

**A SEMINAR PAPER ON**  
**IMPORTANCE AND PROSPECTS OF MEDICINAL PLANTS IN BANGLADESH**

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**A SEMINAR PAPER**  
**ON**  
**IMPORTANCE AND PROSPECTS OF MEDICINAL PLANTS IN**  
**BANGLADESH<sup>1</sup>**

**BY**  
**ABU JAFOR MOHAMMAD OBAIDULLAH<sup>2</sup>**

**ABSTRACT**

Medicinal plants are a vital component of non-timber forest products which are traditionally used in healthcare and source of livelihood all over the world. In an over-populated country like Bangladesh, the pressure on natural forests is immense; thus the cultivation of Medicinal plants can significantly contribute towards improving the livelihood of poor people through enhancing biological diversity. Notwithstanding the growing recognition of its importance and economic and ecological potential, there has been little research on Medicinal plants especially on the cultivation importance and its prospective fields in Bangladesh. Based on some research & survey reports the study explains the importance of medicinal plants & prospects of those plants in our country. The total size of medicinal plant market at wholesale prices was estimated at some US\$14 million – corresponding to 17000 tones of product. Local supply accounts for about 70% by volume and 40% by value. It assesses the major importance, identifies some problems and challenges and indicates ways of maximizing the potential of this important sector. The issues covered in this research include: existing research and policy-making processes related to the Medicinal plants sector; contribution of medicinal plants in the economy of Bangladesh as well as world trade, recent steps taken by govt. & non-govt. agencies to enhance productivity in this sector.

**Key words:** Marketing, Medicine, Antioxidant, Ayuverdic, Unani, Export, Import.

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## CHAPTER I

### INTRODUCTION

Plants that enable therapeutic properties or favorable pharmacological effects on human body are generally designated as medicinal plants. When a plant is designated as ‘medicinal’, it is understood that the said plant is necessary as a drug or therapeutic agent or an active ingredient of a medicinal preparation. “Medicinal plants may be termed as a group of plants that possess few special properties or virtues that qualify them as articles of therapeutic and drugs agents, and are used for medicinal purposes” (Sharmin, 2004). Those plants naturally synthesize or accumulate some secondary metabolites like sterols, alkaloids, terpenes, flavonoids, tannins, resins, lactones, volatile oil etc. Medicinal plants have a global recognition in health care apart from sourcing monetary benefits to the local people and forest users. It has a rich history and traditional cultures that have exhibited the primary health care of the local communities based on medicinal plants and related knowledge (Caniago & Siebert, 1998). According to FAO 2007 an estimated 121 505 tonnes of MP and aromatic products extracted globally out of which 90 181 tonnes are from Asia and according to (Subrat, 2002) this figure is expanding by 15 to 20 percent annually. Among the 422 000 plants species documented worldwide 12.5 percent are reported to have medicinal value (Rao *et al.* 2004). Despite of the deafening escalation of synthetic drugs in the last couple of decades, medicinal plants still play a vital role in the life and living of rural people in many parts of the world, especially in the developing countries (WHO, 1990). Furthermore, herbal medicine is getting a momentum also in the western world to such an extent that it is relevant to raise concerns related to the issue of the sustainability in their production and management. Again medicinal plants consider as a rich resources of ingredients which can be used in drug development and synthesis. Besides these plants play a critical role in the development of human cultures around the whole world. Moreover, some plants consider as important source of nutrition and as a result of that these plants recommended for their therapeutic values. Other plants their derivatives consider as vital source for active ingredients that are used in aspirin (Rasool, 2012). 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 (Sharmin, 2004). The majority of the rural people in Asian countries depend on plant-based traditional medicines for healthcare. These are still produced using age-old methods which can affect their quality, stability, and efficacy. Modern

pharmacopoeia still contains minimum 26% plant derived drugs and many others which are synthetic analogs made on prototype compounds isolated from plants (DeSilva, 1997). Bangladesh is biogeographically a transition between the Indo-Gangetic plains and the eastern Himalayas, and part of the Indo-Chinese sub region. Due to its unique biophysical setting – the combination of a large deltoid freshwater outlet and a large sea fan – Bangladesh is endowed with a rich diversity of plant species (Barua et al., 2001; Chowdhury, 2001; Hossain, 2001; Nishat et al., 2002). It is estimated to harbor 6000 plant species including bryophytes, pteridophytes, gymnosperms, and angiosperms (International Union for Conservation of Nature 2003), about 500 of which are claimed to have medicinal or curative properties (Yusuf et al., 1994; Dixie et al., 2003; Ghani, 2003). In the case of most wild medicinal plants growing in Bangladesh, excessive and unregulated exploitation is a common phenomenon, which often jeopardizes their future availability. FAO (2004) mentions that greatly, the south-east hilly area and north-east terraces of Bangladesh are rich in medicinal plants. They are collected by local, rural and tribal populations as well as by petty contractors, and in some cases by the government and forest department's co-operations. The over extraction and ignorant activities of these people cause biodiversity loss and resource depletion as many communities are unfamiliar with ecological issues and few currently participate in decisions regarding local natural resources (USAID, 2004). While this process of gradual loss of medicinal plants is continuing unabated, the demand for medicinal plants and plant-derived drugs is increasing rapidly with the current resurgence of traditional medicines all over the world (Ghani, 2003). There is unprecedented demand for natural medicines, green health products, pharmaceuticals, food supplements, cosmetics, and herbal pesticides, which is bringing about this alarming loss of plant biodiversity. It is estimated that 70-80% of people worldwide rely chiefly on traditional, largely herbal medicine to meet their primary healthcare needs (Farnsworth & Soejarto, 1991; Shengji, 2001). The global market for herbal medicine is not only large but expanding by 15-20% annually (Subrat, 2002). Planned or commercial production of medicinal plants is virtually non-existent or in some cases at a very preliminary stage in Bangladesh. Forests and other natural ecosystems are the major sources (around 90%) of the overwhelming bulk of the medicinal plants used as raw materials by around 600 small and medium scale industries of traditional and local medicines. Apart from local feedings of raw materials, these industries again depend considerably on processed and imported plant-derived raw materials that mostly come from

neighboring countries through both formal and informal (illegal cross border) trading. In a market survey, (Begum, 2002) found that the yearly market size for medicinal plants is US\$ 11m in Bangladesh.

