Cultivation prospect of medicinal plants in Bangladesh: experiences from Natore

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Cultivation prospect of medicinal plants in Bangladesh: experiences from Natore

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Abstract

The study aimed to explore the possibility of medicinal plant cultivation as a sustainable livelihood option. The study was conducted among the medicinal plant cultivators of five villages of Laxmipur union of Natore *sadar upazila* in Natore district. Both qualitative and quantitative approaches were used. Data were collected during February-April 2004 from both primary and secondary sources. The findings show that the farmers were motivated to cultivate medicinal plants because of its profitability. The cost-benefit analysis of some of the medicinal plants also supported this. But the market of the medicinal plants is still in a pre-mature stage. A linkage between the cultivators and the herbal medicine or cosmetic producers could definitely help develop the medicinal plant cultivation prospect.

Acknowledgements

I am grateful to the growers, *beparies* and other villagers of Kholabaria, Natore who are linked with the medicinal plant cultivation/marketing for sharing their information with us. I would like to thank the research assistants who help me to collect data for this research. I would also like to thank Hasan Shareef Ahmed, Chief of Editing and Publication, Research and Evaluation Division for editing the report. Finally, I wish to thank my research coordinator Dr. Nasima Akter and other colleagues for helping me time to time by giving their valuable inputs and assistance and to the Director, Research for giving me the chance to carry out this study.

Introduction

"The global demand for medicinal plants is expressed from four identifiable sources: (i) pharmaceutical industries, (ii) traditional healthcare systems, (iii) individual traditional health practitioners, and (iv) women in family health care" (1). The medicinal plants are not only using in medicines but also in cosmetics, detergents, dyes, insecticides, foods and paints etc.

According to World Health Organization (WHO), medicinal plants are an accessible, affordable and culturally appropriate source of primary health care for more than 80% of Asia's population (2).

Despite all the progress in synthetic chemistry and biotechnology, plants are still an indispensable source of medicinal preparations, both preventive and curative. Hundreds of species are recognized as having medicinal values, and many of those are commonly used to treat and prevent specific ailments and diseases (3).

Who first used plant medicines is unknown. Trial and error began in many cultures-knowledge accumulated and was handed down in the community/tribe. Those who took special interest in the healing qualities of plants and who became skilled in applying their knowledge gained an honored place in society-medicine men. They attributed the healing powers of plants to gods, higher powers. Thus, the medicine man became associated with religious beliefs and priests became involved (4).

Glimpses of the history of Herbalism

The herbal medicine has a long and respected history. As far as records go, it appears that the king Hammurabi of Babylon (1800 B.C.) prescribed the use of herbals in his time (mint for digestive disorder) (5) The roots of Chinese medicine, which is based largely on herbalism, also dates back approximately 5,000 years. The Chinese emperor Chi'en Nung put together a book of medicinal plants called 'Pen Tsao'. It contained over 300 herbs including Chinese ephedra, which is still widely used today (6).

The earliest mention of the medicinal use of plants in the Indian sub-continent is found in the Rig Veda (4500-1600 BC). The comprehensive Indian herbal, the 'Charaka Samhita', cites more than 500 medicinal plants (7). But, the first written record of herbs used as medicine was make over 5,000 years ago by the Sumerians, in ancient Mesopotamia (now Iraq). Egyptian hieroglyphs also hint about the use of herbs(6).

Then it was the history of developing pharmacopeia. The Greek physician, Hippocrates (460-370 B.C.), compiled the use of 300-400 medicinal plants in 'Materia Medica'. The work of Dioscorides 'De Materia Medica' (1st century Ad) was the forerunner of all modern pharmacopoeias and an authoritative text for 600 medicinal plants (7) In 1649, Nicholus Culpepper wrote *A Physical Directory*, and a few years later produced 'The English Physician'. This respected herbal pharmacopeia was one of the first manuals the ordinary people could use for health care, and it is still widely referred to and quoted. The first *U.S. pharmacopeia* was published in 1820. It was periodically revised and became the legal standard for medical compounds in 1906. But, the development of extracting and synthesizing the active ingredients from plants for drug production outcastes the herbal treatments (5).

Definition of medicinal plants

A considerable number of definitions have been proposed for medicinal plants. According to the WHO, "A medicinal plant is any plant which, in one or more of its organs, contains substances that can be used for therapeutic purposes, or which are precursors for chemo-pharmaceutical semi-synthesis". When a plant is designated as 'medicinal', it is implied that the said plant is useful as a drug or therapeutic agent or an active ingredient of a medicinal preparation. " Medicinal plants may therefore be defined as a group of plants that possess some special properties or virtues that qualify them as articles of drugs and therapeutic agents, and are used for medicinal purposes"(7).

Why some of the plants are valued as medicinal plants?

Many of the plants could be used as stimulants, poisons, hallucinogens or as medicine because of the presence of unique or rich biological-active plant chemicals (i.e. Chemical compounds that have a biological effect on another organism).

Chemicals that make a plant valuable as medicinal plant are (1) Alkaloids (compounds has addictive or pain killing or poisonous effect and sometimes help in important cures, (2) Glycosides (use as heart stimulant or drastic purgative or better sexual health), (3) Tanins (used for gastro-intestinal problems like diarrhoea, dysentery, ulcer and for wounds and skin diseases), (4) Volatile/essential oils (enhance appetite and facilitate digestion or use as antiseptic/insecticide and insect repellant properties), (5) Fixed oils (present in seeds and fruits could diminish gastric/acidity), (6) Gum-resins and mucilage (possess analgesic property that suppress inflammation and protect affected tissues against further injury and cause mild purgative), and (7) Vitamins and minerals (Fruits and vegetables are the sources of vitamins and minerals and these are used popularly in herbals) (7, 8).

The medicinal plants of Bangladesh

South Asian countries have a large number of valuable medicinal plants naturally growing mostly in fragile ecosystems that are predominantly inhabited by rural poor and indigenous community (9).

In Bangladesh 5,000 species of angiosperm are reported to occur (10). The number of medicinal plants included in the 'materia medica' of traditional medicine in this subcontinent at present stands at about 2,000.More than 500 of such medicinal plants have so far been enlisted as growing in Bangladesh (7).Dhaka, Rajshahi, Shylet and Chittagong division is rich in medicinal plants (10) .

World trade of medicinal plants

Sales of herbal medicine were estimated to exceed US$ 12.5 billion in 1994 and US$ 30 billion in 2000, with annual growth rates between 5 to 15%. Rising global interest in

medicinal plants has created a sustained and largely 'underground' trade in plant materials, mainly collected from the least developed countries (LDC). The medicinal plants from the LDCs are collected in an unregulated manner, resulting in indiscriminate harvest of wild varieties and serious damage to biodiversity of these countries (11).

Importers of medicinal plants

Main importers of medicinal plants

The largest global markets for medicinal and aromatic plants are China, France, Germany, Italy, Japan, Spain, the UK and the US. Japan has the highest per capita consumption of botanical medicine in the world (19). Botanical medicine market in Japan in 1996 was estimated at US $ 2.4 billion and sales have grown rapidly in recent years, because doctors increasingly incorporate TCM (Traditional Chinese Medicine) as a complement to Western medicine. In 1983, 28 % of doctors used TCM, but by 1989 this figure had risen to 69 % (12). Table 1 and 2 show the world trade of herbal medicine in the year 1994 and 2002.

Table 1: Sale of herbal medicine in 1994

Region	Million US$
EU	6,000
Rest of Europe	500
Asia	2,300
Japan	2,100
North America	1,500
Total	12,400

Source: Grunwald, 1994

Table 2: World market for herbal medicine in 2002

Region	Billion US$
US	19.4
Asia	5.1
North America	4.0
Japan	2.2
The rest of the world	1.4

Source: Laird and Pierce, 2002

main exporters of medicinal plants

India is a major exporter of raw medicinal and aromatic plants and processed plant-based drugs. Exports of crude drugs from India in 1994-95 were valued at US$ 53,219 million and of essential oils US$ 13,250 million (1)). Table 3 presents the export of crude drugs and essential oils from 1991-1995.

