

**CULTIVATION OF MEDICINAL CROPS AND
AROMATIC CROPS
AS A MEANS OF DIVERSIFICATION
IN AGRICULTURE**

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PREFACE

The medicinal and aromatic crops are firmly emerging on the scene in Indian agriculture from three different perspectives. First, the traditional health system under *Ayurveda*, *Siddha* and *Unani* have become popular mainly due to the holistic treatment, cost of treatment and least side effects. This has spurred the demand for medicinal herbs and aromatic plants. Second, the herbs and plants were collected from the natural habitat and under minimal supervised environment. As a result, the density of medicinal and aromatic plants in the natural habitat started declining at a faster rate. This over-exploitation of these plant species has led to the cultivation of these under field conditions. Lastly, medicinal and aromatic crops have better economic opportunities as against the traditional field crops. The price of these crops as raw-material to the pharmaceutical industries has increased substantially. That fetches higher price to the cultivators and collectors. This is also encouraged by the increasing demand of these crops in the world trade. All these have led to the emergence of medicinal and aromatic crops as alternatives to some of the traditional uneconomic crops, in a few regions of India.

Keeping this in view, a study was undertaken in a few states to look into the relative economics of medicinal and aromatic crops vis-à-vis traditional crops. It has been observed that in certain pockets traditional crops are being replaced with these crops. The study was coordinated by the Agricultural Development and Rural Transformation Centre (ADRTC), Bangalore and the proposal, questionnaire as well as the process of analysis was prepared by ADRTC. The present study on Karnataka conducted at ADRTC, focuses on Sweet Flag and Patchouli representing medicinal and aromatic crops, in two districts of the State. These crops are emerging strongly as alternative to the existing crops and have better economic opportunities. The study clearly brings out relative economics of these two crops vis-à-vis the traditional crops

(paddy and tomato) grown in these regions and provides policy guidelines for the new crops.

I believe that the study will be useful to the academics and policy makers in this sector.

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The use of medicinal plants assumes quite an important place in the history of Indian medicine. In the recent past, the west also accepted the holistic method of Indian medicine, and the demand for these medicines has increased substantially. As a result, the collection of medicinal herbs from the forest area as well as cultivation of medicinal plants increased substantially. The cultivation of medicinal and aromatic crops is replacing that of traditional crops and this change in the cropping pattern is observed in a few states in the country. The Ministry of Agriculture, Government of India, was interested in ascertaining the factors that brought about the changes and to understand the future trends in the cultivation of medicinal crops. This study was undertaken with the intention to understand the factors influencing the change in area under medicinal crops and the relative economics of the crops. This study is undertaken in Karnataka, a State that has a long history in the use of medicinal plants and the traditional medical system.

I was helped in the study by many, including Mr. Ganapathy, M.A., who conducted the field work and painstakingly got the data assembled at one place. Mr. N.T. Neelakanta and Ms. J. Prachitha helped to formulate the tables; the work was later on taken up by Mr. Naveen Hegde in the most efficient manner. Ms. Satinder Kaur Saran also worked for a short while in the project and collected some information on medicinal plants. I am grateful to all of them for their help. Needless to add that, I own the responsibility of errors of interpretation, if any.

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CHAPTER I

INTRODUCTION

1.1. Introduction

Medicinal and aromatic plants constitute a major segment of the flora, which provides raw materials for use in the pharmaceuticals, cosmetics, and drug industries. The indigenous systems of medicines, developed in India for centuries, make use of many medicinal herbs. These systems include Ayurveda, Siddha, Unani, and many other indigenous practices. More than 9,000 native plants have established and recorded curative properties and about 1500 species are known for their aroma and flavour. In one of the studies by the World Health Organisation, it is estimated that 80 per cent of the population of developing countries relies on traditional plant based medicines for their health requirements (WHO, 1991). Even in many of the modern medicines, the basic composition is derived from medicinal plants and these have become acceptable medicines for many reasons that include easy availability, least side effects, low prices, environmental friendliness and lasting curative property. India and China are the two major producing countries, having 40 per cent of the global biodiversity and availability of rare species. These are well known as the home of medicinal and aromatic crops that constitute a segment of the flora, and provide raw materials to the pharmaceutical, cosmetic, fragrance, flavour etc. industries.

The Ministry of Environment and Forest, Government of India has identified and documented over 9,500 species of medicinal plants that are significant for the pharmaceutical industry. Of these, 2,000 to 2,300 species are used in traditional medicines while at least 150 species are used commercially on a large scale (EXIM Bank, 1997). The fact that derivatives of medicinal and aromatic plants are non-narcotic have no ill effects and constitute the natural base for treatments have resulted in an increase in demand for these plants in developing and non developed countries. Due to this rising international demand, many important medicinal plant species are becoming scarce and some are facing the prospect of extinction. Therefore, it is important to conserve the extensively traded medicinal plants in its natural environment or cultivate it in favourable environments.

As compared to the traditional crops, the cultivation of medicinal crops has many advantages. These include:

- Medicinal crops provide better returns than traditional crops;
- Have very high domestic and export demand;
- Fetch better prices in the market;
- Could be stored for a long time, and sold at a time when better prices prevail in the market;
- Are the largely drought tolerant, and not easily grazed by animals;
- Have low incidence of pest attacks and diseases;
- Require minimum resources, therefore the cost of cultivation is lower compared to the traditional crops;
- Could be raised as inter-crops, along with traditional crops, and also on degraded lands.

Given these advantages the cultivation of medicinal crops has been picking up in some regions. However, the spread is not so large to meet the demand of the industry. Owing to short supply, prices of some medicinal crops have increased substantially in the recent past. What is also of great concern is that exploitation of some of the species has threatened their extinction.

1.2. Importance of the Medicinal Crops

The Indian farmer is presently in a very difficult situation and the majority is looking at options other than farming (NSSO, 59th round). The farmer is constrained by the shrinking net income flow due to the increasing cost of cultivation and uncertainty in prices. Largely, farmers have not diversified from traditional crops. Production costs of traditional crops are now becoming costly and the market system is poor. These factors have forced the farmers to shift towards other crops that have the potential for better returns compared to the traditional crops. In this backdrop, the cultivation of medicinal crops is less risky in terms of the incidence of pest attacks, diseases and price fluctuations, and has potential returns. And this significance is further strengthened by the fact that these crops can be grown in degraded and marginal soils, or raised as inter crops in plantation crops like arecanut, coconut etc. with less difficulty. The trade demand for these crops is also increasing with the increased interest in western consumers towards eastern medicinal systems. The estimated area under the medicinal crops in India is in the neighbourhood of two lakh hectares. Nearly 75 per cent of the plant material used in indigenous medicines is collected from forests and wild habitats (GoI, 2000). People hardly have any knowledge about the plants collect the material and pay little attention to selective harvest or harvesting of natural plants.

India has been considered a treasure house of valuable medicinal and aromatic plant species. The Indian System of Medicine uses over 1,100 medicinal plants and most of them are collected from forests regularly, and over 60 species among them are particularly in demands (GoI, 2000). On account of the fact that derivatives of medicinal and aromatic plants have no side effects and deal curatively, the demand for these plants is on the increase in both developing and developed countries. As a result, the trade of medicinal plants is increasing fast.

