Reprint

# International Journal of Sustainable Crop Production (IJSCP)

(Int. J. Sustain. Crop Prod.)

Volume: 14

Issue: 1

November 2019

# Int. J. Sustain. Crop Prod. 14(1): 44-49 (November 2019)

# TRADITIONAL PRACTICES OF AGARWOOD (Aquilaria malaccensis) PLANTATION IN MOULVIBAZAR OF BANGLADESH

M. DAS, M.S. UDDIN, M.A. KASHEM, M.S.A. TALUCDER, T.B. HYE AND T. AFROZ





# TRADITIONAL PRACTICES OF AGARWOOD (Aquilaria malaccensis) PLANTATION IN MOULVIBAZAR OF BANGLADESH

M. DAS<sup>1</sup>, M.S. UDDIN<sup>1</sup>, M.A. KASHEM<sup>2</sup>, M.S.A. TALUCDER<sup>1</sup>, T.B. HYE<sup>1</sup> AND T. AFROZ<sup>1</sup>

<sup>1</sup>Climate-Smart Agriculture Lab, Department of Agroforestry and Environmental Science, Sylhet Agricultural University, Sylhet-3100, Bangladesh; <sup>2</sup>Department of Soil Science, Sylhet Agricultural University, Sylhet-3100, Bangladesh.

\*Corresponding author & address: Mitali Das, E-mail: mitali.das48@yahoo.com

Accepted for publication on 8 November 2019

#### ABSTRACT

Das M, Uddin MS, Kashem MA, Talucder MSA, Hye TB, Afroz T (2019) Traditional practices of agarwood (Aquilaria malaccensis) plantation in Moulvibazar of Bangladesh. Int. J. Sustain. Crop Prod. 14(1), 44-49.

Bangladesh is favorable for commercial agarwood (*Aquilaria malaccensis*) production but very few research works were done in the study area on good agricultural practices. The study was carried out to document the typical management practices of agarwood tree in Barlekha upazila of Moulvibazar district, during September 2017 to March 2018. Total 104 agarwood gardeners and workers of agarwood garden from 14 villages of Barlekha upazila in Moulvibazar district were randomly selected for the study. Data were collected through face-to-face interview using a structured questionnaire. Most of the respondents (80%) used seedling collected from nursery and planted mostly in the month of May-June, whereas only 20% of the respondents used seed for agar cultivation maintaining plant spacing mostly of 0.60-1.0m  $\times$  1.2-2.0m. It was found that seedling used for agarwood plantation was less than one-year and majority of them didn't use fencing. The findings also revealed that agar trees gave flower after 6-10 years. In the study area, only 8% farmers used fertilizer and manure in agarwood cultivation. Insect-pest infestation in agarwood plants was 45%. There was no modern agronomic practices in the study area, which was major reason behind the low quality and quantity of agarwood production in Bangladesh which implies the urgency of research and extension of good agricultural practices on agarwood plantation connected with SDG1 and SDG13.

Key words: agarwood, management practices, Moulvibazar

# **INTRODUCTION**

Agarwood is a resin filled wood produced in Aquilaria and Gyrinops trees with a long history of use as incense, perfume and in traditional medicine. Chakrabarty et al. (1994) stated that the trees grow upto 6-20 m tall. Morphologically the leaves are alternate, 5-11 cm long and 2-4 cm broad, with a short acuminate apex and an entire margin. The flowers are vellowish-green color, produced in an umbel type of inflorescence and the fruit is a woody capsule type having 2.5-3 cm. They are best grown in monsoon regions where annual rainfall is about 2000 mm and hills and mountains of the tropical areas. Agarwood tree grows well in well drained high to medium high land where moist and shady conditions are prevailed. It can also grow in poor sandy soil and tolerate cold or hot weather. The most important source of agarwood is the Aquilaria spp., which is an angiosperm under the Thymelaeaceae family. Eight Aquilaria species, including Aquilaria sinensis, were listed on the IUCN red list as endangered species. According to convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2004), Aquilaria malaccensis is rated vulnerable and A. crassna is "critically endangered" while there seems to be some confusion over Aquilaria agallocha. This species is considered a synonym for Aquilaria malaccensis (Anonymous 1999; Anonymous 2001; Ng et al. 1997) although some believe Aquilaria agallocha to be distinct species. The species, which attains a height of about 40 m, is tropical evergreen in nature and sometimes is also named as Aquilaria malaccensis (Hayder et al. 2005).