Table 3: Export of crude drugs and essential oils from India in 1991-1995 (million US $)

Year	Crude drugs	Essential oils	Total Revenue
1991-92	41,345	15,592	56,937
92-93	48,417	15,267	63,684
93-94	45,355	19,504	64,859
94-95	53,219	13,250	66,469

Source: CHEMEXCIL, Bombay. 1996

Important crude drugs included Plantogo ovata (psyllium), Panax spp. (ginseng), Cassia spp. (senna) and Catheranthus rosesus (rosy periwinkle). Essential oils included santalum album (sandlewood), Mentha arvensis (peppermint) and Cymbopogon flexuosus (lemongrass). Seventy percent of total exports from India are sent to six countries. France, Germany, Japan, Switzerland, the UK, and the US. Other major importers are Bangladesh, Pakistan and Spain (1)

Today traditional practitioners of the Indian systems of medicine-Ayurveda, Unani and Siddha are providing prescriptions in the form of manufactured products rather than their own prescriptions (1).

China's total output of medicinal plants from both cultivated and wild harvested sources is 1.6 million tones. The total value of the finished TCM in 1996 was US$ 3.7 billion. This estimate excludes domestic consumption, the inclusion of which would result in a far higher figure. Overall sale of botanical medicine products in China in 1995 was estimated at US$ 5 billion (12).

Europe is a major world trader of medicinal and aromatic plants. At least 2,000 MAP species are traded, of which two-thirds (1,200-1,300 species) are native to the continent (12). The most popular botanical medicines sold in 1996 were formulated from gingko, ginseng garlic, echinacin and evening primrose.

Medicinal plants, its cultivation and Bangladeshi market

The Bangladeshi herbal medicine market is valued at Tk. 3,300 million (approximately US $60 million) at trade prices (13). The turnover figures for the Ayurvedic sector is around Tk. 1,000 million, Unani around Tk.1, 800 million, and homeopathy around Tk. 500 million.

Table 4: Estimated total value of medicinal plants as raw material

Sector	Local		Imported		Total	
	Tk. million	US $ million	Tk. million	US $ million	Tk. million	US $ million
Unani	127	2.2	127	2.20	254	4.40
Ayurverdic	82	1.4	100	1.75	182	3.15
Herbal doctors	45	0.8	54	0.95	99	1.75
Self treatment	76	1.3	200	3.50	276	4.80
Sub total	330	5.8	481	8.40	811	14.2
Tonnes	12,500		5,000		17,500	
Total value					810	14
Total Quantity					17,500 tonnes	

Source: SEDF/IC, 2003

There is almost no report of cultivation of medicinal plants in our country. A study reported some of the cultivation of medicinal plant in Rajshahi division (14). The largest patch of medicinal plant cultivation was reported first from Laxmipur union of Natore *sadar upazilla* in the daily newspaper Protom alo (15). There are also some informal information of growing medicinal plants in small scale. The medicinal plant *beparis* (middleman) of Natore reported the cultivation of u*latkambal* at Norshindi. The Ayurvedic companies also reported about some discriminate farming of medicinal plants in different areas of Bangladesh. One of the Ayurvedic company reported that some of their supplied raw materials like *badarlathi, ulatkambal, Sharnalata* are supplied from Modhupur, Satkhira which is cultivated there by a small group of farmers. Government

formed a cell for medicinal plant in the 'Ministry of Environment and Forest'. The cell is working in different dimension for developing the medicinal plant sector, like (1) a research center for medicinal plant, (2) promoting *nim* Plantation, (3) medicinal plant seedling production through tissue culture, and (4) leasing of lands for medicinal plant cultivation.

At the same time some initiatives are also taken by the Department of Forestry. Fifty seven different medicinal plant varieties are planted in the adjacent area of Salna national park, Gazipur. In 2001-02 financial year, it was only on 2.02 acre land. Later in the year they extended it to 35 acre land. The government are also selling different medicinal plants at a subsidized rate in 400 different government nurseries all over the country. There are also 450 sub-centers in each upazila under the 400 government nurseries. There are some private companies like 'Gemcon Food Products' or 'Nim Foundation' who have farms of medicinal plants. 'Gemcon Food Products' are preparing some herbal medicine in their cottage industry which are available in the market. The farms are at Dinajpur. The 'Nim foundation' also have a medicinal farm at Faridpur district. They planted different medicinal plants basically *nim* plants. They are preparing different *nim* beauty products. From the above discussion, it is clear that the medicinal plant cultivation is still in a rudimentary stage. There are very few farmers those who are cultivating medicinal plants by their own initiatives.

Rationale of the study

The importance of medicinal plants is increasing day by day. Bangladesh now feels the importance of medicinal plants. Majority of the farmers are totally unaware about the profitability of medicinal plants cultivation. But, there are few cultivators who are trying to cultivate medicinal plants by their own initiatives. BRAC is working with the poor. There are many poor who is cultivating vegetables or other food crops with the assistance of BRAC. This study will shed light on the problems of the medicinal plant cultivation and profitability of cultivating and marketing medicinal plants.

Objectives

The study aims to understand the possibility of medicinal plant cultivation as a sustainable livelihood option. The specific objectives are:

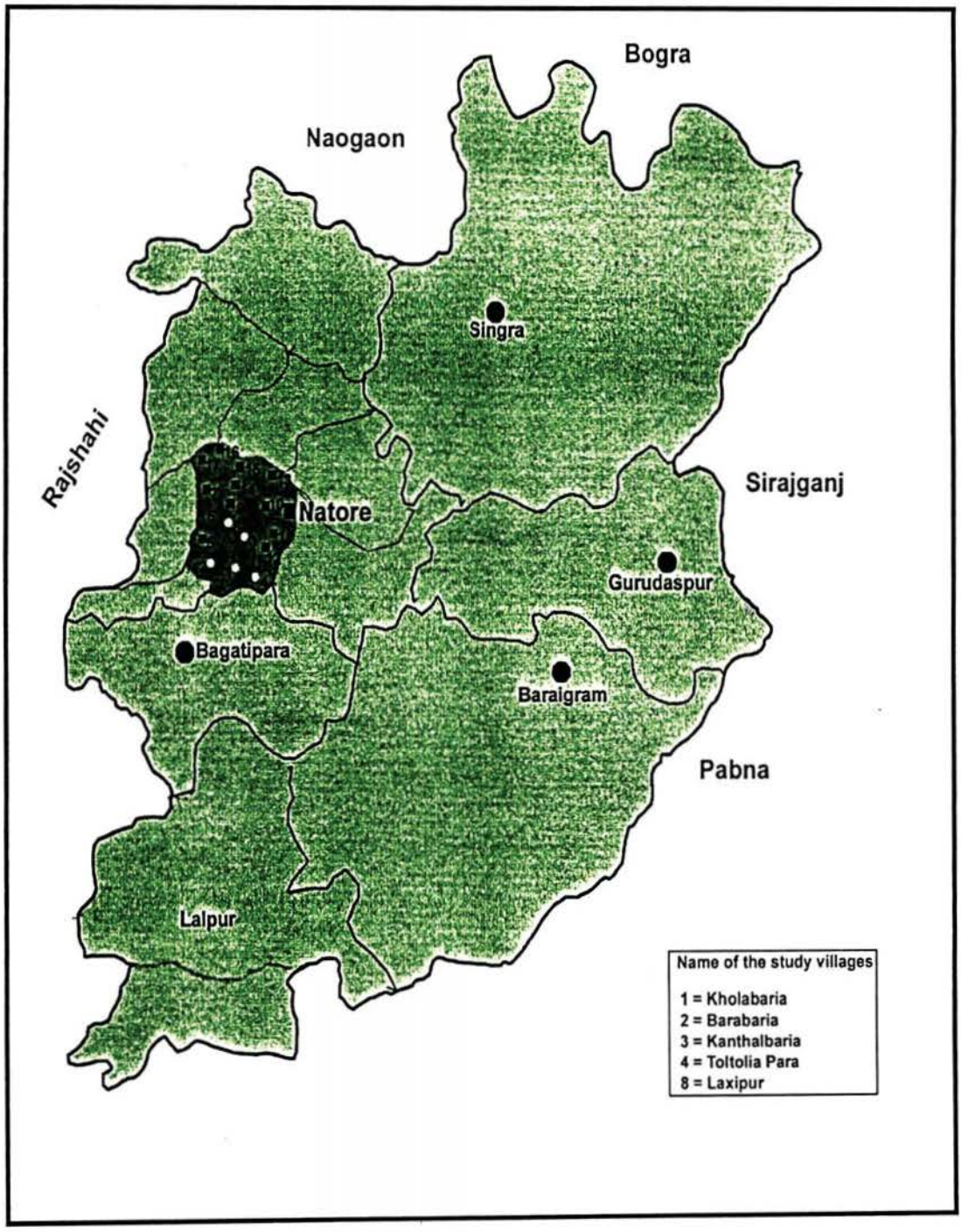
- To explore the factors that motivate the farmers in cultivating medicinal plants;
- To explore women's involvement in medicinal plant cultivation;
- To explore the use of locally produced medicinal plants; and
- To explore the market of medicinal plants in Bangladesh.