From the trade data available, it is clear that the global market for medicinal plants has always been large and has been on increase in the recent past. In the report commissioned by the World Wide Fund for Nature, it is pointed out that, the total import in 1980 of "vegetable materials used in pharmacy" by the European Economic Community was 80,738 tons (Lewington 1993). India was the largest supplier with 10.05 tons of plants and 14 tons of vegetable alkaloid and their derivatives. India, Brazil and China are the largest exporters of medicinal plants. Trade of medicinal plants from India is estimated to be worth Rs. 550 crore. Cosmetics and aromatherapy products are two important areas where Indian medicinal plants and their extracts like essential oils can contribute globally. Medicinal and aromatic plants have a high market potential with the world demand for herbal products growing of the rate of seven per cent per annum.

There is now wide recognition of the contributions that medicinal and aromatic plants make to the global economy and human welfare (WHO, 1978). But one of the greatest difficulties in assessing their importance as resources, either locally or globally, is the shortage of dependable information about the species being used, their availability and distribution, how these are collected or harvested, where the species are cultivated, the quantities involved and trade statistics. Confidentiality still surrounds the industry as well as the State run systems. Much of the evidence is anecdotal, although there has been a concentrated effort in recent years to gather information on these various aspects. National and regional assessments have been published for several countries; also various global reports have been prepared such as Husain (1996) on international trade, marketing and consumption of essential oils, and McAlpine et al. (1997) on future world trends in supply, utilisation and marketing.

World trade in medicinal plants is increasing very fast. One of the interesting features of this trade is that the direction of trade is from developing countries to the developed countries. That has a positive income transfer effect. China and India are the two leading countries in the trade sector. During the past decade, total trade has increased from US \$ 52.8 million to US \$ 68.7 million, recording a growth rate of 3.56 per cent per annum. In spite of this, one cannot confidently say that we have reached even the fragment of the potential of trade in medicinal plants. It is still far below the actual potential of the countries participating in it. However, there are good prospects for export growth from LDCs for medicinal crops. As estimated by FAO, the trade in herbal medicine alone is estimated to have exceeded US\$ 68.7 during 2002 (FAO, 1996).

Table 1.1: Annual Demand for Prioritised Medicinal Plants – India

Crops	Demand (tonnes)		Annual Growth Rate (per cent)
	2001-02	2004-05	
Amla	22730	41783	22.5
Andrographis	2005	2197	3.1
Ashwagandha	7029	9128	9.1
Asoka Tree	7051	10724	15
Atis	270	448	18.4
Bacopa	3823	6622	20.1
Bael Tree	5381	7085	9.6
Black nightshade	2078	2192	1.8
Chitra	965	1285	10
Chlorophytum	38	61	17.2
Costus	1414	1826	8.9
Flamelily	65	101	15.4
Guggul	1505	2549	19.2
Holy basil	3297	5403	17.9
Indian aconite	322	3427	30
Indian barberry	1187	1829	15.5
Indian tinospora	2258	2933	9.1
Jatmansi	675	867	8.7
Liquorice root	873	1360	15.9
Long pepper	3993	6280	16.3
Phyllanthus amarus	2213	2985	10.5
Picrorhiza	220	317	12.9
Rauwolfia	424	589	11.6
Sandalwood	635	1073	19.1
Sen N/A	6463	11677	21.8
Shatavari	10925	16659	15.1

Source: Trade In Medicinal Plants, Raw Materials, Tropical and Horticultural Products Service, Commodities and Trade Division Economic and Social Department Food and Agriculture Organization of the United Nations, Rome.

1.3. World Trade in Medicinal Crops

In 1991 world trade was to the tune of US\$ 1135 million and in 2002 it was US\$ 1034 million, with annual growth rates averaging between 5 and 15 per cent, depending on the region. The market associated with this sector is expected to have recorded an even higher annual average growth rate, ie., 25 per cent between 1990 and 1997. The use of herb-based medicines in developed countries in Europe and the United States is highly regulated. It is well known that these countries put stringent restrictions on the quality of products imported by them. That poses a major constraint for developing countries and LDCs to enter these markets, especially for those whose products have not undergone stringent tests (Cunningham, 1998). Increasing global interest in medicinal plants has created a sustained demand but, at the same time, hidden trade in plant materials results in indiscriminate harvest of wild varieties and pose a serious threat to biodiversity.

Figure 1.1: India's Exports of Medicinal Crops (In million US \$)

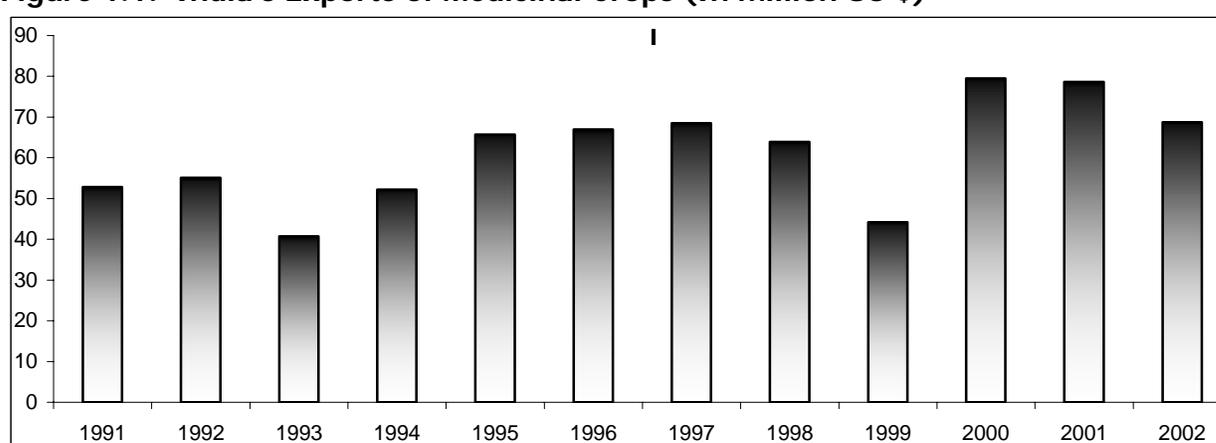


Table 1.2: World Export Value Of Medicinal Plants (In million US \$)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
World	1135.8	1297.4	1176.4	1395.5	1525.1	1406.4	1320.9	1223.5	1102.4	1097	1016.2	1034.8
USA	100.5	137	115.2	119	125	120.3	119.5	104.1	106.7	108.3	78.9	74.1
EU	163.1	181.7	165.5	189.5	215.1	186.6	188.2	203.2	185.7	180.9	169.9	177.4
Germany	66.1	75.7	69.6	65.6	75.1	77.5	76.6	76.3	65.6	55.5	53	56.7
China	208.3	238.5	235.8	410.1	415.4	327.8	314	238.4	211.9	216.5	199.7	215.3
India	52.8	55.1	40.7	52.2	65.7	66.9	68.5	63.9	44.2	79.5	78.6	68.7
Africa	33.7	34.4	28.5	34.7	40.9	49.4	47.7	45.4	44.9	40.6	37.4	49.8

Source: Trade In Medicinal Plants, Raw Materials, Tropical and Horticultural Products Service, Commodities and Trade, Division Economic and Social Department, Food and Agriculture Organization of the United Nations, Rome.