The history of agarwood in Bangladesh is ancient and mainly *Aquilaria malaccensis* grows naturally in Sylhet, Chittagong, Cox's Bazar and Chittagong hill tracts from long-standing but at present natural grown agarwood tree is very hard to find. Agarwood is found irregularly in the forests of Sylhet, Chittagong and the Chittagong Hill Tracts (CHTs). Agarwood has never been cultivated commercially at wide range. At present, approximately 50-60 families of Azimganj, Dakshinbhag and Sujanagar under Barlekha upazila in Moulvibazar district are directly involved with agar production and processing. Agarwood is one of the most promising non-timber forest products (NTFPs) of Bangladesh, which earns huge foreign currency through exporting of attar (agar oil) and other value added products (Talucder *et al.* 2018a; Talucder *et al.* 2016; Hayder *et al.* 2005). There are also some privately owned agarwood plantations in the north-east, particularly in Moulvibazar district where many households have been engaged in production and marketing of agar and agar-based secondary products for several decades (Talucder *et al.* 2016; Hayder *et al.* 2005).

North-east and south-east region is favorable for agarwood tree production due its edaphic and climatic factors. Annual rainfall normality is about  $2420\pm390$  mm in Moulvibazar district (Talucder 2015). However, area under the agarwood plantation is decreasing in the study area (Talucder 2018b). In contrast, demand for agarwood is increasing. Hence, it is very crucial to improve the productivity through good agricultural practices. But, very little information is available on cultivation practices (Talucder *et al.* 2016). Now, there is a need to study the process as ample scope of a boost up its production, particularly in north-east hilly regions in the country. In view of this situation the present study is attempted to document the socioeconomic condition of agar stakeholders and to analyze agronomic management practices of agarwood gardening.

## MATERIALS AND METHODS

A total of 14 villages under 2 unions viz. Sujanagar and Dakshinbhag under Barlekha upazila under Moulavibazar district were selected for data collection during September 2017 to March 2018. Total 104 respondents related to owners and workers engaged in agarwood gardening from Dakshinbhag, Duhalia, Gangkul, Kamilpur, Borthal, Rafinagar, Shalidigha, Hashimpur, Baghmara, Sujanagar, Azimganj, Shapla gate, Babnarchokh, and Chintapur villages were selected randomly. In Barlekha upazila, majority of the residents cultivated agarwood tree. A "simple random sampling" technique was followed to collect the data for this study. Since the main agarwood growing regions are Sujanagar and Azimgani, therefore, most of the respondents were selected from those areas. A survey questionnaire was used for collecting information on agar production from the selected respondents. In order to prepare final survey schedule, a draft questionnaire was prepared for keeping the objectives in view and to record the desired information from the respondents. The draft questionnaire was pretested in the study area by interviewing a few agarwood stakeholders. The respondents were interviewed separately. Before starting the interview, each respondent was given a brief description about nature and purpose of the study. During the interview, the questions were asked systematically and explained wherever it was felt necessary. After completion of each interview, the questionnaire was re-checked and verified to be sure that answer had been properly recorded. All the collected data were re-checked before transferring to the master sheets. The collected data were first transferred to master sheets. Then these were classified, tabulated and analyzed in terms of the objectives set for the study using MS Excel.