In recent years, the Government of Bangladesh has been emphasizing the need to strengthen these traditional medicine-based healthcare systems (Ayurveda, Unani, Homeopath) and the conservation and promotion of related plant species in order to take part in the 62-billion-dollar global market (GoI, 2000) and enhance local public health. In a bid to give a boost to the exportation of herbal medicines and plants, the government has already set up a business promotion council exclusively for this sub-sector. 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. Global statistics has revealed the continued growing economic importance of medicinal plants and plant-based pharmaceuticals which developing countries can harness to improve their pharmaceutical supplies that can impact positively on their healthcare delivery system. This is premised on the fact that most of these medicinal plants are abundantly indigenous in these developing countries that export them at very cheap rates to developed countries only to import pharmaceuticals made from them at very exorbitant prices that most often affect their foreign exchange. It is for these reasons and perhaps among others not mentioned, that this review suggests the need to intensify research into ethno-medicine as this can turn to address the current precarious supply and reduce the burden of import of essential medicines by the developing nations. This study will shed light on the importance of the medicinal plant cultivation and prospects of this sector in Bangladesh.

## **Objectives**

- To increase the consciousness of people about importance & beneficial uses of medicinal plants and
- To point out some prospective areas that enhance the productivity as well as export potential of this sector.



## **CHAPTER II**

### **MATERIALS AND METHODS**

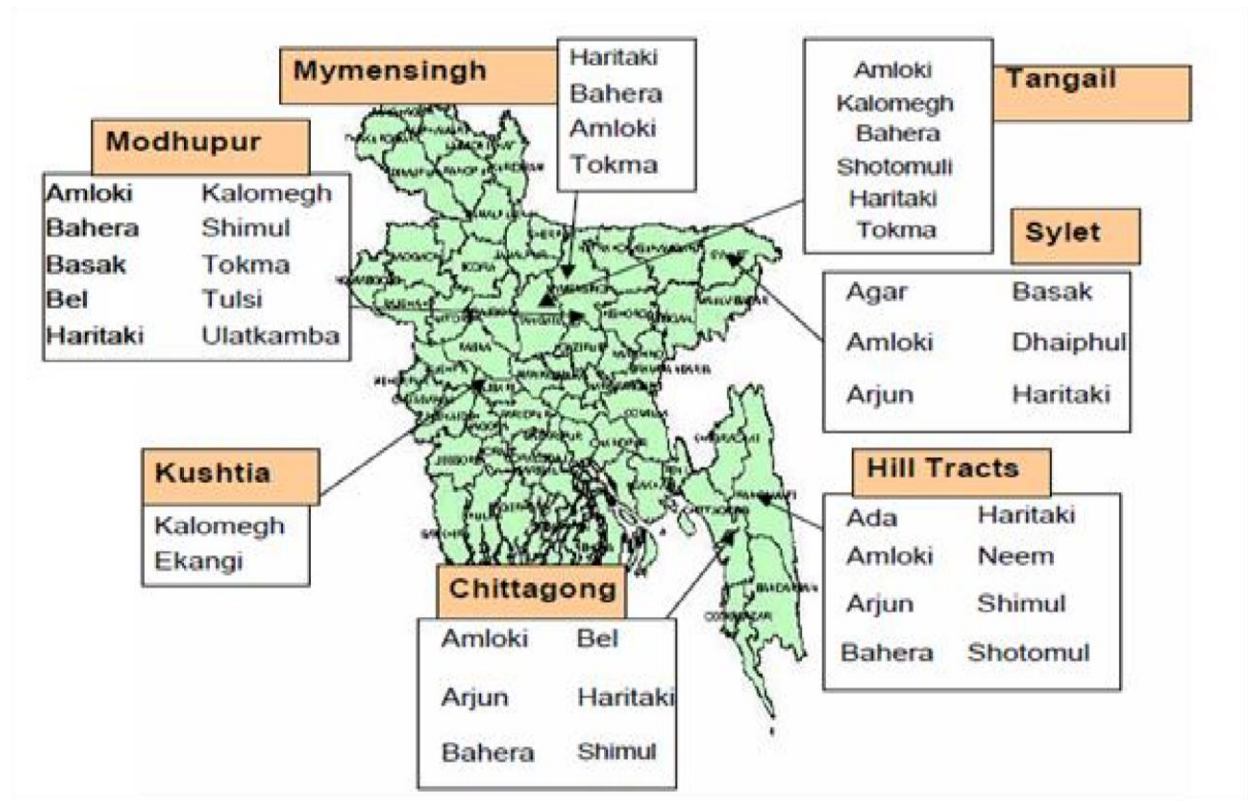
This seminar paper is exclusively a review paper. It has been prepared by reviewing the various articles published in different Books, Proceedings, Abstracts, Review papers, Journals, MS thesis, Ph.D. Dissertation etc. available in the library of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh Agricultural Research Institute (BARI), Bangladesh Forest Research Institute (BFRI) and internet browsing. I prepared this paper in consultation with my learned major professor, and other concerned experts. The necessary thoughts, ideas, facts and findings has been collected through internet searching and incorporated with the body of the seminar. In addition to that constructive and valuable suggestions of the experts were included, as and when necessary, in preparing this paper. Mostly secondary data have been adopted.

### CHAPTER III

#### REVIEW OF MAJOR FINDINGS AND DISCUSSION

##### Cultivation Status in Bangladesh

Bangladesh is situated at the complex interface of the Indian, Himalayan and Southeast Asian biographic regions, and historically it is well-endowed with very diverse complements of terrestrial and aquatic flora and fauna (Rahman, 1999) that include a considerable number of medicinal plant resources. Bangladesh is the home of medicinal plants. It is occupying an area of 147,570 sq. km, which has highly favorable climate and soil conditions for the production of medicinal plants. It is a land of about 17,000 species of plants, out of which 7500 are known for their therapeutic uses (DU, 2012). About 60000 marginal farmers, including female (about 48,000) ones, are involved in the cultivation of this plant in the northern part of Bangladesh.