Trade statistics is not exhaustive as a substantial part of the trade is not recorded. Either the collectors of statistics do not identify the plants individually, or do not separate their medicinal use from other usages. The recorded exports of medicinal plants from LDCs peaked at US\$ 37 million in 1998 before falling to a reported US \$27 million in 1999 (FAO). It averaged around US\$ 31 million a year from 1995 to 1999 (FAO, 2004).

Despite the vast potential for exploiting the market for medicinal, aromatic and exotic plants this sector is still in the nascent stage among many promising country. It can be seen from the table that the total export value of Ayurvedic and Unani medicines is around Rs 300 million. Medicinal plants account for about 70 per cent by value of the total raw materials procured by Ayurvedic pharmacies. Hence, based on the growing demand for herb-based medicines, both in the domestic and international markets, it can be inferred that the demand for the raw material, i.e., medicinal plants, will grow correspondingly. It was estimated that the demand for Ayurvedic medicines in Kerala State alone is growing at a compound rate of 10-12 per cent per annum (Sunitha, 2004), while there are reports that a similar trend is globally observed for alternative medicines. The Centre for Monitoring the Indian Economy (CMIE) estimated that India exported plant based drugs and pharmaceutical products worth Rs. 2,800 million during 1996-97. The world trade in medicinal plants (gathered from our forests as 'non-timber forest products' (NTFPs)) is US \$16 billion per annum.

Table 1.3: India's Exports of Medicinal Plants and Herbal Products

(in crores)

Particulars	1998-99	1999-00	2000-01	2001-02	Major Destinations
Plants and parts of plants (including seeds and fruits), of a kind used primarily in perfumery, in pharmacy or for insecticidal, fungicidal or similar purpose, fresh or dried, whether or not cut, crushed or powdered	268.74	191.44	357.45	370.94	USA, Japan
Vegetable saps and extracts; pectic substances, pectinates and pectates; agar-agar and other mucilages and thickeners, whether or not modified, derived from vegetable products	826.79	921.53	698.99	593.18	USA
Preparations					
Ayurvedic and Unani Medicines	34.76	36.23	96.53	92.26	USA, Russia
Homoeopathic Medicines	0.37	0.67	2.19	2.03	Sri Lanka
Ayurvedic and Unani Medicines for retail sales	98.94	108.79	124.97	147.52	USA, Russia,
Homoeopathic Medicines for retail sales	1.33	3.19	8.96	3.73	Ivory Coast, USA
Total	1230.8	1261.9	1289.1	1209.7	
Growth per cent per annum	--	2.5	2.2	-6.2	

Source: ITC, Asia Healthcare 2004

Table 1.4: Export of Major Medicinal Plants from India (2000-01)

SI No	Medicinal plant/part	Quantity (tons)	Value (Rs. In lakhs)
1	Liquorice roots (fresh/dried/powdered)	54.9	70.53
2	Nux vomica	1.8	17.97
3	Galangal (rhizomes and roots)	108.6	33.45
4	Ginseng roots	3271	1345.6
5	Agarwood	169	45.1
6	Belladonna leaves	1.7	84.63
7	Belladonna roots	2304.6	331.8
8	Poppy flowers and unripe heads	9.4	18.44
9	Poppy husk	1	0.43
10	Isabgol (husk)	19.27	19993.8
11	Isabgol (seeds)	1000.4	746.8
12	Senna (leaves and pods)	7430.25	1839.97
13	Tukmaria	97.7	49.6
14	Catharanthus roseus	522.9	189.31
15	Neem (seed)	106.5	38.64
16	Neem (leaves/powder)	13.13	6.81
17	Gymnema (oowder)	19.99	110.9
18	Ayurvedic and Unani herbs	9367.12	2250.26

Source: DGCIS reports.

Table 1.5: Asian Trade In Essential Drugs in 2002

Country	Export to world (US \$ thousand)	Intra-regional exports (in % of exports to the world)	Imports from world (US \$ thousand)	Intra-regional imports (in % of imports from the world)
Bangladesh	3137	15.8	21599	26.4
Cambodia	41	0	26738	20.3
China	179893	18.5	557970	1.1
India	692957	14.7	113006	6.1
Indonesia	17639	57.1	43316	5.4
Sri Lanka	570	13.7	76439	6.4

Source: (HS 300490) ITC, Asia Healthcare 2004

There are a large number of drugs used over the counter in western countries. These drugs use the herbs indicated as basic ingredients but not normally sold in the same form as Ayurvedic medicines in the Indian medicinal systems. These are used substantially without a prescription. A large amount of ingredients that go into making these drugs are imported from developing countries in a raw form. The total business established under this channel is about US \$ 800 million.

Table 1.6: Over Counter Drugs Used in Western Countries

No.	Common Name	Botanical Name	Use	Business (Us\$ * 10 ⁶)
1.	Psyllium	Plantago ovata	Bulk laxative	250
2.	Ginkgo	Ginko biloba	Memory enhancer	138
3.	St.John Worts	Hyperium perforatum	Antidepression	121
4.	Garlic	Allium sativum	Hypolipdemic	84
5.	Aloe	Aloe spices	Stimulant laxative	52
6.	Peppermint	Mentha piperita	Antitussive	40
7.	Saw- palmetta	Senecis repens	Prostrate hyperplasia	30
8.	Ginseng	Paraax spices	Brain	12
9.	Mandhukparani	Centella asiatica	Blood circulation	12
10.	Black cohosh	Cimiccifuga racemosa	Menopause	10
11.	Kawa	Piper methysticum	Permanent syndrome Antidepresant	8
12.	Milk thistle	Stylybum marianum	Live protection	8
13	Valerian	Valeriana officianalis	Calmative	8

Source: Farooqi, A A, "Status and Prospects of Medicinal Plants –An Overview", in the Symposium of "Prospects for Medicinal Crops Challenges and Opportunities" The Mythic Society, Bangalore.

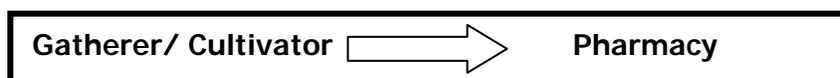
Information about the crops, methods of cultivation, the demand pattern and market share is not well established. The major traders deal with more than one medicinal plant and the raw material is purchased from various places and have different quality. The supply of material is also not regular and therefore the market is not very well-established (Gol, 2000). Prices of individual medicinal crops also vary substantially, and the quality of supply determines the percentage of active ingredients. There are frequent rejections of export consignments and negative externalities are also very high. That causes substantial variation in the net income generated to the collector as well as grower of medicinal crops. In the domestic market, major buyers include Zandu, Himalaya Drugs, Baidyanath, Dabur, Natural Remedies, Charak, Kottakal, Kerala Aurvedic Pharmacy, Dhootpapeswar and a few other.