Methodology

Study site and study population

The study was conducted among the medicinal plant cultivators of Laxmipur union of Natore *sadar upazila* of Natore district in Rajshahi division. The Natore was selected because, a large group of people are cultivating medicinal plants over there. The medicinal plant cultivation spread over eight of the seventeen villages of Laxmipur union. This study covered only five villages viz., Kholabaria, barabaria, kanthalbari, Toltolia para and Laxmipur.

Figure 1: The map of Natore showing the study villages



Study design

Both qualitative and quantitative approaches were applied for this study. The four case studies were done separately with (a) a 'medicinal plant picker ',[1] (b) a *kabiraj*, pioneered medicinal plant cultivation in that union, (c) a medicinal plant hawker (vendor), and (d) a medicinal plant nursery owner. In-depth interviews were done separately with one 'ayurvedic' and one 'unani' companies and one medicinal plant *bepari* of Laxmipur union. Moreover, some informal discussions were also held with personnel from 'Ministry of Environment and Forest', Department of Forestry, herbal product producer of 'Gemcon Food Products' and a NGO called 'Nim Foundation'. Both case studies and in-depth interviews conducted with separate check-list.

The questionnaire survey was done on the medicinal plant cultivators. The snowball sampling technique was applied to get the respondents during the time of the collection of data. According to the medicinal plant cultivators of Laxmipur union, there are at least 100-150 medicinal plant cultivators in that locality. Only 45 medicinal plant cultivators were taken as sample.

Data collection

Data were collected both from the primary as well as secondary sources. The no. of medicinal plants sold from BRAC-operated nursery and amount of herbal products sold in Arong was also collected from BDP (BRAC Development Program), BRAC and the monitoring section (sales) of Arong. The case studies and in-depth interviews were done in February 2004 and the questionnaire survey was done in the month of April 2004.

Limitation of the study

One of the large herbal medicine producer was reluctant to give information about the herbal raw material they used. So, that effects the study to get more clear view about the demanding raw medicinal materials used in this country. Another herbal cosmetic producer (small) was also reluctant to allow visiting their production site and to know

[1] Those who collect medicinal plants from the wild.

about their total amount of used herbal raw materials. So, that also hampers to know about the prospective medicinal plant species that could be cultivated in our country.

Findings and Discussion

The profile of the cultivator and the reasons of cultivating medicinal plants

Usually small farmers are growing the medicinal plants. Among the Forty-five sample cultivators majority were cultivating mainly *ghritakumari* (aloevera). Only two of them were solely dependant on medicinal plant cultivation. But, both of the cultivators had very few lands (10-17 decimal).

Almost all of them planted medicinal plants in their homestead lands. In 15 of 45 cases it was observed that some of the vegetables (kakrole, brinjal) and leafy vegetables and sometimes spices (turmeric and other spices) are replaced by the medicinal plant cultivation. In one case it was found that the nuts are replaced by the medicinal plant cultivation.

Figure 2 shows that those who had less then 50 decimal of land, almost 60% of their land are under medicinal plant cultivation. Those who have 50-99 decimal of land, almost 30% of their land are under med. Plant cultivation. Only 12% and 10% of the land of 100-99 decimal and above 200 decimal of land are under the medicinal plant cultivation. Almost all of them does not take the risk of cultivating medicinal plants in a large portion of lands. Figure 2 also shows that those who had few lands the medicinal plant cultivation become popular to them. The more land one has the less cultivation (medicinal) intensity it has.

Figure 2: Proportion of land under medicinal plant cultivation out of total land owns

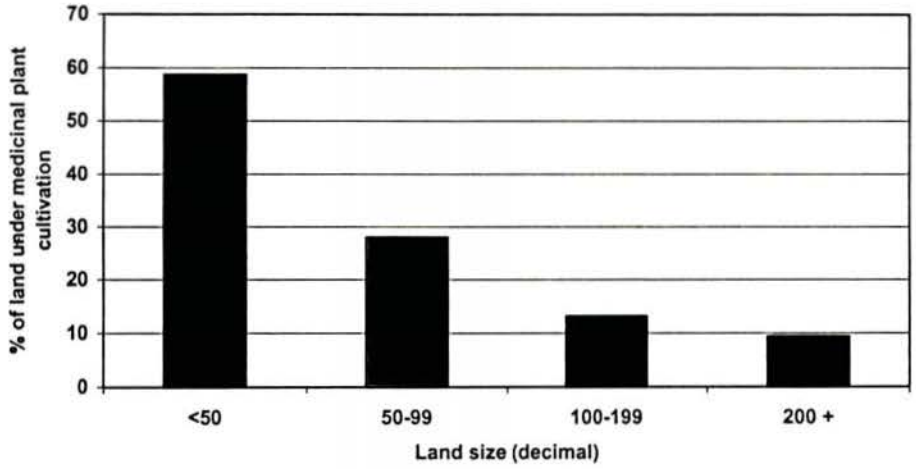


Table 4 shows that majority of the cultivators cultivate medicinal plants between 4-20 decimal of land. Few cultivators cultivate a little large portion of land that is 21-50 decimal of land. Only one cultivator was found cultivating 50 decimal for medicinal plants. The average land size for medicinal plant cultivation is 20 decimal of land.

Table 4: The no. of cultivators and their total land under medicinal plant cultivation

Land size (decimal)	No. of cultivators
4-10	12
11-20	17
21-30	6
31-40	7
41-50	3

Large number of people are taking part in medicinal plant cultivation since the last six years. But, many people of this locality cultivate medicinal plants for last six years. There are few who are cultivating it for ten to twenty years. Table 5 shows the year of involvement in medicinal plant cultivation by the cultivators.

Table 5: Duration of medicinal plant cultivation

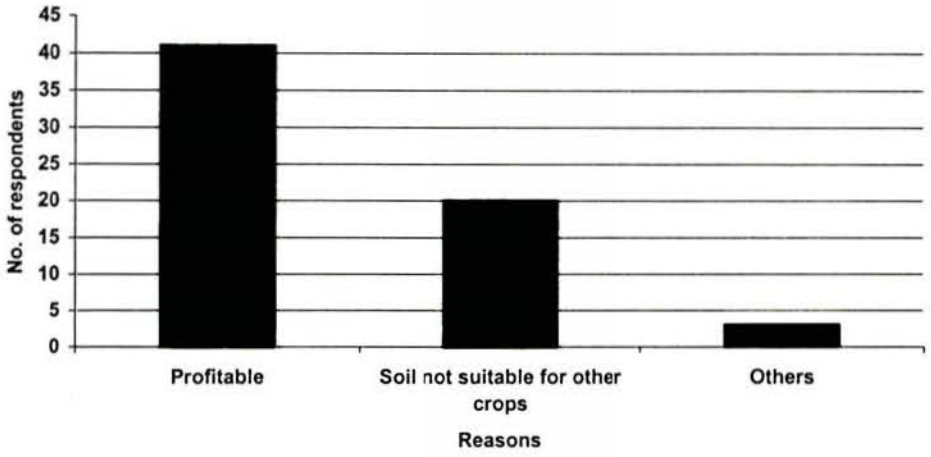
Total years	No. of cultivators
2-3 years	20
4-6 years	16
7-8 years	2
10-15 years	3
15-20 years	2

Factors motivate the farmers to grow medicinal plants

Among the various reasons cited for cultivating medicinal plants, the majority mentioned profitability. Many of them said that, the maximum return by cultivating small portion of land make 'cultivation of medicinal plants lucrative'. Another reasons for cultivation of medicinal plants quoted by the growers is the unsuitability of soils for other crops. Mostly those farmers who are a little bit of well-off said about the use of their fallow lands for medicinal plant cultivation. But, there are very few (20%) those who do not cultivate any other crops or major portion of their lands are under the cultivation of medicinal plants.