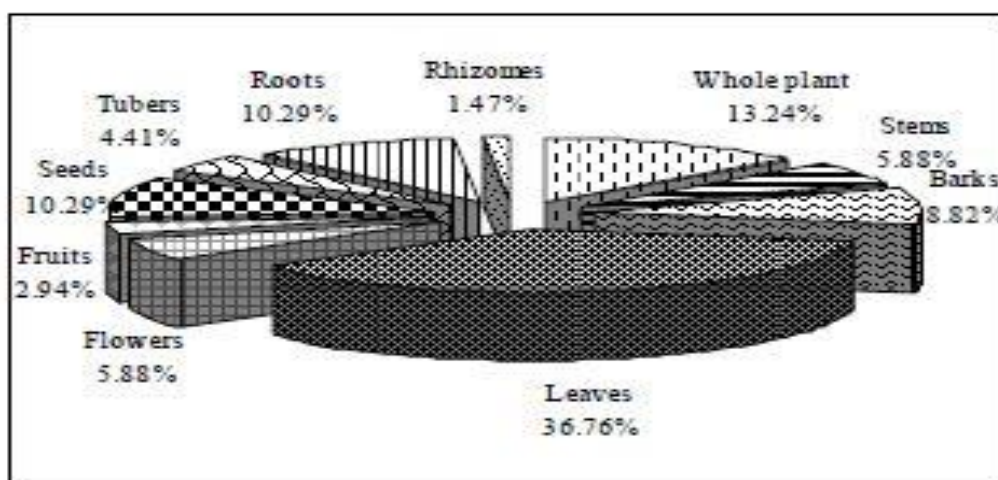
**Figure 1: The major medicinal plants production zones in Bangladesh**

(Source: BFRI, 2014)

In our country, 75% of our population use herbal medicine for primary healthcare. Over 4 billion of world's population use the herbal medicine. Both in home and abroad, herbal medicines are now the most popular form of traditional medicines, free of side effects and is acclaimed highly. In addition, farmers are cultivating different types of medicinal plants in Mymensingh, Tangail, Sylhet, Modhupur, Kushtia and Chittagong Hill Tracts (Fig-1).

### Plants parts used as Medicine

For medicinal preparations, people mostly use above-ground plant parts (70.57%), followed by below- ground parts (16.17%) and whole plants (13.26%). Of the above-ground plant parts, most frequently used parts are leaves (36.76%), followed by seeds (10.29%), stem (5.88%), bark (8.82%), flowers (5.88%) and fruits (2.94%) (Fig-2).



**Figure 2:** Graphical presentations of different parts of medicinal plant species.

**Source:** (Khan et al., 2011)

### Main Medicinal Plants in Bangladesh

There are around 500 medicinal plants in our country. They have much variety diversity. They have diversity in size, shape, in habitat, in adaptation power, in flowering, in production season, in the activity on human life. We can detect them easily for their individual diversity. We can use them in several purposes for their diversity. Main of them is to control diseases. Most of the antibiotic such as subtilin, polymixin, penicillin etc. are produced from this medicinal plants.

Each of the plant group has individual diversity & this diversity has special importance. Some of the importance plants with their therapeutic uses are given below (table 1)

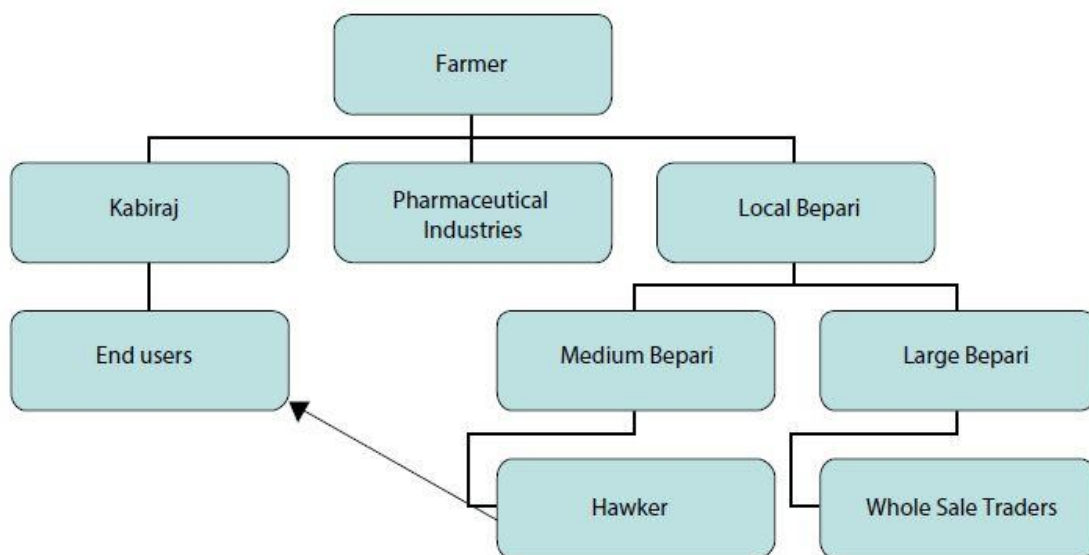
**Table 1: List of the Major Medicinal and Spice Plants Commonly found in Bangladesh**

<i>Scientific name</i>	<i>Common name</i>	<i>Therapeutic use</i>
<i>Adhatoda vasica</i>	Vasak	Expectorant, coughs asthma
<i>Aloe indica</i>	Gritakumari	Purgative, cooling agent, stomach diseases, preparation of lotion
<i>Andrographis paniculata</i>	Kala megh	Hepatitis; antihelmenthic dysentery; fevers & stomach trouble
<i>Asparagus racemosus</i>	Shatamuli	Diuretic; measles; pox and diarrhea; energetic (tonic).
<i>Azadirachta indica</i>	Neem	Tonic, antispasmodic; insecticide
<i>Boerhaavia diffusa</i>	Punorvoba	Asthma, Diuretic, skin diseases
<i>Centella asiatica</i>	Thankuni	Energetic (tonic); nerve diseases; (fairer)
<i>Ocimum sanctum</i>	Tulsi	Cough, fever, dysentery, stomach diseases, mosquito repellent
<i>Phyllanthus emblica</i>	Amloki	Rich in vitamins (components of triphala)
<i>Saraca indica</i>	Ashok	female diseases, dysentery
<i>Terminalia arjuna</i>	Arjun	Heart diseases (component of triphala)
<i>Terminalia bellirica</i>	Bohera	Stomach diseases
<i>Terminalia chebula</i>	Haritaki	Stomach diseases

**Source: (Khan & Rasid, 2006)**

### Supply Chain of Herbal Products and Medicinal Plants

According to the opinion of the shop owners of herbal products, the local raw materials of their products are mostly collected from 5 different areas of the country like Chittagong, Tangail, Gazipur, Khulna and North Bengal (Fig-3).