Due to the increased demand for medicinal plants, the rate of extraction from the natural (wild) sources is higher than that of their regeneration. This can be traced to indiscriminate/ unregulated harvesting practices being followed with no concern for the sustainability of the resource. This obviously leads to a supply crunch. Such a situation is already being experienced in medicinal plants *inter alia* *Aconitum heterophyllum*, *Aegle marmelos*, *Withania somnifera*, *Coscinum fenestratum*, *Swertia chirayatha* etc.

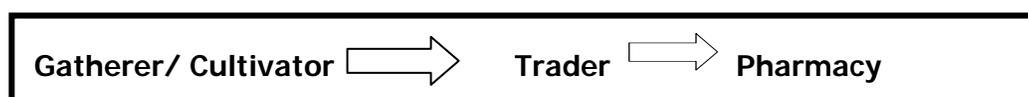
1.4. Marketing Channels of Medicinal Plants

The main driver for the cultivation of medicinal plants could be located in two component, namely pull and push effects. First, in the pull effect, are the factors that attract farmers to cultivate medicinal and aromatic crops, rather than traditional crops. These factors include attractive prices, fixed market channels, price assurance by agents and monopoly of the group of producers in cultivating these crops. Whereas, push effects are dominated by the uncertainty of net income generated from the traditional seasonal crops due to factor and product market imperfections. Well-established market channels prompt farmers to cultivate medicinal and aromatic crops.

There are three marketing routes that operate in the field.



This marketing route is followed largely in *Sida*, *Desmodium*, *Pseudarthia*, *Kaempferia* and a few other crops where there are ample chances of substitution and adulteration (Sunitha, 2004). Here, the gatherer gets 100 per cent of the price paid by the pharmaceutical user but the channel sticks to the enlisted growers.



Gatherer to pharmacy via trader is one of the frequently resorted market routes. The price spread in this channel is slightly higher than the earlier channel. The trader makes most of the profits. A third party gets added in this route, that of a commission agent. The commission agent collects the material from the farmer or the gatherer and sells it to the trader. Here the market margin increases. The commission agent makes a large share (about 70 per cent) of the value due to the farmer in the pharmacy's price, by merely assembling the produce from several gatherers/cultivators (sellers) and later selling the lot, in bulk, to pharmacies and/ or to traders.

The Department of Agriculture and Cooperation, Ministry of Agriculture, launched a Central Sector Scheme on Development of Medicinal and Aromatic Plants during the Eighth Five Year Plan with an outlay of Rs. 500 crore. Programmes for development of quality planting material and the establishment of herbal gardens and regional analytical laboratories were taken up in 16 State Agricultural Universities and three Regional Research

Laboratories (RRL) of the Council of Scientific and Industrial Research (CSIR). Programmes for the establishment of demonstration plots-cum-seed multiplication centres were undertaken through the State Departments of Horticulture/Agriculture from 1996-97. The programme was continued during the Ninth Five Year Plan with an outlay of Rs. 14.50 crores. Activities such as area expansion and training of farmers were included during the Ninth Five Year Plan and continued in the Tenth Plan. With effect from 2000-01, the state departments have been given the option to include various components in their Work Plans.

1.5. Need for the Study

Medicinal plants are natural resources as they are unique, indispensable and an estimate of their availability is complex. Intellectual property rights are not well-defined and can be identifiable with those who gather, or those who hold the knowledge of their use. Externalities emerge during their extraction, processing and use; transaction costs exist due to irreversibility and extinction of species, with crucial equity implications. With all these factors, medicinal crops become as one of the important groups of natural resources. These provide a good source of income if cultivated aggressively and traded, as the demand is fast increasing (Chatterjee, 2002). The advent of IPRs in the pharmaceutical sector offers a ray of hope towards realising the economic value of medicinal plants, since reverse engineering would no longer be possible in the pharmaceutical sector. This may trigger an increase in the price of allopathic drugs, which may result in an increase in the demand for plant based medicinal products and preparations. The economic significance of medicinal plants stems from the fact that the number of patients suffering from chronic ailments is on the rise and drugs from medicinal plants are proving to be more effective in treating such disorders. Thus, the effective demand for medicinal plant products will be shaped by the relative economics of alternative systems of medicines in health care in the era of IPR in pharmaceuticals.

With ecological and economic constraints induced by population explosion and inequity, institutional economic approaches are relevant. Neo-classical economic approaches will address only a few of the issues in traditional health care, which is dominated by medicinal plants, mineral and herbo-mineral preparations. We are quite aware that a purely academic approach to the study will involve pluralism of methodological approaches leading to a blend of institutional economics. This is also called transaction cost economics an essential ingredient of natural resource economics. It will

bring in concepts like survival value, safe minimum standard of conservation, scarcity rents, existence value, intrinsic value, externalities and transaction costs. All these will provide a framework for unravelling the intricate issues in the economics of medicinal plants and hence preferred in the study. But here our approach is not to provide an academic treatise, which certainly is our preference, but to give a clear policy outlook for making medicinal crops, a viable alternative to traditional crops.

In the quest for earning better returns from the land, farmers have been resorting to cultivation of medicinal and aromatic plants instead of conventional agriculture (Chatterjee, 2002). However, there is no authentic information about the extent of area covered under medicinal and aromatic plants. The information about the marketing arrangement is also fluid, particularly for medicinal plants. In these circumstances, there is a need to evaluate the economics of cultivating medicinal and aromatic plants. Considering the inherent market imperfections resulting from institutional and market failures in India, this study aims at development of programmes and policies for a total economic preference for medicinal plants. It does not consider the threats imposed due to indiscriminate gathering and harvesting but focuses on the economic opportunities available for their cultivation. This study is a part of an overall study taken up in a few states in India. India has a huge biodiversity and several states have many medicinal plants and crops. But only a few of these could be considered for the purpose of a systematic analysis.