The effects of neighborhood cultivating medicinal plants and getting easy money out of this is also playing a role for spreading medicinal plant cultivation. Moreover, few of them mention about the selling facility of medicinal plants. Even for some of the medicinal plant, after maturity they sell the whole portion to the *bepari* and it is the *beparies* responsibility to collect medicinal plant/parts of the plant from the field. Few of them also inform that they can earn money all over the year by selling medicinal plant/ parts of the plant (specially for *ghritakumari* which is a very popular medicinal plant cultivated at Natore). Figure 3 shows the reasons of medicinal plant cultivation.

Figure 3: The reasons of cultivating medicinal plants



* Multiple responses considered

Cost of different medicinal plant cultivation

A cost-benefit analysis was done to measure the profitability of mostly cultivated medicinal plants of Natore region. The medicinal plants are: *ghritakumari/ gritakanchan* (aloevera), *simul* and *misridana*. Sugarcane and turmeric (*halud*) are taken as comparison crop group. *Ghritakumari* could be compared with the sugarcane cultivation. Because, the cropping duration for both is three years. *Simul* and *misridana* could be compared with turmeric. The cropping duration of all of these three crops i.e. *simul*, *misridana* and turmeric are one year. To measure the profitability the total cost of production (which includes cost of seeds and seed-bed preparation, fertilizers, irrigation, pesticides (if applied), inter-cultural-operation and both hired and own labour [2]cost) and harvesting was deducted from the total income from land. The loss of crop (if any) was also deducted from the total return of the land.

[2] To calculate the owned labour, amount of owned and hired labour was recorded for each of the activity in the questionnaire was then total work hour of owned labour was calculated by the current market price of per hour labour.

Table 6: Comparisons of profits in different medicinal plants and non-medicinal crops cultivation

Name of the crop	Return (taka/decimal)
Ghritakumari (45)	330
Simul (20)	600
Misridana (20)	1,388
Halud (6)	248
Sugarcane (6)	689

Figure 4 shows the comparisons of profit in different medicinal and non-medicinal plants. The profitability by cultivating medicinal plants like *misridana* rank the highest among all of the crops. Cultivation of *simul* was profitable than *ghritakumari* (aloevera). But, sugarcane cultivation was profitable than cultivation of *ghritakumari* and *simul.* But, it is much more profitable to cultivate all medicinal plants than turmeric.

Figure 4: Comparision of profits in between different medicinal and non-medicinal crops

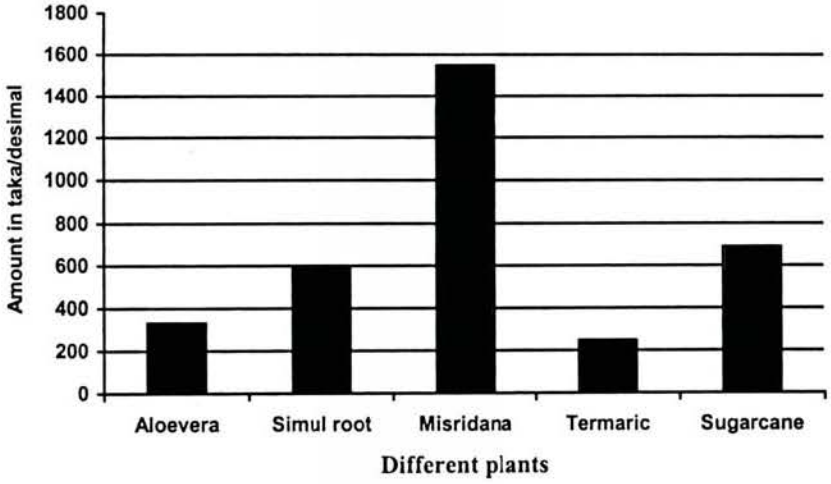


Table 6 shows that the profit/decimal of land for *ghritakumari*, *simul* and *misridana* is Tk.330, 600 and 1568 respectively.

In the item-wise share it was seen that the cost of fertilizer, pesticide and irrigation was not high because of the little application of pesticide and fertilizer to the medicinal plant

field. Most of the medicinal plants do not need irrigation. So, the irrigation cost was also very low. For *ghritakumari* the seed and seed-bed preparation cost was very high. In the case of other two medicinal plants the labour cost was than the seed and seed-bed preparation cost. Figure 5,6,7 shows the details about different item-wise share of *ghritakumari, simul* and *misridana*.

Figure 5: Item wise share in total cost of ghritakumari production

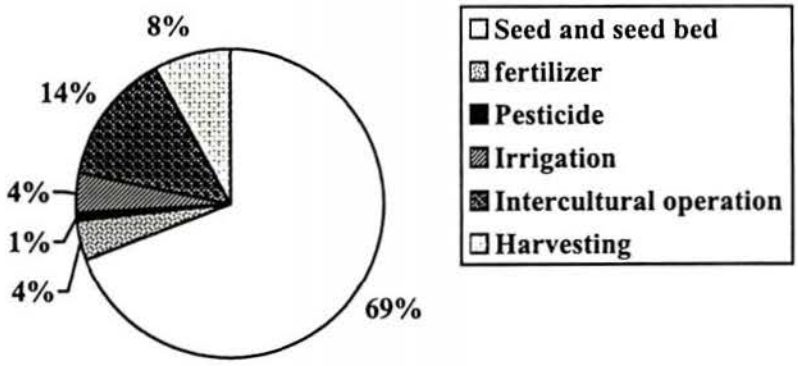


Table 7: Percentage (%) of owned labour, hired labour and non-labour expenses in different medicinal plant cultivation

Name of the crop	Owned labour	Hired labour	Non-labour material input
Ghritakumari	11	14	75
Simul	49	9	42
Misridana	36	25	39
halud	8	28	64
ugarcane	11	19	70

Figure 6: item wise share in total cost of simul mul production

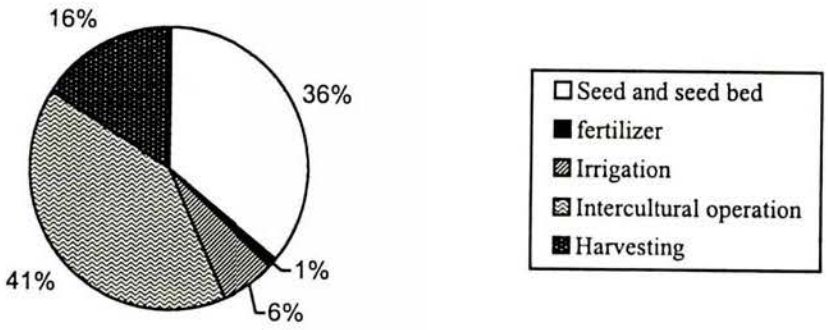
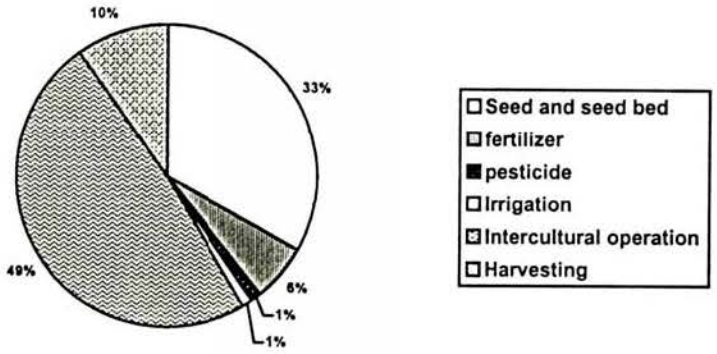