**Figure 3: Supply chain of herbal products and medicinal plants**

**Source: (Rashid et al., 2014)**

The figure drawn above shows the supply chain of herbal products and medicinal plants. We can observe from the figure that local processors like Bepari and Kabiraj collect medicinal plants from the farmers. Pharmaceutical companies also collect medicinal plants from the farmers to produce herbal products. Kabiraj and pharmaceutical companies process the medicinal plants & produce herbal products and they directly sell those to the consumers. Local traders sell the medicinal plants to the whole sale traders, hawkers and consumers, both in raw and processed form.

### Medicinal Plants: as Important Source of Antioxidants

Medicinal plants are a source for a wide variety of natural antioxidants and are used for the treatment of diseases throughout the world. Some of these properties are antimicrobial, anti-cancer, anti-diabetic, anti-atherosclerosis, immunomodulatory, and even reno-protection or

hepatoprotective effects. Recently, due to beneficial effects of antioxidants, particularly natural antioxidants, in the treatment and prevention of diseases, there has been a considerable interest in finding natural antioxidants from plant sources. In this regard various animal models including diabetes, hyperlipidemia, autoimmune encephalomyelitis, inflammatory bowel disease, ischemia-reperfusion in rat skeletal muscle or kidney, hepatotoxicity, renal toxicity, radiation injury, and cataract for assessing antioxidative effects of medicinal plants have been investigated and most of them have been treatable with specific medicinal plants according, at least in part, to their antioxidant properties. In this regard, medicinal plants have also been a reliable source for preparation of new drugs. Nowadays, researchers more than before are dependent on medicinal plants for discovery of new drugs with fewer side effects (Rafieian, 2012). Such as- Neem is an importance source of antioxidant. A research was conducted by Ghimeray et al., 2009 found that the azadirachtin content was highest in methanolic extract of seed (3300 µg/g dw), followed by the hexane extract (177 µg/g dw). The hexane fraction of bark also showed the presence of azadirachtin (86 µg/g dw). However, the leaf showed trace amount (17 µg/g dw) of azadirachtin content in water fraction. Likewise, the hexane fraction of bark showed highest amount of nimbin content (271 µg/g dw) followed by the methanolic extracts (260 µg/g dw) and butanol fraction (60 µg/g dw). Similarly, the hexane fraction of leaf also showed significant amount of nimbin content (112 µg/g dw). The methanolic crude extract and hexane fraction of seed showed 88 and 82 µg/g dw of nimbin content, respectively. Overall, the HPLC result showed that the concentration (Table-2).

**Table-2: Estimation of azadirachtin and nimbin content in the seed, bark and leaf extracts of neem in different solvents**

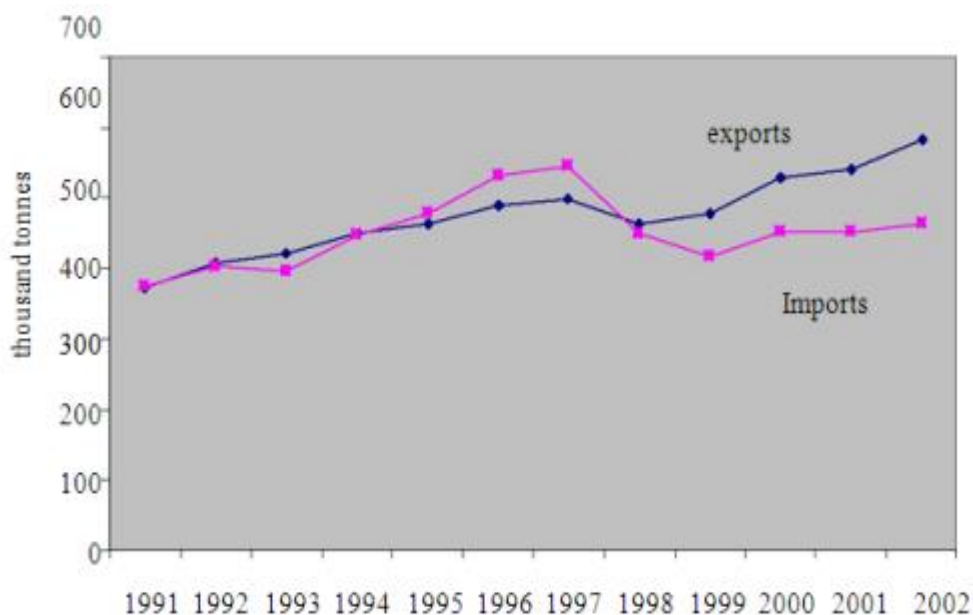
Sample	Azadirachtin (µg/g dw)	Nimbin (µg/g dw)
Neem seed (methanol 80%)	3300	88
Neem seed Hexane	177	82
Neem leaf Hexane	ND	112
Neem leaf water	17	ND
Neem bark (methanol 80%)	ND	260
Neem bark Hexane	86	271
Neem bark butanol	ND	60

ND = Not determined.

**Source: (Ghimeray et al., 2009)**

### Medicinal Plants as Pharmaceuticals

According to WHO report (2003), 30% of pharmaceuticals sold worldwide contained compounds derived from plant materials as global sales of herbal products totaled an estimate of 600 million USD in 2002. Almost 80 % of the population of developing countries depending largely on plant-based pharmaceuticals for their healthcare needs (Fig-4). Therefore, the commercial factor in medicinal plant use probably provides the incentive and a key developing strategy that could best safeguard the interest of the low-income countries.



