Small-scale Forestry (2008) 7:139–149
DOI 10.1007/s11842-008-9046-2

RESEARCH PAPER

Small-scale Agar (*Aquilaria agallocha* Roxb.) Based Cottage Enterprises in Maulvibazar District of Bangladesh: Production, Marketing and Potential Contribution to Rural Development

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Accepted: 24 March 2008 / Published online: 10 April 2008

Abstract Globally, trade in agar-based products is growing rapidly due to their recent adoption as an ingredient in the cosmetics and pharmaceuticals sector. In Bangladesh, people living in some north-eastern districts have been engaged in the production, processing and trading of such products for several decades. These practices, which they consider as the lifeblood of their existence, have been inherited from their ancestors. This paper reports a case study carried out in Maulvibazar district exploring the production and marketing, and industry problems, of agar-based enterprises and their potential contribution to socio-economic development. An exploratory survey was undertaken over 30 randomly selected agar-based factories during December 2005–April 2006, with entrepreneurs of the factories personally interviewed using a semi-structured questionnaire. The majority of the factories of the area were found to depend on local sources of raw materials to produce agar-based products. About 514 full and part-time workers are employed in the factories. Average annual expenditure, revenue and net annual income per factory for three consecutive years 2003–2005 of the study were estimated as Tk 63,980, Tk 111,414 and Tk 47,435, respectively, being highest where *attar* (agar oil) of superior grade was produced for export. There appears to be a sustainable source of raw materials, availability of technical and financial assistance and opportunity for expansion of market facilities to secure the maximum benefit achievable from this highly promising industry.

Keywords Small enterprises · Labour condition · *Attar* · Secondary products · Marketing channel · Income generation

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Introduction

Agar, eaglewood, *gaharu* and aloeswood are alternative names for the resinous, fragrant and highly valuable heartwood produced by *Aquilaria agallocha* Roxb. (Thymelaceae) and other species of the Indomalasian tree genus *Aquilaria* (Barden et al. 2000; Das and Alam 2001). The species, which attains a height of about 40 m, is tropical evergreen in nature and sometimes is also named as *A. malaccensis* (Chang et al. 1997; Chowdhury et al. 2003; Hayder et al. 2005). It occur widely in south and south-east Asia, including in Bhutan, Nepal, India, Myanmar, Malaysia, Indonesia, Thailand, Vietnam and Papua New Guinea (Rahman and Khisa 1984). Agarwood has been used for diverse purposes throughout the world for thousands of years. Its use has been reported in Ayurvedic, Tibetan and traditional east-Asian medical practice, including *Shahih Muslim* and *Susruta Samhita* (Chakarbarty et al. 1994; Fratkin 1994). Its use as a perfume has been recorded in the *Old Testament*. Agarwood incense has been burned to produce a pleasant aroma for centuries, on important religious ceremonies, by Buddhists, Hindus and Muslims (Ng and Azmi 1997).

Agar is traded in several forms, from large sections of trunk to highly processed products including incense and perfumes. The essence extracted from agarwood is now widely used as a fragrance to manufacture beauty soaps and shampoos. Trade in agarwood dates back as early as the 13th century. India was one of the earliest sources of agarwood for foreign markets but the major suppliers are now Indonesia and Malaysia. Currently the demand for the species far exceeds supply. Up-to-date cumulative data concerning worldwide trade in agar products are very limited; over 700 tons of agarwood were reported in international trade in 1997, with the price of agarwood chips during that year of $US 20–60/kg and the price of oil distilled from agarwood ranging between 956 and 7,059 $US/kg (Barden et al. 2000).