Figure 7: Item wise share in total cost misridana production



Involvement of woman in medicinal plant cultivation

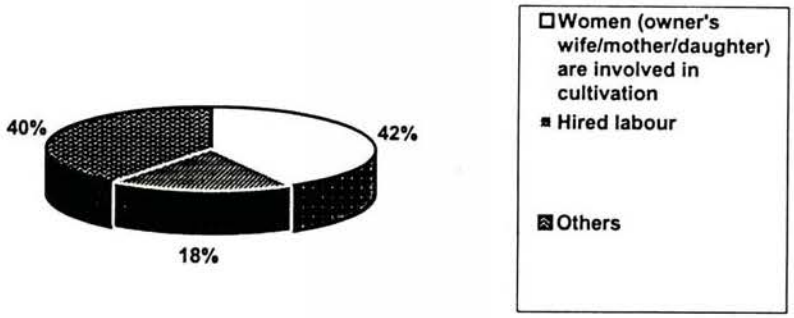
In most of the cases, women take part in the cultivation of medicinal plants. In all cases except one it was found that men are the owners of the land but the women are putting labour to the cultivation. The women may be the owner's wife or mother or in few cases daughter. Others, those help in medicinal plant cultivation, are owner's son, brother and nephew. In very few cases the cultivators hired labour for cultivation (Figure 8).

Some of the respondents informed that their wives were the first person to collect the seedling or seeds from their neighbours or relatives and encourage them to cultivate medicinal plant.

When asked about their involvement in medicinal plant cultivation many women replied that the medicinal plant cultivation is like vegetable cultivation. But, some mention that the cultivation of medicinal plants is a labour intensive job. Women also informed that medicinal plants could be cultivated in the homestead lands. So, if a woman wants she could cultivate it, but for other crops they have to go to the field which is not possible in most of the cases.

Moreover, in most cases men are also involved in other businesses. So, they could not get enough time to take care of their cultivated lands. In those cases women are fully involved for taking care of the cultivated land. Forty two percent cases are found like that (Figure 8).

Figure 8: Involvement of women in medicinal plant cultuivation



Plant diseases and the use of pesticide and fertilizers

The mostly cultivated medicinal plants of Natore are *ghritakumari, misridana* and *simul.* Other medicinal plants are cultivated, but in a small scale. Most of the *ghritakumari* plants are infected by spotting of leaves.The cultivators do not have any clear idea about where and how the leaves are infected by this spotting syndrome. One of the cultivators also mention that he had talked with an official of the agricultural directorate, but they could not tell them anything about the infestation. Almost all the cultivators were using ash and lime to protect the plants from infestation. But, many of them also have doubt about the usefulness of lime and ash. The cultivators are also using a variety of pesticides

Table 8: Different medicinal plants and their symptoms of diseases.

Name of the plant	Symptoms of the diseases	Attacked portion
Ghritakumari	Spots all over the leaves	leaves
Misridana	Roots and sometimes the whole plants degradation	Root (dana) as well as the whole plant
Simul	Leaves are eaten up by insects	leaves

without knowing about exactly what is the remedy for the particular plant disease. The chemical pesticides they are using to the medicinal plants, specially on *ghritakumari,* are: Phantox (1), lobler (10), bavistine (2), Furadhan (4),fanfan (6), noin (1), Ripcord (1), Dusban (1),Karmil (1)[3].Some of them also apply some vitamins. The amount of chemical pesticide applied is also not uniform. It seems that different cultivators applied pesticides according to their own judgment. The application of various types of pesticides ranges from 6-250 gm/decimal and 4–300 ml/decimal at a time. In one case, it was 3 kg/decimal. Most of them apply 2/3 kinds of pesticides. The intensity of applying pesticides also differs from cultivator to cultivator. Majority of them also informed that the chemical pesticide has no effect on spots of *ghritakumari* plants.

Use of fertilizers in medicinal plant cultivation: The cultivators are using organic fertilizers as well as chemical fertilizers. Cowdung is used popularly as organic manure. TSP, urea, potash and in one case zinc was used as chemical fertilizer. Among the 45 farmers 32 were found using chemical fertilizer. The average dose of using fertilizers (kg/decimal) is as follows: TSP 3.5 kg, urea 2.9 kg and potash 3.4 kg per decimal of land.

There was no guideline found about using chemical fertilizers and pesticides in medicinal plant cultivation. But, in China and Japan the government manuals for medicinal plant cultivation recommend to avoid chemical pesticides. If not possible then pesticides. should be applied at the minimum effective level in accordance with the recommendations from the manufacturer or authorities. And the minimum interval between such treatment and harvest time must be maintained. In the China's manual it is also recommended that low toxicity and low residue pesticides should be selected (16).

[3] The figure in the parenthesis show the no. of cultivators using that particular chemical pesticide.

Use of chemical fertilizers and pesticides to the medicinal plants of Laxmipur need to be studied.

Credit facility for cultivation of medicinal plants

Government has instructed the Janata Bank and krishi Bank to give loans to the medicinal plant growers. The farmers are, however, reluctant to take loans. Only 2/3 persons of those villages avail loans for this purpose. The reasons that they cited were: (1) they usually cultivate in small portion of land and that does not require a loan, (2) for taking loan from the bank they have to deposit the 'documents of lands'. But, most of them have very few amount of lands, (3) the amount of loan they received was not enough to (Tk.10,000 for one *bigha* of land) cultivate one *bigha* land. It takes at least 30,000-35,000 thousand taka to cultivate one *bigha* land.

The story of kholabaria, Natore becoming 'Oushodhi gram'

Affazuddin, a man with long hair, wearing peculiar clothes and having a stick in his hand could horrify anybody at the beginning. But, majority of the villagers treat him as the pioneer of medicinal plant cultivation in that locality. Afazuddin is the local *Kabiraj* of Kholabaria, Natore. He is popularly known as "Afaz pagla" in his community. He is in this profession for at least 35 years. He inherited the knowledge of herbal remedies from his grandmother and mother. Later on, he became a '*murid*' of another *Kabiraj* known as Jalaluddin. He traveled many places to understand different plants and their remedies. As such, he had to be attached with those persons whom he thought as knowledgeable about herbal remedies. He collected many rare medicinal plants from different areas and planted all those in his 3.5 *kantha* land. Afazuddin does not charge anything for his treatment, because "all of my clients are very poor so, how could I charge them" he said. But, when other *Kabiraj* or business men came to him for different plants, he took money by selling those herbal plants. This became his major source of income. Later, he trained many young men on identifying medicinal plants and send them in groups to collect different medicinal plants. They are known as *jangla party* to the local community. Primarily they had to sell those only to their *Ustad* Afaz pagla. Afaz pagla used those medicinal plants and also planted those on his small land. Later he gave them permission

to sell those plants to other people also. Some of the *jungla party* members became canvasser or hawker. These canvassers or hawkers traveled many places to sell medicinal plants and tell about their remedies. When many business man started to came to Afaz pagla specially to buy *ghritakumari* plants what he cultivated in a large scale and that created huge interest in the local poor people. Then many people came to Afaz pagla to learn how to cultivate the *ghritakumari* plants. He taught them how to do it. Thus, the cultivation of ghritakumari plants spread in that locality and surrounding villages. Presently these villages of Natore are the main supplier of *ghritakumari* (aloevera) leaves

Around 30 different types of medicinal plants are cultivated in these areas. The mostly cultivated medicinal plants are *Ghritakumari*. The *Ghritakumar* is cultivated for the 'sarbat' (health drink).