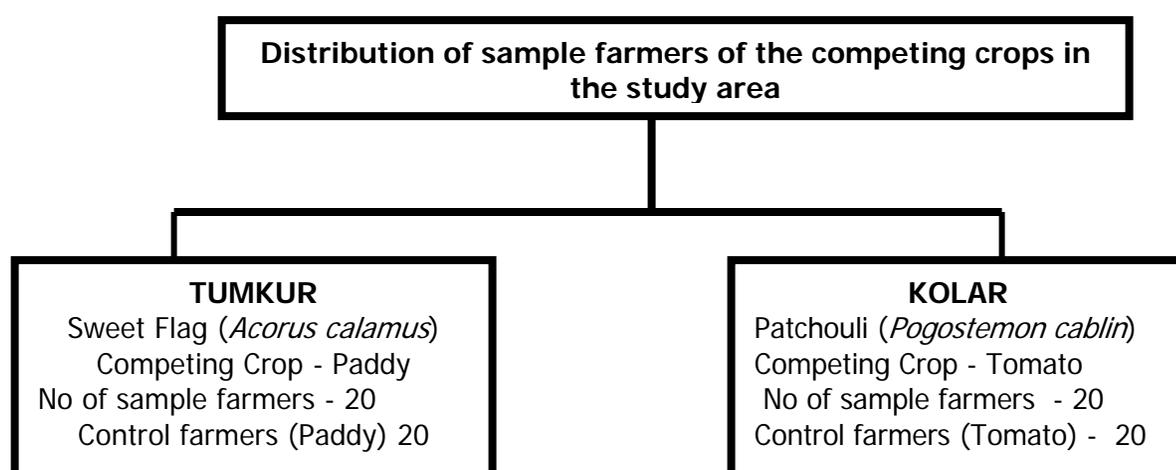
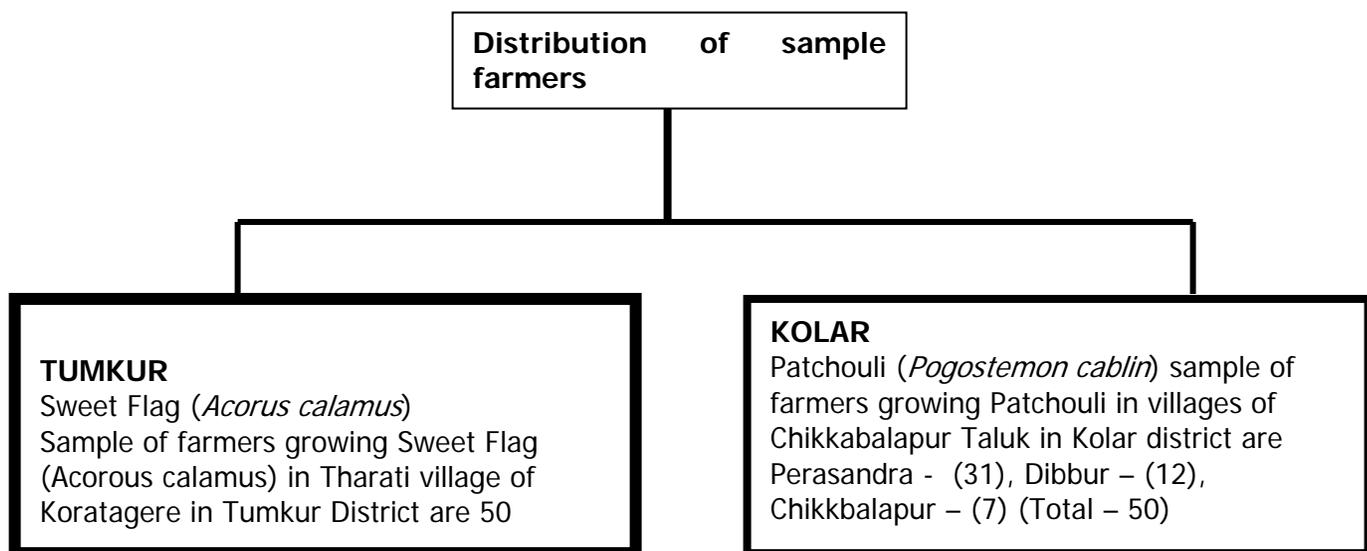
1.6. Objectives of the Study

1. To understand the economics of cultivation/production/gathering of the selected medicinal plants and find their economic and market potential as preferred for cultivation by farmers.
2. To assess the extent of area in which selected medicinal and aromatic crops are cultivated.
3. An estimate of domestic and international demand for the selected medicinal plants in the light of the effect of a new IPR regime on pharmaceuticals.
4. To study the relative economic impact of cultivation of medicinal and aromatic plants by farmers.
5. To identify the bottlenecks in the marketing of medicinal and aromatic plants, and suggest possible remedies.

1.7. Methodology:

This study uses secondary as well as primary data at macro and micro levels. One of the major difficulties, however, is to get data on medicinal crops from secondary sources. Whatever data was available was collected but soon we realised that the data availability can be a major constraint for the analysis. The study focuses on Karnataka, but does not claim to have covered all the medicinal crops significantly grown in the State. After listing the major crops/plants available in the region, their normal use, location and processing facilities, two important crops, one medicinal and one aromatic crop are selected for study largely grown in two of the districts of Karnataka. We selected sweet flag (*acorous calamus*) and patchouli (*pogostemon cablin*) crops after discussing with many academicians and practitioners/users working in the field. These two crops are cultivated in a few districts of Karnataka but one can get only farm level information for these crops. After consultations, we selected Tumkur and Kolar districts keeping in view the density of the crops grown in view. We selected Tharati village of Koratagere taluka in Tumkur District for Sweet Flag (*Acorous calamus*) and Perasandra, Dibbur, Chikkabalapur villages in Chikkabalapur taluk of Kolar district for Patchouli (*pogostemon cablin*). These crops are grown substantially in this area and market channels are well established. Sweet flag (*Acorous calamus*) has been identified as a medicinal crop and patchouli (*pogostemon cablin*) is taken to represent aromatic crop for the purpose of this study. As mentioned above, our intention here is to explore the relative economics of medicinal and aromatic crops as against the seasonal competing crop. For the purpose of comparison, we selected two main competing crops in each of the districts to represent medicinal and aromatic crops. We selected Paddy in Tumkur district and tomato in Kolar district as competing crops. The competing crops are selected keeping in view three important factors. First, we listed the crops grown by farmers who changed to medicinal and aromatic crops and selected the pre-dominant crop among these. Second, we checked the soil-climatic conditions required for the competing crops and matched that with the selected medicinal and/or aromatic crop. Third, we had also kept in mind the density of medicinal and aromatic crops as against the competing crop. Thus, paddy and tomato were selected as competing crops for sweet flag (*Acorous calamus*) and patchouli, (*Pogostemon cablin*) respectively, in their region.

Sample Design



The study employed a four-stage approach. First, we consulted commodity agents to find out about the major crops grown and marketed in the state. This helped us to select the districts with one medicinal crop, sweet flag (*Acorus calamus*) and another aromatic crop, Patchouli (*Pogostemon cablin*). In the second stage we carried out discussions at the village level to understand the basic factors that prompt farmers to take up cultivation of these crops, and the earlier crops from which farmers have shifted to these crops. That also made our choice of the competing crops easy. As a third stage, we carried out discussions with marketing agents and some of the pharmaceutical companies to understand demand for these crops. Finally, we carried out a field study based on a carefully selected sample as shown above.

1.8. Introducing the Selected Crops

We have selected two crops from different perspectives. While sweet flag is used only by pharmaceutical companies directly as an ingredient and, therefore, has to go through a full circle market chain, patchouli can be processed at the field level by the grower in a simple decanter to extract the base oil.

i. Sweet Flag (*Acorous calamus*)

Sweet flag (*Acorous calamus*) is highly valued as a rejuvenator for the brain and nervous system and as a remedy for digestive disorders. The rhizome is pale pink inside and contains an essential oil that has medicinal value. Major constituents of the essential oil are phenylpropanes, monoterpenes and thermolabile sesquiterpenoids. A powder made from rhizomes is smoked or chewed to destroy the taste of tobacco. However, some care should be taken in its use since some forms of the plant might be carcinogenic. Some of the uses of (*Acorous calamus*) discussed with the users are given below:

Uses of Sweet Flag (*Acorous calamus*)

- To overcome stomach related disorders in both human and animals;
- Enhance mental abilities in children
- Treatment for nerve related disorders;
- Chewing sweet flag reduces throat pain, indigestion and productive cough and diseases
- Dried sweet flag rhizomes are used in medicinal preparation and as a flavoured liquor;
- Used in veterinary sciences as a carminative;
- Powdered rhizomes and the oil is used as a safeguard against flies, mosquitoes, bed bugs, moths and lice;
- As a combination with other ingredients it cures burn injuries;
- As a remedy for asthma, and nausea;
- Used to treat bronchial catarrh, hysteria, and neuralgia; and
- Used to improve appetite, voice and speech disorders.