Agar is one of the most promising non-timber forest products (NTFPs) of Bangladesh, and earned Tk.[1] 300 M through exports of *attar* (agar oil) in 2004 (Hayder et al. 2005). About 25,000 workers were engaged in cultivation, collection, processing and marketing of agar and agar-based products in that year (Hayder et al. 2005). Despite the huge demand in local and international markets, no major extension program has so far conducted by governments or other agencies in Bangladesh. The Forest Department (FD) recently raised some agar plantations in denuded and encroached forest areas of the Chittagong and Sylhet districts. Agar is found irregularly in the forests of Sylhet, Chittagong and the Chittagong Hill Tracts (CHTs). There are also some privately owned agar plantations in the north-east, particularly in Maulvibazar district where many families have been engaged in production and marketing of agar and agar-based secondary products for several decades. Of the 121 registered agar-based factories nationally, 111 are located within this region, making a major contribution to regional employment and gross domestic product (Hayder et al. 2005).

In spite of the important economic role of these factories, little reliable information is available about their status, socio-economic significance, production and marketing. The study reported here was designed to examine the production and marketing of agar-based products in the north-eastern Bangladesh, and its potential

[1] $US1 equals approximately 69 Bangladeshi Taka (Tk), as at November 2007.

contribution to regional socio-economic development. A further objective was to generate policy implications for efficient management of this industry and to develop new strategies for improvement of agar and agar-based industries.

The Study Site

The study was conducted at Barlekha upazila (sub-district) of Maulvibazar district in Sylhet division on north-western Bangladesh during December 2005–April 2006. The majority of agar and agar-based factories of the country are located in this area. The upazila covers an area of about 430 km^2 located between 24°33′ to 24°50′ north latitude and 92°02′ to 92°18′ east longitude (Fig. 1). The area is bounded Beanibazar