#### **RESULTS AND DISCUSSION**

#### Socio-economic profile of the respondents

Age of the respondents ranged from 14 to 65 years with an average of 34 years. The sample farmers of the study area were categorized into five groups on the basis of their education *viz*. illiterate, primary (class I to V), secondary (class VI to X), higher secondary (class XI to XII) and Graduate (above class XII which indicates hons./degree/graduation/postgraduation). Observed range of educational status of the respondents were 0 and 16 with an average of 7. The findings indicated that most of the farmers' education status was upto primary and secondary level in Barlekha upazila. This observation is also in conformity with national average of education of Bangladesh (BBS 2017). Family members of the area ranged from 2-9 with an average of 6. In Sylhet division, it is very common to live together with parents and with brothers, sisters and sometimes with relatives. Farmers homestead size was categorized according to BBS (2010) where 46% farmers belong to the landless group. Annual income of the respondents ranged from Tk. 72,000 to 1500,000 with an average value of Tk. 257,000.

Category	Related percentage
Age (years)	
Young (up to 35)	62
Middle (36 to 50)	25
Old (above 50)	13
Educational status	
Illiterate	2
Primary (1 to 5)	36
Secondary (6 to 10)	47
Higher secondary (11 to 12)	10
Graduate (13 to 16)	5
Family size (family member)	
Small (1 to 4)	38
Medium (5 to 8)	48
Large (>8)	14
Homestead size (ha)	
Landless (up to 0.05)	46
Marginal (0.05-0.10)	24
Small (0.11-0.20)	5
Medium (0.21-0.3)	4
Large (>0.30)	21
Annual income status	
Low income (up to 100000 Tk.)	5
Medium income (100000-300000 Tk.)	76
High income (>300000 Tk.)	19

### Traditional management system of agarwood plantation

The findings of the study indicated that most of the respondent farmers (80%) used seedling for agarwood cultivation, whereas only 20% of the respondent farmers used seed. The best time is during the rainy season (May-September) according to EIRI (2009). It was observed in present study that about 88% planting was done mainly in the month of May-August. Seed viability is approximately one week and germination takes place between 16 and 63 days (Ng 1991). In this study, germination was observed mostly in between 6 and 25 days. In Barlekha upazila, most of the farmers (96%) used one year or less aged seedlings for planting. In contrast, 4% farmers used 1 to 2 years aged seedlings for planting. Sarker (2016) observed planting materials mostly used in the study area were seedling, which was collected mostly from nursery. In this research, it was also observed that near about 80% planting materials used in the Barlekha upazila were seedling, which was also collected from nursery. Most of the seeds (90%) are available in the month of May-August in this study. Ahmed (2010) also reported that Agar plant is propagated by seeds, which are available in the month of June-July.

Table 2. Different categories related to management practices are given below

Category	Related percentage
Planting materials	
Seed	20
Seedling	80
Time of planting (month)	
May-June	62
July-August	36
September-October	2
Days to seed germination	
1-10	33
11-20	44
21-30	18
>30	5
Age of seedling	
$\leq 1$ year	96
1year-2years	4
Source of seedling collection	
Private nursery	85
Self production	15
Seed collection month	
May-June	47
July-August	43
September-October	10

#### Other management practices related to agarwood plantation

Majority of the farmers (61%) opined that they maintained the plant spacing  $0.60-1.0 \times 1.2-2.0$  m, while 30% farmers maintained  $<0.50 \times 1.0$  m spacing and only 8% farmers maintained  $1.0-2.0 \times 2.0-4.0$  m spacing and rest 1% farmers maintained  $>2.0 \times >4.0$ (m) spacing during agar plantation. Pit size was found 31-40 cm but planting of the saplings is done in well-prepared pits of size 50 x 50 x 50 cm according to EIRI Board (2009). Height of agarwood tree ranged from less than 6 m to 15 m. In this range, 14% farmers opined that the height of agarwood tree was <6.0 m, 45% farmers opined that it was 6.0-9.0 m. 39% farmers opined that it was 9.0-12.0 m and rest 2% farmers opined that the height was 12.0-15.0 m. In Barlekha upazila, most of the farmers opined that the agarwood plant took 6-10 years for flowering after planting. Ahmed (2010) reported that in agar plant flowering occurs in the month of February-March which is similar to this observation. In this present study, it was observed that fertilizer and manure was not used by most of the growers only a very few of them used it in very low amount. Because without using fertilizer and manure they believed that they are getting the ultimate product properly. As a result, the respondents were not interested in using fertilizer and manure. Fertilizer applied in the agarwood plantation was mainly urea, TSP and MoP. Sarker (2016) also reported only 20% farmers used fertilizer and manure.