**Figure 4. World imports and exports volume of medicinal plants (1991-2002)**

**Source: (Bukar et al., 2016)**

Table 3 shows Square and ACME's demand of Bangladeshi medicinal plants and herbal products. Total export value of Square Herbal & Nutraceuticals Ltd. Products in 2016 (since 2013 to till date) stood at \$25000. In our country, 86.7% of drug manufacturing factories are importing Indian raw materials. And around, 53.3% of factories are importing from Pakistan & very few of them are importing the raw materials from Nepal, Iran, and Korea. We observe that, we are highly dependent on the import of raw materials.

**Table 3: Demand of medicinal plants (Square and ACME pharmaceuticals) in Bangladesh**

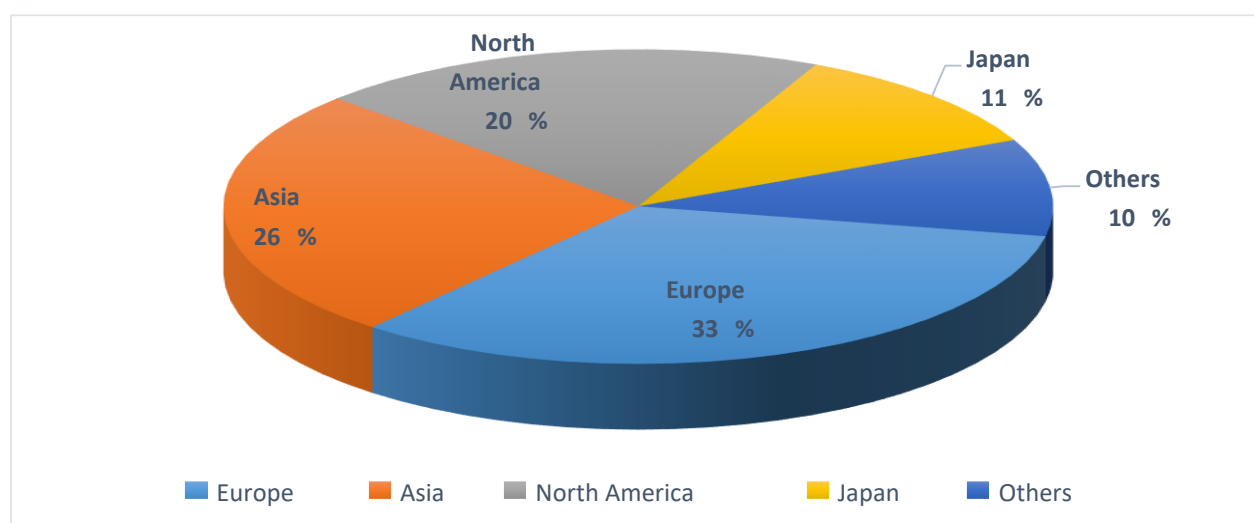
<b>Name of Medicinal Plants</b>	<b>Usable portion</b>	<b>Name of the Company</b>	<b>Place of Collection</b>	<b>Demand/Year</b>
<b>Bashak</b>	Leaves	Square	Kustia	<b>40 ton (Dry)</b>
		ACME	Natore, Gaibandha	<b>3 ton (Dry)</b>
<b>Satamuli</b>	Root	Square	Dhaka	<b>1 ton (Dry)</b>
			Natore, Gaibandha	<b>80-90 kg (Dry)</b>
<b>Aswagandha</b>	Root	Square	Natore and India	<b>2-3 ton (Dry)</b>
		ACME	Natore, Gaibandha	<b>300 kg (Dry)</b>
<b>Kalomegh</b>	Leaves	Square	Hyderabad, India	<b>200-500 kg Dry Extract of active ingredient</b>
		ACME	Natore, Gaibandha	<b>250 kg (Dry)</b>
<b>Tulsi</b>	Leaves	Square	Dinajpur	<b>2.5-3 ton (Dry)</b>
		ACME	Natore, Gaibandha	<b>250 kg (Dry)</b>

**Source: (BFTI, 2014)****Importance of Medicinal Plants as Herbal Medicine****Herbal Medicine & World Trade**

At present, about 70% of the world population rely on herbal medicine for their Primary Healthcare needs, according to WHO estimation. Even in the developed countries, complementary or alternative medicine (CAM) is gaining more popularity and is being developed. On an average, 48% of the Americans prefer herbal medicine. The United States



spends about 5 million US Dollars per year for herbal products and normally 20% of the people use herbal commodities and medication. In addition, in China, herbal medicine accounts for 40% of all healthcare delivered and about 200 million patients are covered by it per annum. 70% of the population in Chile and 40% in Colombia use herbal drugs. 48% of the population in Australia, 70% in Canada, 38% in Belgium and 75% in France prefer herbal products. The United Kingdom imports about 90% of its medicinal herb and the requirement involves about 139-million-euro market (Fig -5).



**Figure 5: World Market of Herbal Medicine**

**Source: (BFTI, 2014)**

### **Main importers:**

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. 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 the figure had risen to 69 % (Sharmin, 2004).

### **Main exporters:**

India is a major exporter of raw medicinal and aromatic plants and processed plant-based drugs. 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 (Sharmin, 2004).

### **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. 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).

**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
Ayurvedic	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: (Sharmin, 2004)**

### **Medicinal plants and the Bangladesh Economy**

It is estimated that some 12,500 tonnes of dried medicinal plant material produced in Bangladesh is sold. These products are worth some Tk 255 million (\$4.5 million) to the rural economy and around Tk.330M (\$5.8M) at the factory rate/wholesale. The 5,000 tonnes of imported medicinal plants cost around Tk 480 million (\$8 million). It is believed that there are around 350 inter-district beparis who are serviced by 6,000 to 10,000 local collectors, pikers and growers. In total

there are said to be around 200 Unani and 200 Ayuverdic registered factories, plus some 70 homeopathic factories (Dixie et al., 2005).

### **Major Exportable Items & Export Destinations**

According to a field survey conducted by the BFTI, Adovas Syrup, Pepnor Syrup, Probio Capsule, Arubin Capsule, Eyebill Capsule, Giloba Capsule, Livolite Capsule, Silybin Capsule, Inacea Capsule, Jort Capsule, Gintex Capsule are the main export items.