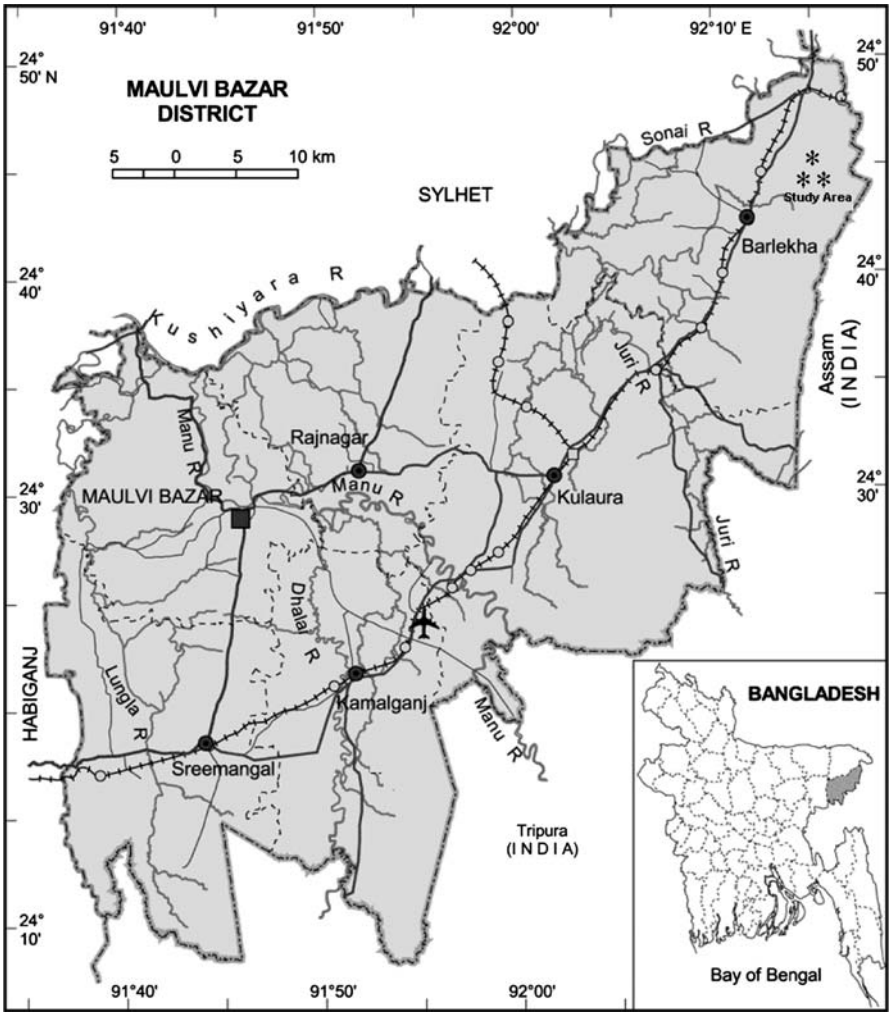

Fig. 1 Map of the study site

upazila in the north, Kulaura upazila on the south, India in the east and Golabganj and Fenchuganj upazila in the west (SRDI 2001). Topographically, the upazila consists of small to medium hillocks locally termed as *tillah*. Soils in the area are sandy-loam to clay-loam, and are slightly acidic. The average annual rainfall ranges between 600 and 2,000 mm (Alam 2004). November–February (winter) are relatively dry months, with hot weather in March and April. The maximum and minimum monthly temperature varies, respectively, between 22 to 28°C and 14 to 21°C (SRDI 2001). The population of the upazila in year 2001 was 200,674 (ASB 2003).

Survey Method

Thirty small-scale agar-based enterprises were chosen at random from within two unions of Barlekha upazila, namely Sujanagar and Dhakhinbag, a sampling fraction of about 27%. A semi-structured questionnaire was developed for interviewing factory owners, with survey data supplemented by direct observation of local factories and markets. Interviews were performed during daytime, with an average duration of about 45 min. Data were sought on production of agar and agar-based secondary products, labour use, sources of raw materials, market channels and marketing of finished products, and the socio-economic impact of small-scale agar-based enterprises. For financial analysis, data were collected from factory owners for three consecutive years–2003–2005–and were cross-checked against data from other reliable sources, including from local knowledgeable persons involved with *attar* trade. On each survey topic, respondents were encouraged to express their views and provide additional information regarding agar husbandry in the area.

Study Findings

Socio-economic Background of the Respondents and Labour Condition

All respondents were male, the average age was 37 years, and the literacy rate was 77%. About 57% of respondents had been involved in agar-based business for at least 10 years, and 27% respondents for 5–10 years. Agar-based business was the main occupation for 63% of respondents.

The small agar-based factories occupied land areas of between 0.02 and 0.15 ha. About 90% of factories were found to collect raw materials (agar chips) only from local sources, mainly self-managed agar plantations; the remainder depends both on local sources and importing agar chips from Singapore and other Asian countries. The volume of raw materials used differed widely between factories; about 27% of factories utilized 100–200 kg/month, 50% used 200–500 kg/month, and the remainder 500–1,000 kg/month.

A total of 514 workers were engaged in the 30 factories surveyed, among whom 68% were male and 2% children (of age 16 or less). The numbers of labourers employed varied between 5 and 30 per factory. Among the labourers about 49% were skilled and 7% semi-skilled. Only about 10% of labourers were occupied

permanently in the factories, the others being employed as needed. The wage rate for full-time labourers varied from Tk 1,500 to Tk 6,000 per month. There was a shortage of skilled labourers, and these received a salary premium. Men were more highly paid than women and children.

Production of Agar-based Products

Attar, *agarbati* and agar chip residues were the main agar-based products in the study area that are traded both in local and international markets. *Attar* was the main or primary product of the local factories, and *attar* production was the most profitable business in the sub-district. Yearly production of *attar* varied between 11.28 and 37.5 kg per factory. Besides *attar*, the agar chip residue was used by bakers and *agarbati* (agar sticks) were used to produce scented flame; small unused branches of agar trees were used as firewood. These by-products had a strong domestic market. The average monthly production of agar chip residues by local factories was 33 sacks, with each sack weighting approximately 20 kg and worth Tk. 30-50 ex factory.

Production costs of agar-based products varied according to fuel source, being lower for those using natural gas (37% of respondents) compared with those using fuelwood. Fuelwood was mainly from local sources, the most common species being listed in Table 1.

