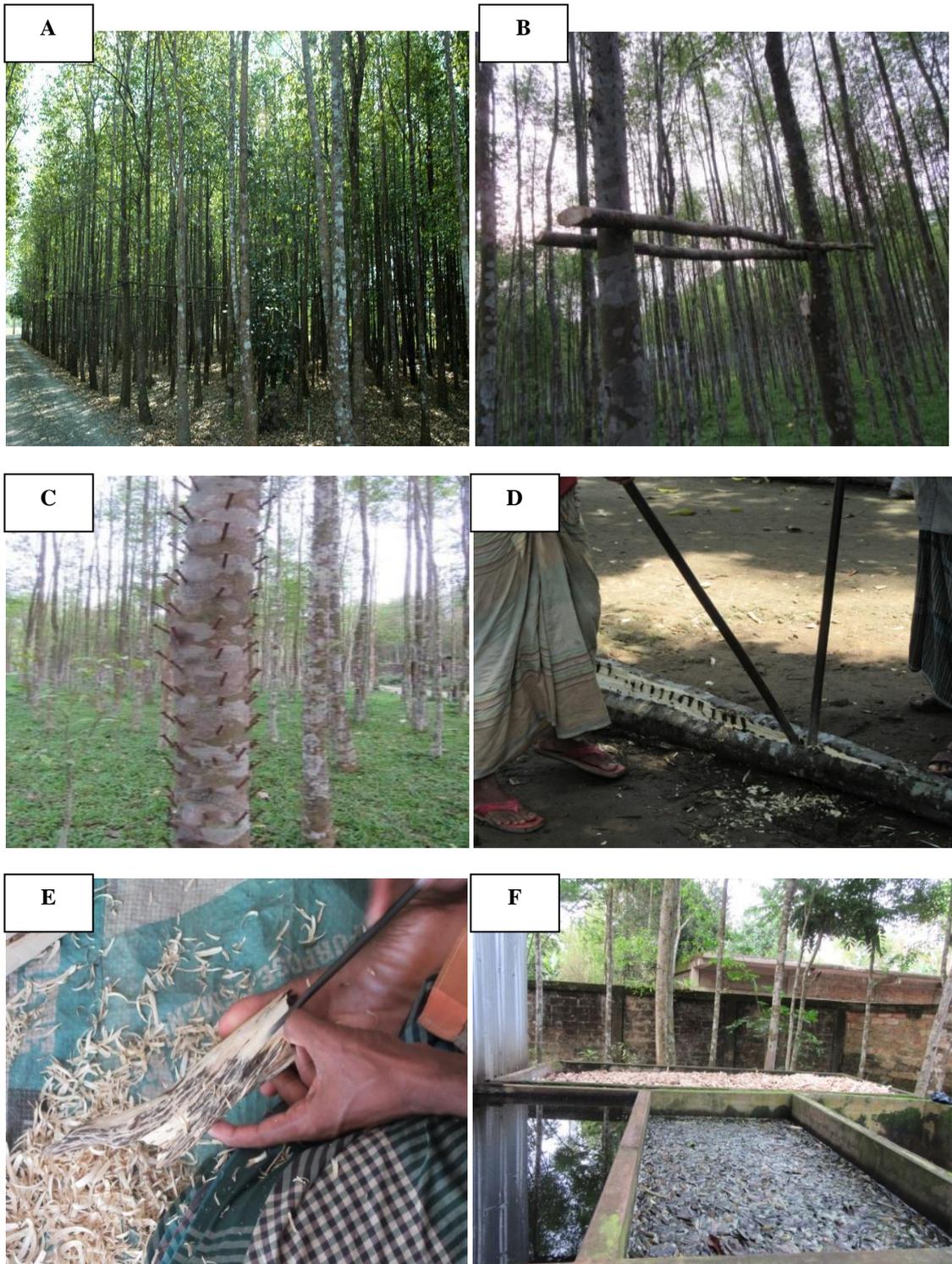


Figure 1: Agar tree nailing and agarwood processing techniques chronologically, A- Agar garden, B- Using trench (Macha) for nailing the agar trees, C- A nailed tree, D- Separation of the nail from the tree, E & F- Separation of black wood from the white wood and soaking in the water.



Figure 2: G & H- Continuous heating of soaked wood by gas

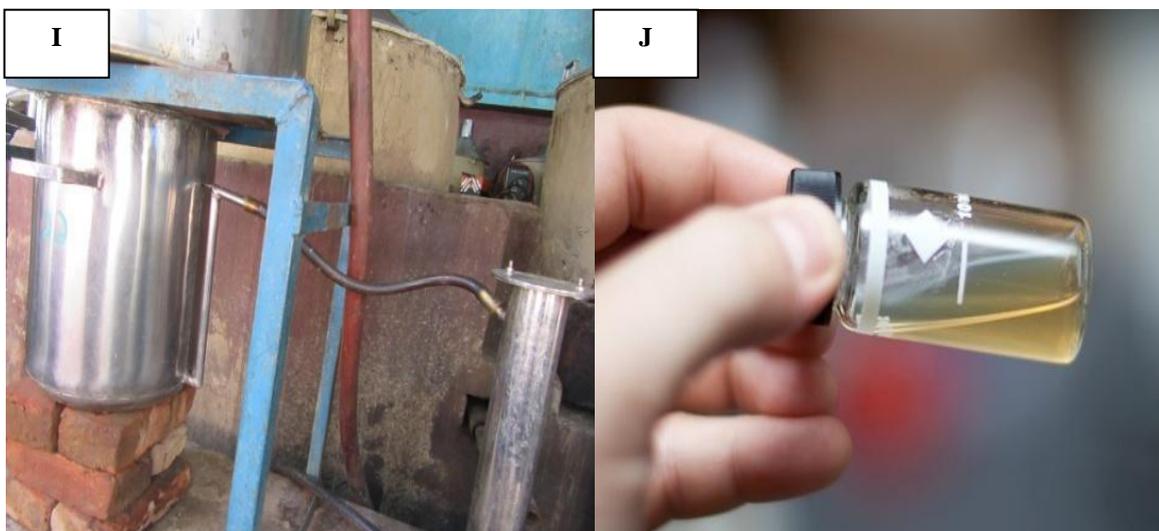


Figure 3: I- Cooling system, **J-** Final product (Agar oil)

Conclusion

Due to its favorable climatic and edaphic conditions, the agar tree is one of the most promising components for varied agroforestry systems in Bangladesh, particularly in the Sylhet region. Agarwood is a resinous wood substance produced by the tree as a nonspecific host response to wounding. Nailing is popular in Barlekha Upazila in the Moulvibazar district, although low yield. However, traditional nailing technique is not profitable, so modern technology should be introduced among the farmers, as Talucder et al. (2016) mentioned. With the modern techniques, proper training and loan facility should be provided with easy terms and conditions.

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