The other mostly cultivated medicinal plants are *sotomuli* (cultivated in 2-8 decimal land on average, mostly in the fencing or by the side of *ghritakumari* field). *Misridana* (cultivated on an average of 3-10 decimal of land) and *simul* (cultivated in 4-33 decimal land) are also cultivated next to *ghritakumari*. Some of the cultivators also planted *Bhuikumra,* Rajkantha, Nilkantha and *Hastipalash*. (not more than 2-4 decimal of land). Many of them also planted other medicinal plants but in a very small portion of land. The medicinal plants include *Arshagandha, Kalomegh, talamuli, Ulatkambal, lazzaboti,* different types of Chandal (like *guruchandal, bhaichandal, raktachandal, turukchandal), Arjun, Pantharkuchi, sarpagandha, Sonkhamul, Ishwarmul, anantamul,, kalkashinda, vimraj, sishmoni, tulshi, Tisi* etc.

Use of traditional medicine to the study villages

In the WHO traditional medicine strategy 2002-2005, WHO defines traditional medicine as "including diverse health practices, approaches, knowledge and beliefs incorporating plant, animal, and/or mineral based medicines, spiritual therapies, manual techniques and exercises applied singularly or in combination to maintain well-being, as well as to treat, diagnose or to prevent illness" (WHO 2001/2002).

Hossain et al. reported that about 58 different medicinal plants were being used in rural Bangladesh (1). These are used in various lesion, antacid, itching, for dysentery, skin disease, cold/cough, headache, fever, appetizer, paralysis, burning during urination and burning of palm and foot soles, mouth wash, dental plaque, Rheumatic pain, pain killer, conjunctivitis, vomiting, fairness, blindness, bronchitis, etc.

The knowledge of using herbal medicine was disseminated to them by local *Kabiraj*. The newly formed *Krisak samity* also plays a good role to disseminating knowledge about cultivated medicinal plants among the farmers.

Herbal medicines could be prepared from a variety of plant parts like roots, bark, leaves, flowers and fruits. Any single part or a combination of multiple parts could be used fresh or in dried form. In modern days to prepare herbal medicine the particular chemicals of the plant that has medicinal properties are extracted. Herbal not only could cure diseases but also an important ailment for beauty. Locally produced many medicinal plants are important source of treating problems related to beauty.

Different uses of herbal plants:

Remedies for digestive disorder/gastric ulcer

Ghritakumari is the most cultivated medicinal plants in the study villages. The *ghritakumari sarbat* keeps the stomach cool and also helps in mitigating constipation. *Misridana* (root), cultivated largely in the study villages, is used to control gastric. They take one root and eat it like a fruit, then drinks lot of water. *Rajkantha* and *Nilkantha* is also cultivated widely by the villagers. One of the cultivators stated that, one of the neighbour was running to her by grabbing her stomach for pain (gastric pain) and asked her to give her some *nilkantha* leaves. After taking the leaves with salt the pain immediately stopped. *Simul* (root of simul tree) also cultivated in the study villages. *Simul* root is also used in the treatment of constipation and piles. *Lazzaboti* plant and *arjun* bark are also used for the treatment of piles. Though not cultivated, these are available naturally. Some of them keep the *lazzaboti* (sada) in their nursery.

Remedies for body/teeth pain

Rajkantha, Nilkantha, Simul and *Ghritakumari* are used widely in treating body and teeth pain. *Rajkantha* and *Nilkantha* are popular for treating teeth pain. *Simul* suppress weakness and are used in arthritis. *Ghritakumari* is also used to control burning of hand and feet.

Remedies for skin diseases and lesions

Local people use *Daudmoni, Raktachandal/ Rahuchandal* for treatment of ringworms or *daud*. One of the cultivators, mentioned that he suggested to use '*daudmoni*' to one of his relatives who was not living in that locality. One week later, the patient reported to have been completely cured. Another cultivator, informed that young girls of the locality use the pulp of *ghritakumari* to erase spots and to brighten the skin. They also said, once a person from 'Keya cosmetic company' informed them about this. People also use *anantamul* for itching , scabies, and eczema.

Remedies for jaundice

Kalomegh and *Misridana* are used to treat Jaundice in the study area.

Remedies to control high pressure and heart problems

Misridana is used to control high blood pressure and *arjun* bark is used for heart problems, though very few *arjun* trees were found in that locality. So, it is assumed that common people except '*kabiraj*' do not use *arjun* bark very frequently, but they know the use of *arjun* bark.

Remedies as vitamin

Some of the cultivators mentioned about using *arshagandha* as vitamin or blood purifier.

Herbal remedies for worm:

The cultivators also mentioned about using of *kalomegh* for de-worming purpose.

Remedies for reproductive disease control

The people of the study villages informed that the sexual problem was not very unusual among the villagers. Varieties of sexual problems could be treated by herbal plants. But usually people went to *'Kabiraj'* for the treatment. The sexual problems include white discharge, gonoria and ill sex power. *Saktibindu, sankhamul, Hastipalash, bhaichandal /Guruchandal/kalichandal /lahuchandal* and sometimes *simul* root were used to increase sexual power. One of the cultivators said that he used to take one '*sankhamul*' with betel leaf and that act immediately to increase his sexual power. In the study area, *sotomuli* and sometimes *talamuli* are used to treat white discharge of women. *Lazzaboti* is used to treat gonoria.

Remedies for urinary infection and diabeties

Sotomul, one of the most cultivated medicinal plants used to treat urinary infection and diabetes.

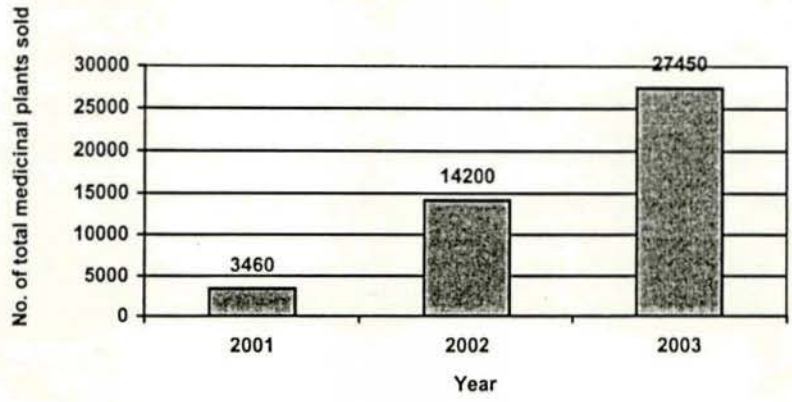
Others

Use of some other herbal plants were also reported. *Bhuikumra* were used among the lactating mother to increase breast milk. Another herbal plant i.e. *Ulatkambal* was used there to increase delivery pain and sometimes applied in the hair for louse killing. Many villagers told about treating snake-bite by *Ishwarmul* plant. One of the villagers informed that, he knows the use of bhaichandal /Guruchandal/kalichandal /lahuchandal for treating evil sprit ('Bhute-dhara patient).

Medicinal plants and it's market in Bangladesh

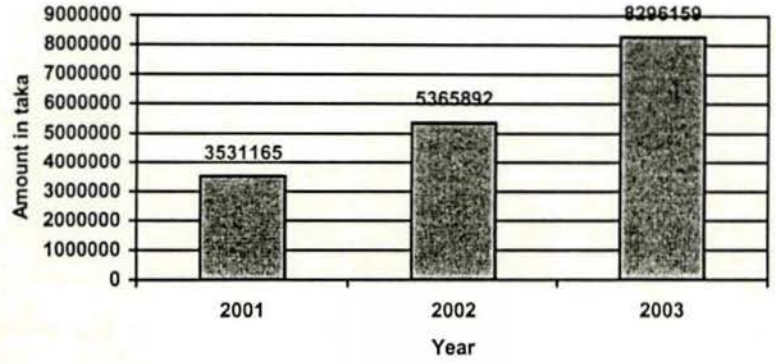
One of the criteria for creating demands of medicinal plants in market is expanding people's interest for that. To get a view of people's interest in herbal plants and products, the data of herbal plants sold and herbal products of 2001-2003 was taken from the

Figure 9: Sales of medicinal plants in the BRAC operated nursery



Source: BDP, BRAC

Figure 10: Sales of herbal products at arong in 2001-2003



Source: Monitoring (sales) section, Arong

BRAC-operated nurseries and from Arong. Figure 9 and figure 10 show the sales of herbal plants [4]and herbal products [5]from BRAC nursery and Arong respectively.