The average annual expenditure of the surveyed factories was calculated as Tk 63,980 (compared with the current average capital investment required to establish an agar-based factory of about Tk 560,000), and the average annual income from both primary and secondary products was about Tk 111,414. Incomes were higher in factories that produced *attar* of higher grades and exported this to foreign countries. The annual net revenue of the factories was estimated to be Tk 47,435, indicating a profitable production system. Table 2 reports the financial analyses of

Table 1 Species commonly used as fuel at local agar factories of the study area

Species	Local name	Use frequency	Performance[a]	Price (Tk/kg)
Mangifera indica L.	Am	Frequently	++	5.0
Bombax ceiba L.	Simul	Frequently	++	3.0
Acacia auriculiformis Benth.	Akashmoni	Frequently	+++	5.0
Acacia mangium Willd.	Mangium	Frequently	+++	5.0
Albizia saman (Jacq.) Merr.	Raintree	Frequently	+++	4.0
Albizia spp.	Koroi	Frequently	+++	4.0
Erythrina variegata L.	Mandar	Occasionally	+++	3.0
Artocarpus heterophyllus Lam.	Kathal	Occasionally	++	3.5
Baringtonia acutangula (L.) Gaertn.	Hizal	Frequently	++	3.0
Syzygium cuminii (L.) Skeels	Jam	Rarely	+	3.5
Bambusa spp.	Bash	Occasionally	++	2.0
Anthocephalus chinensis (Lam.) Hassk.	Kadam	Occasionally	+++	4.0
Aegle marmelos (L.) Corr. Serr.	Bel	Rarely	+	3.0

[a] Fuelwood performance was ranked by respondents as: +++ very good; ++ satisfactory; + poor

Table 2 Financial performance of the survey factories[a]

Factory no.	Expenditure[b] (Tk)				Revenue (Tk)			Net revenue[f] (Tk)
	Labour[c]	Fuel	Other costs[d]	Total	*Attar* sales	Sales of by- product[e]	Total	
01	20000	9500	12170	41670	56000	700	56700	15030
02	24000	11400	10600	46000	50000	700	50700	4700
03	12500	7600	99735	119835	180000	2000	182000	62165
04	15000	7600	83735	106335	200000	2500	202500	96165
05	15000	9500	108500	133000	224000	3000	227000	94000
06	16000	9400	9600	35000	37500	420	37920	2920
07	21000	14250	15085	50335	60000	700	60700	10365
08	75000	31350	108320	214670	400000	6000	406000	191330
09	10000	9500	40500	60000	96000	1050	97050	37050
10	17600	11400	15600	44600	180000	1400	181400	136800
11	20000	14250	27420	61670	120000	1200	121200	59530
12	36000	28500	71500	136000	250000	5250	255250	119250
13	12500	7600	11735	31835	33750	490	34240	2405
14	11600	10400	9600	31600	33750	480	34230	2630
15	24000	28500	63170	115670	216000	2000	218000	102330
16	7500	7600	13735	28835	30000	420	30420	1585
17	10000	7600	12065	29665	35000	420	35420	5755
18	14000	19000	16000	49000	90000	1200	91200	42200
19	35000	28500	16500	80000	150000	1350	151350	71350
20	10000	11400	12265	33665	48000	600	48600	14935
21	24000	19000	17665	60665	126000	1000	127000	66335
22	12000	9500	10500	32000	45000	600	45600	13600
23	16000	14250	12420	42670	60000	700	60700	18030

Table 2 continued

Factory no.	Expenditure[b] (Tk)				Revenue (Tk)			Net revenue[f] (Tk)
	Labour[c]	Fuel	Other costs[d]	Total	*Attar* sales	Sales of by- product[e]	Total	
24	30000	28500	14835	73335	112500	1200	113700	40365
25	18000	20900	15765	54665	120000	1200	121200	66535
26	10500	14250	12415	37165	54000	700	54700	17535
27	15000	23750	12915	51665	81000	900	81900	30235
28	12500	19000	13665	45165	81000	800	81800	36635
29	14000	15200	14135	43335	80000	800	80800	37465
30	10000	8400	10933	29333	52500	630	53130	23797
Average	18956.7	15253.3	29769.4	63979.4	110066.7	1347.0	111413.7	47434.2