#### Traditional practices in agarwood plantation

In this study, 45% farmers responded about positive insect-pest infestation. According to farmers' base line survey the insect were ant, caterpillars but they didn't use any type of insecticide/fungicide. Because they thought insect attack was not so harmful for the trees. According to the EIRI (2009), agarwood plantation no such serious pests and diseases have been observed. However, *Heortia vitessoides* a leaf-eating caterpillar is considered to be the most destructive pest causing damage by complete defoliation of agar plantations and has become a real menace to the plantations in this region.

#### Das et al.

T 11 0	$\alpha$ ·	1 . 1 . 1 .			C 1	1
I ahla 3	1 otornorior r	acondente related to	o managamant	nracticae o	t anarwood	nlantation
$1 \mathbf{a} \mathbf{m} \mathbf{a} \mathbf{n}$	<u>, an 2011, s i</u>			naunas u		планнанкли
1 4010 01	Caregoines i	espondents renated t	o management	presence of 0	1 4944 11 000	preserveron

	6 1
Category	Related percentage
Plant spacing (m)	
<0.50×1.0	30
0.60-1.0×1.2-2.0	61
1.0-2.0×2.0-4.0	8
>2.0×>4.0	1
Pit size (cm×cm×cm)	
20-30×20-30×20-30	32
31-40×31-40×31-40	43
41-50×41-50×41-50	5
>50×>50×>50	20
Height (m)	
<6	14
6-9	45
9-12	39
12-15	2
Time to flowering after planting (years)	
<5	6
6-10	61
11-15	33
Flowering month	
January- February	8
March-April	69
May-June	23
Use of fertilizer and manure	
Only fertilizer	5
Only manure	1
Both fertilizer and manure	2
Neither fertilizer nor manure (None)	92

According to the respondent's perception, 5% of them cultivated intercrop such as some cultivated betel leaf and some cultivated black pepper along with the agar tree. 95% didn't practice any kind of intercrop in agarwood plantation. Some of them were interested for intercropping but majority of them were not interested. As the medicinal value, they said that agarwood leaves act as remedial measurement of cold, cough etc. as well as the water remain after heating of agarwood acts as gastric remedy. Vegetables/pulses or aromatic crops like Patchouli (*Pogostemon cablin*), Sugandh mantri may be cultivated as short season/short term intercrops during first three to five years of plantation. In the later stages shade loving medicinal plants like Sarpagandha (*Rouvolfia serpentina*), long pepper (*Piper longum*) may also be grown for another few years depending on plant population and land type. Ginger/turmeric may also be planted leaving about 50 cm around plant base (Ahmed 2010). Most of the respondents in the study area opined that they were satisfied with agar plant cultivation. All (100%) of the respondents of Barlekha upazila opined that there was a positive impact of agar production on environment. They thought that agar gave them shade, oxygen and it helped the environment to keep sound as well as it conserves biodiversity which contributes to at least SDG1 (no poverty), SDG 13(Climate action) and SDG 15 (life on land) (Talucder *et al.* 2016).

Table 4. Traditional operations practiced in agarwood plantation in Barlekha upazila of Moulvibazar

Catagony	Related percentage		
Category	Yes	No	
Fencing	7	93	
Insects-pests infestation	45	55	
Insecticide/pesticide/fungicide use	0	100	
Intercropping practices	5	95	
Medicinal value	1	99	
Satisfaction on agarwood cultivation	96	4	
Collection of agarwood seed	69	31	
Environmental impact	100	0	



**Fig. 1.** Agarwood plantations in Barlekha upazila of Moulvibazar district. A & B- Agarwood plantation orchard at Sujanagar union, C- Agarwood seedling grown from seed, D- Agarwood seedling grown from nursery, E-Agarwood fruit, F- Association of betel leaf with agarwood tree.