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[4] The herbal plants available at BRAC operated nursery are: Pithraj, jam, haritki, bohera, nim, kadam, dumur, gritakumari, kawphal, kamini, tulsi, basak, amra, chirata, akanda, bel, arjun, harjora, lazzaboti, kalomegh, arshagandha, ulatchandal, mohua, tokma, sarpagandha, koramcha, mehendi, nischinda, chatim and lebu.

[5] The herbal products of Arong includes: (1) Herbal upton, (2) Herbal face pack (3) herbal scrub (4) herbal Shampoo (5) herbal hair oil (6) herbal hair pack (7) herbal henna (8) different herbal products of ***neem*** like soap, tooth powder, oil , face pack etc (9) mustard oil and (10) honey.

Marketing strategies adopted at Laxmipur, Natore

The selling season: The medicinal plants cultivated in Laxmipur are marketed through middleman (bepari and hawker/canvasor). Usually the middleman come to them and the cultivators do not have to face the hassle of transportation or selling those in the open market. None of the farmers said that it ever happened to them that they could not sell their medicinal plants. But, the sale of *ghritakumari* falls drastically in rainy and winter season. The sale become highest in summer. The sale is also very low in Ramadan. But, usually the sale of other medicinal plants is not restricted to any particular season.

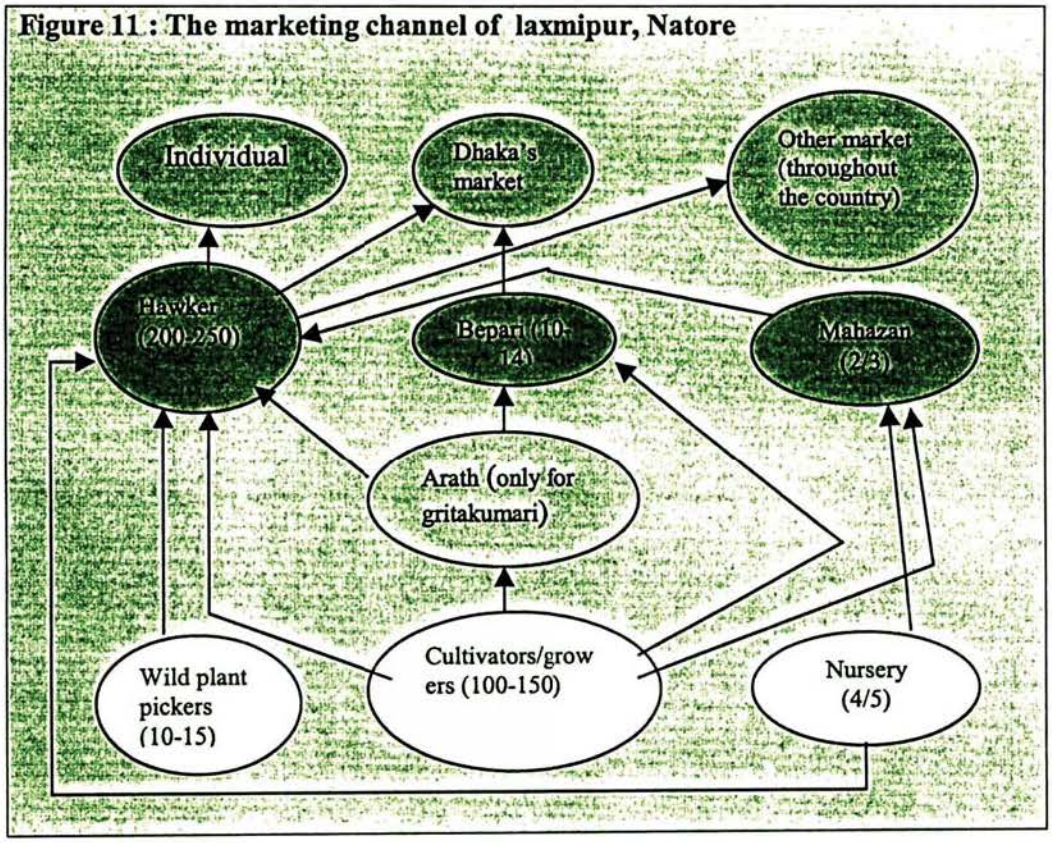
The price of medicinal plant: The price for the *ghritakumari* is usually Tk. 400 per cartoon in summer and Tk. 100 per cartoon in winter. Price of *misridana* varies between Tk. 20-50 . The price of *simul* also varies between Tk. 15-25 . Some of the cultivators store those and sell at different times around the year.

Krisak samiti: There is a '*Krisak samiti*' at Kholabaria *bazaar* which deals with the *ghritakumari* transaction between farmers and *bapari*. Seventy farmers are the members of this *samiti*. The *samiti* which was established in January, 2004. Everyday usually 80-100 cartoons of *ghritakumar* transported to Dhaka. The placement of order occurrs through *arathdar*'s mobile phone. The cultivators receive slips against delivered goods and collect money from the *arath* presenting the slip. The *arathdar* received Tk. 10/cartoon (five from cultivator and five from *bepari*). Majority of the farmers were deceived by the *beparies* last year and the '*krishak samiti*' is the result of that. The *krisak samity* is playing a positive role for the farmers/cultivators of medicinal plant in Laxmipur union.

Problems associated with marketing: Ghritakumari is the most cultivated medicinal plants in the study areas. Most of these are sold through '*arath*' but some quantity are also sold directly to the *beparis*. In the later case (those who are selling directly), there are two ways of dealing it: (1) the *beparis* will pay to the cultivators after selling their products to Dhaka; (2) through seasonal contract i.e. from one Ramadan to another Ramadan. Throughout the whole season the beparis will pay in cash at a price fixed for the whole season.

the relatives or well related with *beparis* prefer to transect directly. But, others face a lot the whole year. It varies from Tk. 850 to Tk. 1050/1250 per gari[6]. Usually those who are of problem to realize money from the *beparis*. So, they prefer to sale their products through '*arath*'.

Figure 11 : The marketing channel of laxmipur, Natore



The *beparis* buy one *gari* (6 cartoons) of *ghritakumari* at Tk.120 to Tk. 350 per cartoon from the cultivators. The local *bepari* [7]sold one cartoon at the rate of Tk. 600 per cartoon to the *bepari* of Dhaka. Usually one *bepari* take 4-8 cartoons at a time. The *bepari* of Dhaka segregates the *gritakumari* leaves of all of the cartoons into three categories i.e.

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[6] 1 gari = 6 cartoon
1 catoon = 1 ½ *maun* (55 kg)

[7] The local *bepari* has to pay Tk. 80-100 to transport one cartoon of *gritakumari* from Natore to Dhaka. Out of this, Tk. 40 has to pay as track fair, Tk 10 as labour cost , Tk. 5 to the local *dalal* and Tk. 10-20 to the *mastan's* of Dhaka .

large, medium and small. Price of large ones is Tk. 4/piece, medium Tk. Two/piece and the small is Tk. one/piece. Usually there could be 300-350 pieces of leaves in one cartoon. So, the *bepari* (Dhaka) could earn as much as 800-1000 takas from one cartoon.

The ayurvedic and unani companies and the use of medicinal plants

To see the marketing prospect of medicinal plants two commercial firms i.e. 'Sadhana Oushodhalaya' and 'jayson natural Products limited' were taken for the study. Questiones were asked about most demanding local and imported medicinal raw materials and material in short supply. Among the most demanding locally produced raw materials both of the commercial firms told about *amloki* (56,900 kg/year), *haritoki* (20,000 kg/year), *bahera* (23,000 kg/year) and *kalomegh* (2,000 kg/year). The figures in the parenthesis show the amount of raw materials needed for the two companies. One company told about *guruchilata* (6,000 kg/year), bark of *arjun*, *ashok* and *basok* (4,500 and 7,000 kg/year respectively) as demanding raw materials. But, another company mentioned about *bel* (1,500 kg/year), dried ada (1,200 kg/year), *nagarmotha* 800 kg/year), *banarlathi* (700 kg/year) and *swarnalata* (700 kg/year) in their demanding medicinal raw materials. Both of the firms named *chirota* in their demand list. One of the firm mentioned that, they imported it from outside but another firm mention about collecting it locally.