Notes: [a] In the financial analysis, the cost of raw materials was not included (except for Factories 3–5 which also collected a proportion of total raw materials from outside sources) because most of the farmers of the area collected raw materials from their own or self-managed sources without keeping any reliable records. The respondents however argued that the cost should be an additional 60–75% over the total expenditure

[b] Each value under expenditure and income represent the mean over three years (i.e. 2003–2005) adjusted to the 2007 price

[c] This cost includes an allowance for unpaid labour of the operator and their family estimated at the present wage rate (wage rate/day; male, Tk 160; female, Tk 90 and children, Tk 60)

[d] Other costs include an allowance for fixed costs (e.g. permanent structures and processing tools, over a rotation length of 15 years), depreciation, other unplanned costs and cost of raw materials from outside sources, where necessary

[e] The by-products include agarbati and other forms of agar-based products, but excluding attar

[f] Net revenue is estimated as total revenue less total expenditure

the factories surveyed. The average annual costs for labour and fuel were about Tk 18,956 and Tk 15,253, respectively. Annual income from *attar* averaged Tk 110,067, or nearly 100 times that from by-products (Tk 1,347).

Marketing of Agar-based Products

Assembling, grading, storage and transport are the main functions involved in marketing of agar products to both local and international markets. Figure 2 presents a flow chart of marketing of major agar-based products in the study area. The stakeholders in this supply chain include growers, processors, local traders, retailers, exporters and international traders. About 90% of local agar-based products of respondents' factories were found to be sold in international markets, mainly in the Middle East, notable the Kingdom of Saudi Arabia, United Arab Emirates, Kuwait and Qatar. The main actors playing important roles in the marketing of agar-based products are described below.

Growers

The agar farmers generally cultivate agar trees on their personal land and sell it to a processor or middleman.

Growers cum Processors

Madhyam Agar Bepari (middle-class agar businessman) usually they have their own factory or processing unit to convert agarwood chips to *attar* in a distillation

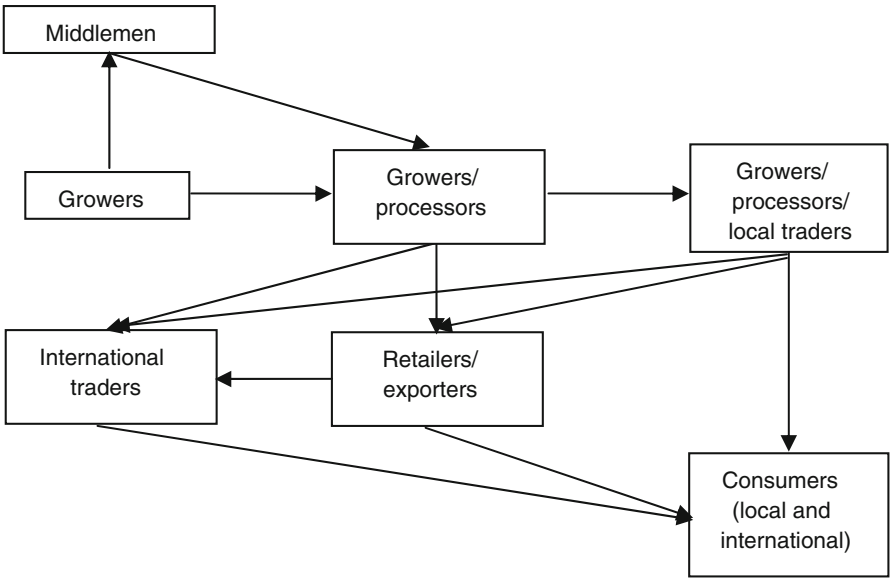

Fig. 2 Marketing flow chart of agar-based products in the case study area

process. They collect raw materials mainly from their own plantations and sometimes from other growers or middlemen. Local and international traders and exporters usually purchase agar-based products from them.

Growers cum Processors cum Local Traders

Baro Agar Bepari (upper-class agar businessman) have large agar tree plantations and processing plants and have licenses to trade agar products to local and international markets.