**Table 5: Country-Wise Export Earnings of Bangladesh's Medicinal plants (HS code: 1211) during 2013-14 to 2014-15.**

(In US dollar)

<b>Countries</b>	<b>Export value in 2013-14</b>	<b>Export value in 2014-15</b>	<b>Growth Rates (%) During 2014- 15</b>
<b>VIETNAM</b>	<b>413,975.05</b>	<b>317,578.89</b>	<b>-23.29</b>
<b>UNITED ARAB EMIRATES</b>	<b>155,767.61</b>	<b>30,894.49</b>	<b>-80.17</b>
<b>MYANMAR</b>	<b>598,8.91</b>	<b>22,409.94</b>	<b>274</b>
<b>THAILAND</b>	<b>....</b>	<b>6,552.72</b>	<b>....</b>
<b>OMAN</b>	<b>....</b>	<b>6,068.20</b>	<b>....</b>
<b>ROMANIA</b>		<b>2,019.83</b>	<b>....</b>
<b>MALAYSIA</b>	<b>510.62</b>	<b>1,990.06</b>	<b>289</b>
<b>UNITED KINGDOM</b>	<b>....</b>	<b>57.61</b>	<b>....</b>
<b>AUSTRIA</b>	<b>....</b>	<b>2,610.77</b>	<b>....</b>
<b>INDIA</b>	<b>811,6.39</b>	<b>....</b>	<b>....</b>
<b>SINGAPORE</b>	<b>138,57.44</b>	<b>....</b>	<b>....</b>
<b>YEMEN</b>	<b>163,4.55</b>	<b>....</b>	<b>....</b>
<b>TOTAL</b>	<b>599,850.57</b>	<b>390,182.52</b>	<b>34.95</b>

Source: (BFTI, 2014)

Some new emerging export items are RoohAfza, Cinkara, Safi, Sualin, Chyabanprash, Naunehal, Endurex, Libidex, Frudex etc. Vietnam, Hong Kong, Uganda, Kenya, Somalia,

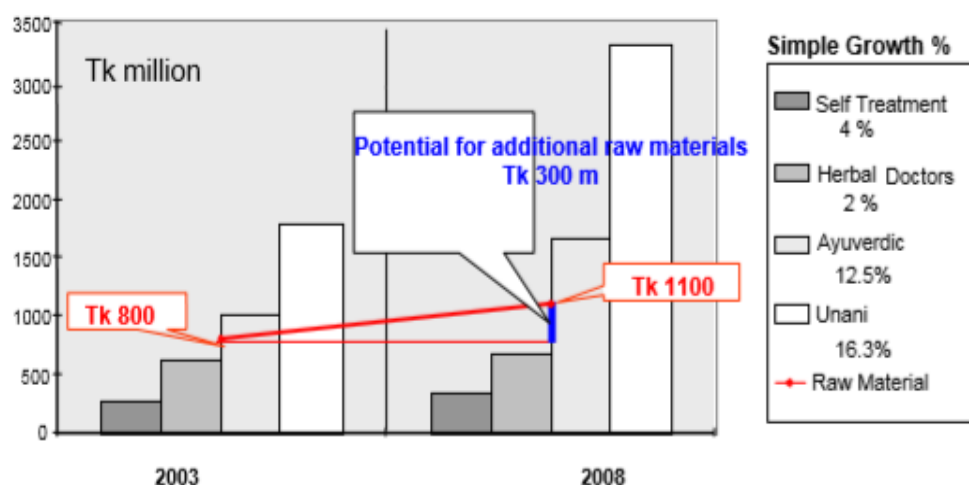
Cambodia, Fiji, Georgia, United Arab Emirates, Myanmar, Thailand, Oman, Romania, Malaysia, United Kingdom, Austria, India, Singapore and Yemen are the major destinations of export. Moreover, we are exploring many other countries in Asia Pacific, Africa, Europe and Latin America for exporting herbal products (Table-5).

### **Future prospects of medicinal plants**

Very recently, the Government of Bangladesh formulated development strategies recognizing the potential role of the traditional healers (Baiddyas & Kabiraj) in rural health care and suggested necessary directives in a draft national health policy 2008. This is now being processed by the parliament. Apart from this initiative, the government already created positions for 45 medical officers termed as alternative medicines (AMC) in 45 Thana health complexes to mainstream this branch with modern health care system. A demonstration plot with important and widely used medicinal plants has already been established in many Thana Health Complexes to aware people about the importance of MP in traditional health care system. These state interventions are scattered and do not necessarily reflect the actual demands of the field practitioners strictly, since there is virtually no controlling body or mechanism to monitor the whole process. Weak linkages between research organizations and state forest agency are also responsible for the poor performance in this sector.

### **Increased Demand for Medicinal Plant Materials**

Projections of the future size of the herbal medicine market in 5 years' time based on the assumption that the existing simple growth rate for herbal practitioners, self-treatment and the Ayurvedic and Unani sectors will continue are presented in Figure 6. The total value of the herbal medicinal market, at trade prices, is expected to increase from around Tk 3,700 million in 2003 to Tk 5,850 million in 2008. These growth rate assumptions are conservative. As a result of the effects of the government's active promotion, market liberalisation and the dynamism of the corporates, these growth rates should be exceeded. Figure 6 also demonstrates that the demand for medicinal raw materials per year is expected to increase from around Tk 800 million to Tk 1,100 million - an increase of Tk 300 million.

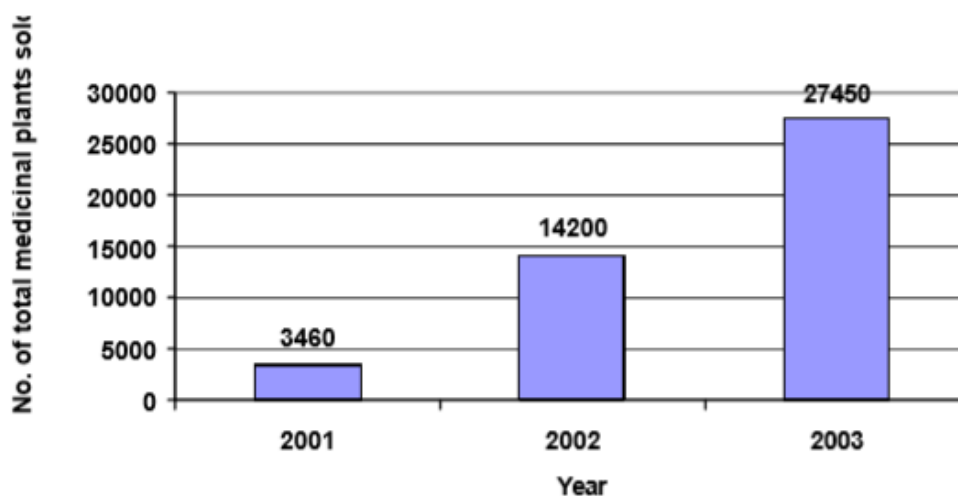


**Figure 6: Increased Value of Medicinal Plant Materials**

**Source: (Dixie et al., 2003)**

### **Expanding people's interest for medicinal plants cultivation**

According to the research conducted by Lammiya Sharmin on Cultivation prospect of medicinal plants in Bangladesh in Natore at the year of 2004, it can be seen that peoples interest in using medicinal plants and herbal products expanding as selling quantity of these products is increased rapidly (Fig-7).