In the imported raw material items both of the firms named about *peepul* (3,600 kg/year for the two companies). Both the firms also mentioned about *arshagandha* in their demanding imported raw material items (3,000 kg/year for both the companies). One of the firm also mentioned about *ulatkambal* (1,500 kg/year), *zoin* (1,400 kg/year), *mouri* (1,200 kg/year), *Radhuni* (1,200 kg/year), *sarpagandha* (600 kg/year), *methi* (600 kg/year), *isabgular bhushi* (500 kg/year), *Zaisthamodhu* (300 kg/year) in their demanding imported raw material item. Among these imported raw materials they mentioned about collecting *ulatkambal, arshagandha, sarphagandha* and *radhuni* previously from Bangladesh. Another firm mentioned about imported *elachi, daruchini* and *kismich* in a very limited amount.

One company mentioned about occasional short supply of *bhuikumra* (5,000 kg), *alkushi* seeds (2,000 kg), and *simul* (4,000 kg). Another firm mentioned about *chirota* (400 kg), *swet chandan* (320 kg) and *agar kath* (480 kg) in their list of short supply. One of the firm mentioned that presently *chirota* is totally out of the market.

Both the firms has particular *bepari,* importers or wholesellers. A firm mentioned about having some contract growers. Another firm was reluctant to have contract growers. About contract growing different firms have different views. One firm responded that, they are not facing any shortage of raw materials. Another firm responded that they failed in the partnership with the growers. In those cases they could not deliver in particular amount and in most cases the quality of raw materials was also a problem. At present some of the growers from Satkhira (Modhupur) come to them with *banarlathi, ulatkambal,* bittergaurd (root), dried *bel* and *sarnalata.* If, the quality is within permissible limit then they accept it. When asked, if those were wild collected or cultivated then they said cultivated. Another firm responded that, they do not have any rule about having contract growers. But, they think if something could do then both the parties could be benefited. In that case, the company could get enough raw materials and on the other hand, the cultivators could be benefited by cultivating medicinal plants.

Conclusion and Recommendation

There is a huge medicinal plant market in Bangladesh as well as globally. Bangladesh government is also trying to promote medicinal plant cultivation. But, still the medicinal plant cultivation is in a very rudimentary stage. Almost nobody knows about the cultivation of medicinal plants by the farmers at their own initiatives.

The medicinal plant cultivation in Natore is spreading from one village to the adjacent village, but very slowly. The medicinal plants are cultivated in the village Kholabaria at least for the last 20 years. Recently the cultivation of medicinal plants specially *ghritakumari, sotomuli, simul, misridana ,rajkantha* and *nilkantha* is becoming popular.

It was seen from the study that, the medicinal plants are cultivated in the homestead land or fallow land. Usually the vegetables and spices are replaced by the medicinal plant cultivation. From the cost benefit analysis, it was also confirmed that the most cultivated medicinal plants are profitable than the cultivation of one of the spices i.e. *halud* (turmeric). But, the sugarcane cultivated in the homestead lands are far more profitable than the cultivation of medicinal plants (ghritakumari and *simul*) except *misridana*.

The causes cited by the farmers for cultivating medicinal plants are profitability and the unsuitability of soil for other crops. But, they also mentioned that it is profitable when cultivated in a small portion of land.

The involvement of women is also noticeable in the medicinal plant cultivation. So, cultivation in the homestead land could be a good source of income for the rural women.

The cultivated medicinal plants of Natore are infected by different diseases specially the mostly cultivated plant *ghritakumari* is infected by spotting of leaves. The cultivators are applying variety of pesticides according to their own judgment without knowing the exact remedy.

The cultivated medicinal plants are used widely in the study villages for primary health care. The medicinal plants are used basically as remedies for digestive disorder/gastric ulcer, body/teeth pain, jaundice, high pressure and heart problems, as vitamin, worm control, skin diseases and lesions, reproductive disease, urinary infection, diabeties and others.

The cultivation is restricted to the small farmers. Big farmers are not coming forward to cultivate medicinal plants. Moreover, even after offering loans by 'Krishi Bank' and 'Janata Bank' farmers are not becoming interested to get loan. These reflect that though there is a market of medicinal plants, but there is a gap in the market linkage with the farmers and manufacturers. The big cultivators are also restricted their medicinal plant cultivation to the fallow lands. They are not willing to take the risk of entering in the

small market. Most of the farmers mentioned that medicinal plant cultivation is profitable when cultivated in a small portion of land. One of the cultivators informed that, only the *ghritakumari* had a confirm market, but for the other medicinal plants they had to depend on medicinal plant vendor/hawker. The hawkers usually pay after the selling of those item and most of the time the cultivators has to face the hassle to realize their money. But, the farmers informed that the price of *ghritakumari* leaves is declining. According to them, if the market of *ghritakumari* does not expand than in the near future the farmers will not be interested to grow *ghritakumari*.

So, a few recommendations are narrated below for developing the medicinal plant cultivation in Bangladesh.

1. Further research on medicinal plants and their diseases are needed. Moreover, the cultivation of medicinal plants needed supports from the expert persons. It is very important to maintain the quality and disease free medicinal plants to enter in the world's medicinal plant market.

2. Expands markets of different medicinal plants. Like,
    - Increasing the use of mostly cultivated medicinal plant, *ghritakumari* could help to prosper the *ghritakumari* production. Like preparing 'mussabar' ('jel like substance collected from the *ghritakumari* plants) or 'aloe health drinks' in powdered form. In Bangladesh, 250 tones of 'mussabar' are using per year and the whole of it is exported from outside.
    - Use the herbals in cosmetic industry. Different medicinal plants like *gritakumari* is an ingredient of herbal cosmetics like soap/skin care products.
    - Use of medicinal plant as as organic pesticide. Many of the herbals like 'nim' or 'ata' could be use in the preparation of insecticides. 'Jeyson Natural products' are going to prepare these types of insecticides.

3. Develop linkage between the cultivators and herbal medicine producers.

   - 'contact growing' between the companies and medicinal plant cultivators could be helpful to develop a guaranteed market and that could effect positively to this sector.

   - If the cultivation has to be flourished than patronization for cultivation (like providing standard seeds and technical support) of different herbal companies is also necessary. Like other companies (sugarcane, tobacco) those who provide different supports to the growers could also be replicated by the herbal medicine producing companies.

Some of the companies are planning to enter in producing herbal cosmetics. So, a linkage with the growers and the herbal cosmetic companies could help to thrive this sector.
BRAC may establish cottage industry those use medicinal plants.BRAC VO members could be motivated to cultivate medicinal plants. BRAC is working with the poor rural people of our country. So, Plantation of medicinal plants in the homestead lands by the BRAC members could be a important source of income for them. The Arong could come forward to utilize those medicinal raw materials (the herbal products are already there in the store). A small cottage industry could also be developed by BRAC where the BRAC members could work with their produced medicinal raw materials to prepare herbal remedies and cosmetics.

Above all government has to come in front to create an appropriate market or collaborate the companies with the cultivators. Without initiation of new market, a prosperous farming sector could be destroy.

Though there is a demand of medicinal plant but, the linkage has to be developed between the herbal companies and with the cultivators.

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১৫. প্রথম আলো (ফেব্রুয়ারী, ২০০৪)। বিশেষ প্রতিবেদনঃ নাটোরের ঔষধি গ্রাম।

16. স্বাস্থ্য ও পরিবার কল্যাণ মন্ত্রণালয়, গণপ্রজাতন্ত্রী বাংলাদেশ সরকার (২০০২)। প্রাথমিক স্বাস্থ্য পরিচর্যায় ভেষজ উদ্ভিদঃ পরিচিতি, চাষ ও ব্যবহার বিধি - ১।

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