## CONCLUSION

Agarwood plantation was found very profitable as well as good for environmental benefits (Biodiversity conservation) in Barlekha upazila of Moulvibazar district due to its favourable climatic conditions. Major constraints faced by the agarwood workers in the study area were lack of knowledge on technologies of management practices. Weeding, timely earthing up, proper plant spacing maintaining, fencing, manuring or composting in appropriate time are recommended to get high quality wood or oil from the tree. As agarwood is a long-durated crop, intercropping may be done such as shade loving crop could be cultivated in the agarwood garden. As a high-valued crop, it can be introduced in the other high hilly areas e.g., tea garden, homestead and roadside agroforestry. Creating public awareness about environmental benefits of agarwood tree is also to be considered to improve the economic condition of the rural people.

# ACKNOWLEDGEMENT

Authors acknowledge the Competitive Research Grant (CRG) Project of PIU-BARC, NATP-2 (Project ID-418) for providing financial support during data collection. The first author also acknowledges the National Science

& Technology (NST) fellowship by the Ministry of National Science & Technology, Government of the People's Republic of Bangladesh.

# REFERENCES

Ahmed F (2010) Study of Agar Production in two selected areas Bangladesh. MS Thesis, Department of Farm Power and Machinery. Bangladesh Agricultural University, Mymensingh.65p.

Anonymous (1999) Taiwan Regulates CITES Plants. TRAFFIC Bulletin.17(3), 95.

Anonymous (2001) Land and Soil Resources Bulletin (Barlekha, Moulvibazar). SRDI, Ministry of Agriculture, Government of the People's Republic of Bangladesh.

BBS (Bangladesh Bureau of Statistics) (2010) Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics. Ministry of Planning, Dhaka.

BBS (Bangladesh Bureau of Statistics) (2017) Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics. Ministry of Planning, Dhaka.

Chakrabarty K, Kumar A, Menon V (1994) Trade in agar wood. WWF-India/TRAFFIC India, New Delhi.

CITES (2004) The CITES Appendices (The Convention on International Trade in Endangered Species of Wild Fauna and Flora). Available Source: http://www.cites.org/eng/append/index. Shtml. 3 Sep. 2003.

EIRI (2009) Hand Book of Medicinal and Aromatic Plants: Cultivation, utilization & extension process, Delhi. 396.

Hayder MAK, Rahman LM, Rahman MA (2005) Experimental agar production project (in Bengali). Department of Forests, Ministry of Environment and Forest, Dhaka.1-16.

Ng FSP (1991) Manual of forest fruits, seeds and seedlings. Forest Research Institute Malaysia. 2(34), 997.

Ng LT, Chang YS, Kadir AA (1997) A review on agar (gaharu) producing Aquilaria species. JTFP. 2, 272-285.

Sarker R (2016) Socio-economic Analysis of Agar Tree Producers in Moulvibazar District of Bangladesh. MS Thesis, Department of Agronomy and Haor Agriculture, Sylhet Agricultural University, Sylhet.

Talucder MSA (2015) Annual and seasonal trends of precipitation in Moulvibazar district of Bangladesh from 1950 to 2014 using Mann-Kendall test. J. Sylhet Agril. Univ. 2(2), 183-188.

Talucder MSA (2018a) Opportunities and challenges of existing agroforestry practices in Sylhet region for food security. *SAU Res. Prog. Rep.* 05, 15.

Talucder MSA (2018b) Evaluation of tree-crop interaction from existing agroforestry systems in Sylhet region for food security by the lens of Climate-Smart Agriculture framework. Project Completion Report. Project Implementation Unit, National Agricultural Technology Program-Phase II Project (NATP-2), Bangladesh Agricultural Research Council (BARC), New Airport Road, Farmgate, Dhaka-1215.Bangladesh.

Talucder MSA, Haque MM, Saha D (2016) Development of Agar (*Aquilaria malaccensis*) cultivation, propagation technique and its potentiality as agroforestry component in Bangladesh: a review. J. Sylhet Agril. Univ. 3(2), 149-157.