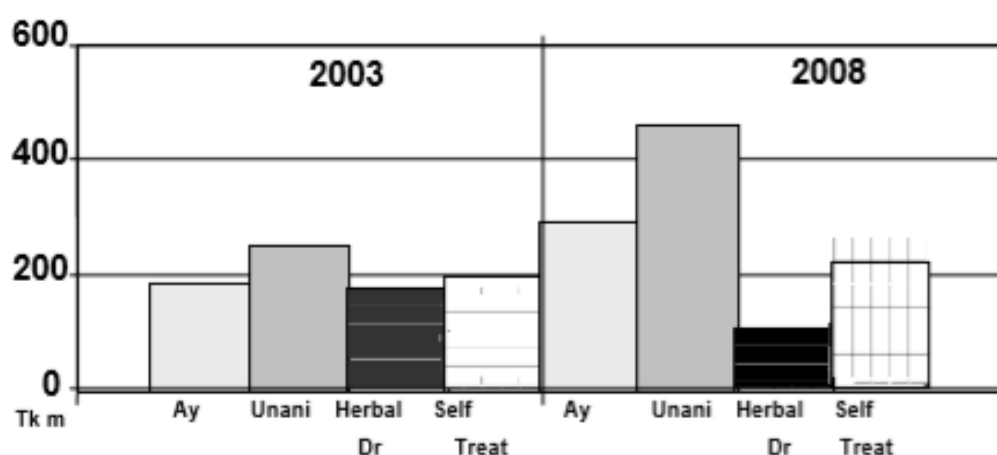
**Figure 7: Sales of medicinal plants in the BRAC operated nursery**

**Source: (Sharmin, 2004)**

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. If BRAC operated nurseries along can increase the selling quantity so there lies a great prosperity in this field.

### Place in the formal Ayuverdic and Unani Sectors

The bulk of this increased demand for raw material is likely to take place in the formal Ayuverdic and Unani sectors as demonstrated in graph 7. Currently, Bangladesh holds around 40% by value of the medicinal herb market, worth Tk 340 million. Given Bangladesh's reliance on an unsustainable wild harvest and its lack of a specific integrated programme to develop commercialized medicinal plant production, in 5 years' time it may only continue to supply Tk 340 million of raw material. In this scenario its market would drop from 40% to 30%. Conversely, with an active programme to commercialize the production, improve quality and to take back market share from products that are currently being imported, Bangladesh could expect to take 60% of the market and supply Tk 660 million of product per year – an increase of Tk 320 million (over \$5 million) of increased rural income per year (Fig-8).



**Figure 8: Demand for raw Medicinal plants by different sector**

**Source: (Dixie et al., 2003)**

### Cultivation with other trees in multistoried system

The economics of cultivation of aloe vera solely as well as together with coconut, guava and lemon trees has been analyzed to ascertain economically profitable combinations as feasible for Bangladesh conditions. Table 2 indicates that the total cost of production was the highest (107428 Tk./ha) in sole cropping (T3) followed by coconut+guava based MAF (80693 Tk./ha) (T1). The lowest cost of production (78546 Tk./ha) was recorded in coconut+lemon based MAF (T2). Higher cost of production was found in sole cropping of aloe vera due to larger area being cultivated (100%) for aloe vera production as compared to coconut based MAF (25%), as a result more input cost was required. However, the highest gross return (285922 Tk. /ha) was obtained from the coconut+guava based MAF (T1), which was followed by the coconut+lemon based MAF (T2). The highest benefit-cost ratio of 3.54 was recorded from coconut+guava based MAF (T1) which was followed by coconut+lemon based MAF (T2). The lowest benefit-cost ratio of 1.65 was observed in sole cropping (T3) (Table 6). Aloe vera can therefore be advantageously cultivated in coconut based multistoried agroforestry systems.

**Table 6: Economics of aloe vera production under coconut based multistoried cropping system**

Treatments	Return (Tk/ha)				Gross Return (Tk. ha <sup>-1</sup> )	Total cost of Production (Tk. ha <sup>-1</sup> )	Net Return (Tk. ha <sup>-1</sup> )	BCR
	Aloe vera	Guava	Lemon	Coconut				
Coconut+Guava+Aloe vera (T <sub>1</sub> )	18530	172080	---	95312	285922	80693	205229	3.54
Coconut+Lemon+Aloe ver (T <sub>2</sub> )	22480	---	103837	95312	221629	78546	143083	2.82
Open (T <sub>3</sub> )	124400	---	---	---	177330	107428	69902	1.65

Note: Aloe vera 4 tk./kg, Guava 6 Tk./kg; Lemon 1 Tk./piece, Coconut 8Tk./nut

Source: (Bari & Rahim, 2012)

Another study was done in producing Misridana with coconut based cultivation. In this case, the result found was as same as the result of Aloe vera cultivation in multistoried system. The lowest cost of production (46132 Tk./ha) was recorded from coconut+lemon based MAF (T2). Higher cost of production was found in sole cropping of misridana due to higher area being cultivated (100%) for misridana production as compared to coconut based MAF (25%), and consequently

more input cost was involved. However, the highest value of gross return (235444 Tk. /ha) was obtained from the T1 treatment (coconut+guava based MAF), which was followed by the treatment T3 (sole cropping of misridana). On the other hand, the lowest value of gross return (176772 Tk. /ha) was obtained from coconut+lemon based MAF (T2). Among the treatments, it was found that the highest benefit-cost ratio of 5.06 was recorded from T1 treatment (coconut+guava based MAF), followed by coconut+lemon based MAF (T2). The lowest benefit-cost ratio of 2.33 was observed in T3 treatment (sole cropping of misridana). Integrations of misridana under multistoried agroforestry systems were thus clearly preferred production systems (Table-7).