Retailers and Exporters

These collect *attar* from processors and export it to the Middle East, also exporting to some agar products to China, Japan and some European countries. They are usually the second most benefited group of the marketing channel.

International Traders

These are the largest and most influential actors in the marketing channel of agar products and receive the greatest share of revenue in the product distribution chain. They usually have a direct link with the foreign industries using agar-products where they sell large quantities of high-value products after assembling these from exporters or local retailers.

Problems and Urgent Priorities Identified by Local Entrepreneurs

When questioned about prevailing problems in the local and national industry, survey respondents observed that there is a lack of capital investment and shortage of raw materials, skilled manpower and up-to-date information. Their profitability was sometimes limited by lack of technical knowledge and of ability to assure high product quality, as well as by lack of market information and inefficient marketing facilities. Respondents therefore suggested various measures—at both the local and national level—to increase profitability, particularly concerning credit facilities (73% of respondents), training (63%), and technology improvement (63%) (Table 3). At a national level, development of a national information centre (57% respondents) and assistance with exporting were the most highly ranked options.

Concluding Comments

The survey clearly revealed that the agar-based industry makes a great contribution to—and has further potential for—socio-economic upliftment in the rural areas through providing job opportunities for poor and semi-skilled workers. The industry generates substantial revenue locally, after allowing for costs, and is an important source for foreign currency earnings. Globally, the demand of agar-based products

Table 3 Suggested measures to improve the condition of agar-based enterprises

Local level	National level
Provide microfinance and credit facilities (22)	Establish a national buying house and information centre for agar-based products (17)
Trained local agar workers (19)	
Technological up gradation of processing units (19)	Active Governments' support in export of agar-based products (13)
Establish local buying house and information center (18)	Raise a national network for agar-based product producers (12)
Ensure sustainable supply of high quality raw materials (16)	Raise new agar plantations in government fellow land, encroached and denuded forest lands etc. (12)
Provide gas facilities in local enterprises (11)	Provide training and other facilities to agar-based factory owners and workers (10)

Note: Values in parenthesis indicates the numbers of respondents reporting each measure

(mainly agar oil) for manufacture of perfumes, cosmetics and pharmaceuticals is high and increasing, and there is scope for government to promote expanded production. If Bangladeshi agar-based industry is supported and marketing facilities are improved for selling products abroad to attract high prices, this has much potential to generate foreign exchange along with creation of employment opportunities for thousands of workers.

The main problems facing the industry include financial and technical limitations, lack of skilled labour and raw materials, market insecurity (with large price fluctuations) and lack of research to increase productivity. Both government and non-government organizations can play a role in overcoming these constraints. The Forest Department has recently successfully established approximately 785 ha of agar tree plantation in denuded forest areas of Sylhet, Chittagong and CHTs. The FD can encourage planting on many other denuded and degraded areas, including fallow land (i.e. unused government land) and other public land (e.g. along roads and railway tracks, canals and embankments) by allowing landless and marginal farmers to plant agar on a participatory (i.e. benefit sharing) basis. The existing transit rules for transportation of forest products should also be revised to facilitate easy transportation of agar trees to processing units. The production cost of agar-based products is highly sensitive to fuel costs, hence expanding the supply of natural gas in all factory areas is desirable. In recent years, some dishonest traders have disrupted the country's long achieved goodwill on agar-based products to foreign countries by exporting adulterated attar. A high standard of monitoring and quality assurance is needed to overcome this unforeseen situation.

Acknowledgements We wish to acknowledge the support provided by the Department of Forestry and Environmental Science of Shahjalal University of Science and Technology, Bangladesh, Thanks also due to the responsible editor Dr. Steve Harrison of the University of Queensland and Dr. Narayan Saha, Department of Forestry and Environmental Science, Shahjalal University of Science and Technology, for their innumerable efforts and advice to enhance the quality of this manuscript. Finally, the heartiest cooperation provided by the people of the study areas during fieldwork is gratefully acknowledged.

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