Many pharmaceutical companies use Sweet flag (*Acorous calamus*) in various formulations. These are commonly used In Ayurvedic as well as the other systems of medicines.

Table 1.7: Major Pharmaceutical Companies who Use Sweet Flag in their Medicinal Formulations

Sl.No	Name of the company	Formulations
	Alarsin Pharmaceuticals	Fortege; Sildein; Sooktyn
	Baidyanath Ayurved Pharmacy Pvt. Ltd	Swapnadoshahari bati
	Bharatiya Nirmanshala	Sleepinol
	GurukulKanri Pharmacy	Sarvadyarishta; Sarpagandha bati Shatavarighrit
	Herbals (APS) Pvt. Ltd	Narvinol; Vasaksar
	Himalaya Drug Co	Pilex ointment, tablets, Rumalaya cream; Styplon tablets Vegecort tablets, ointment
	Indian National Drug Co. Pvt . Ltd	Asmin
	Modern Drug House	Vasaka syrup
	Treatment Home Products	Digichlor
	Yogi Pharmacy	Shodha
	Zandhu Pharmaceutical Works Ltd (Arya Vaidyasala Pvt. Ltd)	Abhayamlaki; Ashwagandharista; Blood purifier; Brahmighrita; Chandrodayavati; Dhan Dhanvantar Tailuam; Dwiru Dwiruttarhingwadi charna; Hynot Hynotensan tablet; Kalko Kalkoot Rasa; Maha Mahanarayan Tail; Phala Phalagharita; Rassn Rassnadi Quath; Sangi Sangivini guti; Saras Saraswat Churna SarasSaraswat Chrita; Siddh; Siddharthak ghrita; Suver Suverna muktadi guti Visha Vishagharbha tail; Yogra Yograj guggala Karnabindhu

Source: G.B Lokesh and M.G Chandrakanth (2001)

ii. Patchouli (*Pogostemon cablin*)

Patchouli (*pogostemon cablin*) oil is extracted from young dried leaves of the plant, which are fermented and then dried before steam distillation. Patchouli oil is considered an excellent base in the perfumery industry. As a fixative, it slows the evaporation of other, more volatile oils so that their aroma may be released over a longer period of time. The patchouli oil is dark orange to amber in colour with an exotic heavy and earthy fragrance. Extraction of the oil is by steam distillation of the young leaves.

Patchouli has a strong, earthy, musty and spicy smell, and is used in many perfumes with an oriental or exotic aroma. The fragrance is reported to improve with age

of the oil, and this property has been compared to that of a good Scotch whisky, improving as it ages. Besides having properties that are reported to be useful, it also has many practical uses, some are given below:

- It is used as a base in Ayurvedic medicines, perfumery, rituals, and cosmetics.
- It is used as an oil base in incense sticks.
- It is used for digestive disorders and as a remedy for dry skin, wrinkles, dandruff, oily skin and scalp, fungal infections and insect bites.
- In oil therapy, it is used to ease tensions and diminish anxiety and depression.
- In aromatic treatment, it is used for controlling diarrhoea, vomiting, and nausea.
- Used as an aromatic oil in vaporisers and burners for obesity, anxiety.
- It is also used as an insect repellent.
- The aroma of patchouli is considered to help with the clarity of mind and thought.
- Patchouli oil is blended with other ingredients as massage oil for treating dermatitis, obesity, anxiety and dandruff.
- In a lotion or cream, patchouli oil is used as a base for ointments treating foot cracking, eczema, acne and sores.
- It is used for bad breath and halitosis while gargling

There are many formulations that use patchouli oil as a base and the list is very long, but largely it is used in most ointments for treating skin disorders and as a base in perfumes.

1.9. Design of the Study

The first chapter has set the tone for the study and includes a discussion on the importance of medicinal crops in general. It elaborates the study design and discusses the crops selected for the purpose of the study. Chapter two explains the importance of medicinal and aromatic crops in the State. We have to keep in mind the fact that data on these crops are not collected and disseminated like other crops. The chapter, therefore, focuses on the importance of medicinal crops in the State and highlights the difficulties in data collection of medicinal crops and provides whatever the present sources of data there are. In the third chapter, we have given a brief analysis of the processing units operating in the State and the relative economics of medicinal and aromatic crops. Here, trends in area, production, and yield of medicinal and aromatic plants and potentials of diversification towards medicinal and aromatic plants are looked into based on the available data. The chapter mainly includes suggestions to collect and collate such data. This will also include an evaluation of the adequacy and availability of planting material in the cultivation of aromatic and medicinal plants. Following this is the core chapter of the report. Here we have presented and analysed the data collected on 'Relative Economics'. The Chapter contains a detailed analysis of relative economics of the two selected crops with respect to

the competing crops. Costs and returns of the selected crops will be worked out in relation to the competing crops. The motivational factors and decision-making have been analysed in the fourth chapter based on the primary data. This chapter also includes discussions that the study team had with users of medicinal crops and processing units about problems in cultivation and marketing. In the final chapter, marketing and cultivation problems have been analysed on the basis of the data collected and the information available in the literature in the State. This is followed by a discussion on suitable policies towards the cultivation of medicinal and aromatic plants as a means of diversification in agriculture.

Appendix Table 1: Medicinal Plants Having Consumption of More Than 10 Tonnes Per Year in India