**Table 7: Economics of misridana production under coconut based multistoried cropping system**

Treatments	Return (Tk/ha)				Gross Return (Tk. ha <sup>-1</sup> )	Total cost of Production (Tk. ha <sup>-1</sup> )	Net Return (Tk. ha <sup>-1</sup> )	BCR
	Misridana	Guava	Lemon	Coconut				
C+G+Misridana (T <sub>1</sub> )	100300	87188	—	47956	235444	46525	188919	5.06
S <sub>1</sub> +L+Misridana (T <sub>2</sub> )	77400	---	51416	47956	176772	46132	130640	3.83
Open (T <sub>3</sub> )	285600	---	—	---	177330	76117	101213	2.33

Note: C =coconut; G = guava; L = lemon; Misridana 40 Tk./kg. Guava 6 Tk./kg; Lemon 1 Tk./piece, Coconut 8 Tk./nut

**Source: (Bari & Rahim, 2012)**

### **Cultivation in the southern part of Bangladesh**

Saline prone areas are more exposed to climate change in Bangladesh. The saline land is unfit for crop cultivation, afforestation and rehabilitation (Shivanna et al., 2013). In order to meet the ever increasing demand of medicinal plants, for the indigenous systems of medicine as well as for the pharmaceutical industry, some medicinal plants need to be cultivated commercially. In this regard, it seems significantly to test the important medicinal plant for their salt- tolerance capacity (Leithy et al., 2009). As well as, in case of medicinal plants it is also important to identify the quantity and quality of active ingredients in saline affected areas. Effect of salt stress



has been studied in some medicinal plants such as Thai neem (Cha-um et al., 2004), neem, aloe vera, golden shower tree, madagaskar periwinkle (kumari et al., 2012), Moringa oleifera (Nouman et al., 2012), Majorana hortensis (Shalan et al. 2006) etc.

**Table-8: Determination of plant height**

PLANTS	5 <sup>th</sup> day	10 <sup>th</sup> day	15 <sup>th</sup> day	20 <sup>th</sup> day
<i>Azadirachta indica</i>	C-46	C-46	C-47	C-48
	S -47	S -48	S -49	S -51
<i>Cassia fistula</i>	C-45	C-46	C-47	C-48
	S -45	S -45	S -45.5	S -46
<i>Aloe barbadensis</i>	C-20	C-21	C-22.5	C-24
	S -20	S -20	S -21	S -21
<i>Catharanthus roseus</i>	C-13	C-14	C-14	C-16
	S -12	S -13	S -13	S -14

Source: (Kumari et al., 2012)

Table 8 shows the parameter in terms of growth where we can see clearly the inhibitory effect of salt in all plants, but astonishingly *Azadirachta indica* shows the growth effect when compared with another plants while all other plants height was less when compared to their respective control plants.

**Table-9: Total carbohydrates content in plant leaves**

Plants	Control on 20 <sup>th</sup> day	5 <sup>th</sup> day	10 <sup>th</sup> day	15 <sup>th</sup> day	20 <sup>th</sup> day
<i>Azadirachta indica</i>	1.98	1.888	1.87	1.47	1.57
<i>Cassia fistula</i>	1.45	1.23	1.22	1.20	0.878
<i>Aloe barbadensis</i>	1.23	1.01	0.67	0.64	0.56
<i>Catharanthus roseus</i>	1.23	1.21	1.023	0.98	0.77

Source: (Kumari et al., 2012)

Total carbohydrates content was estimated by Anthrone method, and the total carbohydrate content of all the plants with respect to their days of interval is tabulated here (Table 9). More amount of carbohydrate was found in *Azadirachta indica* control plant and also the salt stress effected *Azadirachta indica* has nearby amount of carbohydrates in it. It resembles that *Azadirachta indica* has some internal tolerance towards salt stress.

### **Roadside Plantation in Floodplain Areas**

Shahidullah, A. K. M. (2007) found that Plantation took place in all the floodplain areas including the Madhumati floodplain (Fig-9). Many wide and uncultivated lands, including the front and backyards of educational institutions, have been brought under an afforestation program. Compact block plantation, with varieties of species in the cultivable wastelands, and roadside strip plantation have been carried out and are considered effective initiatives for environmental amelioration. Religious places like churches, temples, mosques, *haat* and *bazaar* were brought under plantation, and under social forestry, homestead plantation, and plantation at river and canal banks were also done. There has been 43 km of plantation with more than 100 species. The species include *Arjun*, *Haritaki*, *Bahera*, *Neem*, *Amloki*, *Tetul*, *Gab*, *Kathal*, *Am*, *Jam*, *Hijal*, *Jambura*, *Kotbel*, *Chambol Sisso*, *Boron*, *katbadam*, *Jalmander*, *Krishnachura*, *Pepe*, *Payara*, *Telikadam*, *Lebu*, *Bilombi*, etc., which are plants or trees with medicinal values.



Figure-9: Road side plantation at Madhumati Floodplain

**Source: (Shahidullah, 2007)**

## **CHAPTER IV**

### **CONCLUSIONS**

From the review, it is obvious that there is growing economic value of medicinal plants that the developing countries need to harness in order to improve their economic and health care delivery systems. The major importance of the medicinal plants sector can be measured from the fact that herbal medicines serve the healthcare needs of about 80 per cent of the world's population. According to the World Health Organization (WHO), the goal of 'Health for All' cannot be achieved without herbal medicines.

While the demand for herbal medicines is growing in developing countries, there are indications that consumers in developed countries are becoming disillusioned with modern healthcare and are seeking alternatives. This has renewed interest by the multinational pharmaceutical industry in bio prospecting. With this cautionary note, it may be concluded safely that herbal medicines hold good future prospects and they may, one day emerge as good substitutes or better alternatives for synthetic chemicals-based allopathic drugs or may even replace them.

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