SI No	Botanical Name	Family	Habit	Part Used
1	Acacia catechu	Mimosaceae	Tree	Stem Extract
2	Achyranthes aspera	Amaranthaceae	Herb	Whole Plant
3	Adhatoda beddomei	Acanthaceae	Herb	Whole Plant
4	Adhatoda zeylanica	Acanthaceae	Shrub	Leaves
5	Aegle marmelos	Rutaceae	Tree	Roots, Fruit Pulp
6	Aerva lanata	Amaranthaceae	Herb	Whole Plant
7	Alpinia galanga	Zingiberaceae	Herb	Rhizomes
8	Alpinia malaccensis	Zingiberaceae	Herb	Rhizomes
9	Andrographis paniculata	Acanthaceae	Herb	Whole Plant
10	Aphanamixis polystachya	Meliaceae	Tree	Bark
11	Aristolochia indica	Aristolochiaceae	Climber(H)	Roots
12	Aristolochia tagala	Aristolochiaceae	Climber(H)	Roots
13	Asparagus racemosus	Liliaceae	Herb	Roots
14	Bacopa monnieri	Scrophularaceae	Herb	Whole Plant
15	Boerhaavia diffusa	Nyctaginaceae	Herb	Whole Plant
16	Bombax ceiba	Bombacaceae	Tree	Bark, Gum Exudate
17	Borassus flabellifera	Arecaceae	Tree	Fruit
18	Butea monosperma	Fabaceae	Tree	Bark, Fl & Seeds
19	Caesalpinia bonduc	Fabaceae	Shrub	Roots, Seeds
20	Calotropis gigantea	Asclepiadaceae	Herb	Roots, Lvs, Fl
21	Calycopteris floribunda	Combretaceae	Shrub	Fruits, Lvs
22	Cassia tora	Fabaceae	Herb	Roots, Seeds
23	Cayratia pedata	Vitaceae	Climber(H)	Whole Plant
24	Celastrus paniculatus	Celastraceae	Liana	Seeds
25	Centella asiatica	Apiaceae	Herb	Whole Plant
26	Citrullus colocynthis	Cucurbitaceae	Herb	Roots, Fruits
27	Costus speciosus	Costaceae	Herb	Roots
28	Cynodon dactylon	Poaceae	Grass	Whole Plant
29	Cyperus esculentus	Cyperaceae	Herb	Roots
30	Cyperus rotundus	Cyperaceae	Herb	Rhizomes
31	Desmodium gangeticum	Fabaceae	Shrub	Roots
32	Dioscorea bulbifera	Dioscoreaceae	Climber(W)	Tubers
33	Dolichos biflorus	Fabaceae	Herb	Seed
34	Eclipta alba	Asteraceae	Herb	Whole Plant
35	Embellia ribes	Myrsinaceae	Liana	Fruits, Seed, Root
36	Fumaria indica	Fumariaceae	Herb	Whole Plant
37	Garcinia gummigutta	Cluciaceae	Tree	Resin
38	Garcinia indica	Cluciaceae	Tree	Fruit/Seeds

39	<i>Garcinia morella</i>	Cluciaceae	Tree	Seeds
40	<i>Gardenia gummifera</i>	Rubiaceae	Tree	Resin(FI)
41	<i>Gmelina arborea</i>	Verbenaceae	Tree	Roots
42	<i>Helicteres isora</i>	Sterculiaceae	Shrub	Fruits
43	<i>Hemidesmus indicus</i>	Asclepiadaceae	Climber(W)	Roots
44	<i>Holarrhena antidysentrica</i>	Apocynaceae	Shrub	Bark, Seed
45	<i>Ichnocarpus frutescens</i>	Apocynaceae	Liana	Stems
46	<i>Ipomoea mauritiana</i>	Convolvulaceae	Climber(H)	Whole Plant
47	<i>Ipomoea nil</i>	Convolvulaceae	Herb	Seeds
48	<i>Lepidium sativum</i>	Brassicaceae	Herb	Seeds
49	<i>Leptadenia reticulata</i>	Asclepiadaceae	Shrub	Stems
50	<i>Luffa echinata</i>	Cucurbitaceae	Climber(H)	Seeds
51	<i>Mallotus philippensis</i>	Euphorbiaceae	Tree	Fruits
52	<i>Mucuna pruriens</i>	Fabaceae	Climber(H)	Seeds, Roots
53	<i>Nigella sativa</i>	Nigellaceae	Herb	Seeds
54	<i>Oroxylum indicum</i>	Bignoniaceae	Tree	Roots
55	<i>Pedaliium murex</i>	Pedaliaceae	Herb	Whole Plant, Fruits
56	<i>Peganum harmala</i>	Zygophyllaceae	Herb	Seeds
57	<i>Phyllanthus amarus</i>	Euphorbiaceae	Herb	Whole Plant
58	<i>Phyllanthus emblica</i>	Euphorbiaceae	Tree	Fruits
59	<i>Piper longum</i>	Piperaceae	Shrub	Fruits, Roots
60	<i>Plumbago indica</i>	Plumbaginaceae	Shrub	Roots
61	<i>Plumbago zeylanica</i>	Plumbaginaceae	Herb	Roots
62	<i>Polygonum glabrum</i>	Polygonaceae	Herb	Roots, Leaves
63	<i>Premna serratifolia</i>	Verbenaceae	Tree	Roots
64	<i>Pseudarthria viscida</i>	Fabaceae	Climber(H)	Roots
65	<i>Psoralea corylifolia</i>	Fabaceae	Herb	Seeds
66	<i>Puereria tuberosa</i>	Fabaceae	Climber(W)	Tubers
67	<i>Punica granatum</i>	Punicaceae	Shrub	Fruit Peels/Rind
68	<i>Ricinus communis</i>	Euphorbiaceae	Shrub	Whole Plant
69	<i>Rubia cordifolia</i>	Rubiaceae	Climber(H)	Stems
70	<i>Sida cordifolia</i>	Malvaceae	Herb	Stems, Roots
71	<i>Sida rhombifolia</i>	Malvaceae	Herb	Roots
72	<i>Solanum melongena</i>	Solanaceae	Shrub	Roots, Lvs, Fr
73	<i>Solanum nigrum</i>	Solanaceae	Herb	Whole Plant
74	<i>Solanum torvum</i>	Solanaceae	Herb	Whole Plant
75	<i>Solanum xanthocarpum</i>	Solanaceae	Herb	Whole Plant
76	<i>Stereospermum suaveolens</i>	Bignoniaceae	Tree	Roots
77	<i>Symplocos racemosa</i>	Symplocaceae	Tree	Bark
78	<i>Terminalia arjuna</i>	Combretaceae	Tree	Bark, Lvs

79	Terminalia bellerica	Combretaceae	Tree	Fruits, Rind
80	Terminalia chebula	Combretaceae	Tree	Fruits
81	Thespesia populnea	Malvaceae	Tree	Bark
82	Tinospora cordifolia	Menispermaceae	Climber(W)	Stems, Seeds
83	Tragia involucrata	Euphorbiaceae	Climber(H)	Roots
84	Tribulus terrestris	Ygophyllaceae	Herb	Roots, Fruit
85	Vernonia anthelmintica	Asteraceae	Shrub	Fruits/Seeds
86	Withania somnifera	Solanaceae	Shrub	Roots
87	Woodfordia fruticosa	Lythraceae	Shrub	Flowers

Source: M.G. Chandrakanth, A. Ravishankar, M.S. Suneetha and R. Rangesh Parmesh Medicinal And Aromatic Plants Revisited: An Institutional Analysis Of The Common Property Resources Regime (Draft Chapter for a Book on CPR). Original from the data base of the Foundation for Revitalization of Local Health Traditions

Appendix Table 2: Medicinal Plants found in Karnataka

SL.No.	Common Name	Botanical Name
A. Annuals		
1.	Isabgol	Plantago ovata
2.	Long pepper	Piper longum
3.	Senna	Cassia angustifolia
4.	Ashwagandha	Withania somnifera
5.	Kalmegh	Andrographis paniculata
6.	Safed Musali	Chlorophytum arundanaceum
7.	Liequorice	Glycyrrhiza glabra
8.	Bhumi amla	Phyllanthus niruri/ P. amarus
B. Perennials		
1.	Amla	Emblica officinalis
2.	Ashoka	Saraca asoka
3.	Bale	Aegle marmelos
4.	Guggal	Commiphora wrightii
5.	Sandal wood	Santalum album
6.	Kokum	Garcinia indica
C. Climbers		
1.	Giloe	Tinospora cordifolia
2.	Glory Lily	Gloriosa superba
3.	Madhunasini	Gymnema sylvestre
4.	Satavari	Asparagus racemosus
D. Plants for high altitudes		
1.	Atis	Acontium heterophyllum
2.	Chirata	Swertia chirayita
3.	Indian Barberry	Berberis aristata
4.	Jatamansi	Nardostachys Grandiflora
5.	Kutki	Picrorrhiza Kurroa
6.	Kuth	Saussura costus

CHAPTER II

IMPORTANCE OF MEDICINAL CROPS IN KARNATAKA

2.1. Introduction

Medicinal and aromatic crops occupy an important position in the socio cultural, spiritual and health aspects of Indian rural population. These have become an integral part of the culture and rituals. Karnataka has one of the richest traditional medicine cultures in India. Many important and useful species are found here. These are long known for their medicinal properties and these references are available in scriptures. Millions of households, particularly in rural areas, use medicinal plants for self-medication, for preventive purpose, rejuvenating and curative applications. Recognising this importance, the Government of Karnataka established Medicinal Plant Conservation Areas to promote and regulate the sector for optimising the benefits to people as well as to ensure sustainable growth. Medicinal plants have also been identified as one of the thrust areas by the forest department and different programmes have been initiated for their conservation in the forests and protected areas. In the recent past, cultivation of these plants is being undertaken on private lands also.

It is estimated that 90 per cent of the industrial requirement of plant material comes from forests (EXIM Bank, 1997). Karnataka state has a forest area of about 20 per cent and this includes evergreen, semi-evergreen, moist deciduous, dry deciduous, scrub and thorny jungles. According to the report of the Botanical Survey of India 1984, there are 3,924 species belonging to 1,323 genera and 199 families in the forests of Karnataka, of which, 1,493 species are of medicinal value. These belong to 808 genera and 108 families. They occur in different vegetation types across the Western Ghats. The rate of exploitation has also been increasing at a very fast rate and that has caused supply bottlenecks for a few. In the recent past, these are taken for cultivation as regular seasonal crops and becoming popular among cultivators. Soon some of these species acquired the status of crops from plants, and this transition has made a significant difference in the economy of medicinal crops.

2.2. Medicinal Crops in the Indian Context

The World Health Organisation has recognised that a large proportion of the population of developing countries depends on traditional medicines and herb-based remedies for primary health care. Transition from western medicines to plant-based preparations is rapidly gaining acceptance. This has not remained a phenomenon confined to tribal belts, where since a long time people have believed in the use of plant-based medicines, but has also been well-accepted in developed regions. Even in developed urban areas medicinal systems like Ayurveda, Unani, Siddha and other indigenous systems are preferred. The popularity of traditional medicines has grown enormously during the recent years for many reasons. With this renewed interest in the Indian system of traditional medicines, the domestic demand for medicinal herbs increased many folds. Presently, the market for traditional systems of medicine in India is estimated to be about Rs.4,000 crore per year (Sunitha, 2004).

Owing to the growing importance of medicinal crops the central government established a National Medicinal Plants Board (NMPB) in December 2001, which is the apex body for coordination and implementation of policies related to medicinal plants both at the Centre and State levels. The Board has the mandate to facilitate inter-ministry, inter-state and institutional collaboration for all matters relating to medicinal plants, including drawing up policies and strategies for conservation, proper harvesting, cost-effective cultivation, R&D, processing and marketing of raw materials. The NMPB has been instrumental in setting up state medicinal plant boards (SMPBs) in 29 States of the country. It has also prioritised 32 medicinal plants that have high demand both in domestic and international markets. These are taken on priority for cultivation, conservation and development. In the Integrated Development Scheme of Vegetable/Medicinal and Aromatic Plants, the Centre has allocated some funds to promote medicinal and aromatic plants in India. It is true that the allocated fund are quite insufficient (**table 2.1**), but still this is a good move in promoting these plants.

Table 2.1: Funds Allocated under Integrated Development Scheme of Vegetable/Medicinal and Aromatic Crops

(Rs in lakh)

States	1998-99		1999-2000		2000-01		2001-02	
	M & A	Veg	M & A	Veg	M & A	Veg	Macro Management: M & A	Macro Management : Veg.
Andhra Pradesh	7.5	6	4.5	18	0.28	0	4500	4500
Assam	4.5	3	4.5	12	0.28	0	1160	1200
Gujarat	4.5	4.5	4.5	18	0.28	0	3000	4000
Himachal Pradesh	4.5	3	1.5	13.5	0.35	0	1500	1800
Karnataka	9	6	12	27	0.35	0	6500	6500
Kerala	9	4.5	12	49.5	0.35	0	4000	4000
Madhya Pradesh	6	12	6	36	0.32	0	4442	5000
Maharashtra	7.5	4.5	7.5	18	0.35	0	10000	10000
Rajasthan	7.5	6	7.5	18	0.35	0	7000	8000
Tamil Nadu	6	6	9	18	0.32	0	5000	5000

Note: M & A: Medicinal and Aromatic Plants; Veg- Vegetables

Source: www.indiastat.com

The national economic growth focussed on restoring the ecology, without compromising the environmental quality, will have to consider plantations of medicinal and herbal crops and trees on priority. Ayurvedic, Unani and Siddha medicines are now well established in our country, and these have increased demand not only in India but also emerging demand in the western countries. A large share of the population on the globe wants to utilise these therapeutic interventions for maintaining health, preventing diseases as well as treating both acute and chronic ailments with eco-friendly medicines that have least side-effects. In fact, the demand for such natural, holistic, eco-friendly and herbal-based therapeutics is increasing and it can be believed that this industry will grow even faster in the coming years. These medicines prepared in the traditional manner involve simple methods such as decantation, boiling water extraction, juice extraction after crushing, powdering of dried material, formulation of powder into pastes using water, oil or honey, and even fermentation after adding more than one ingredient. Traditionally, the practitioners produced herbal medicines manually in small quantities. They were the only knowledgeable individuals who were able to identify the correct plant species and their combinations. Communicating the knowledge through oral tradition was the only way of preserving the knowledge. Over the years, the documentation process became stronger and many *Samhitas* were written. That has paved the way for manufacturing bulk drugs and now there are many manufactures in the production process.

2.3. Medicinal and Aromatic Crops in the Context of Karnataka

Karnataka is one of the leading States that has a significant presence of Ayurvedic and Unani manufacturing companies. Use of Ayurveda as means of medicine has been growing in the State quite fast. Some large manufacturers and top class nature cure centres are located in Karnataka. Presently there are 71 Ayurveda; Unani, homoeopathy and nature cure & yoga colleges in Karnataka (www.cetinformatoin.com) and these add to the number of practitioners every year. Today, many people are engaged in these systems of medicines in the State and the State has its popularity offering nature cure to many diseases.

The demand exceeds the supply of medicinal plants in Karnataka. At present, around 90 per cent of the supply of the raw material is directly from the forest and mostly from outside the State. Cultivation of a few species began only recently and that meets only about 10 per cent of the demand (Govt of Karnataka, Horticulture, Dept. of Horticulture, personal interviews). Traditionally, the tribes and local communities 'in and around forest', used to supply medicinal plants from herbal products. There are a few regions that specialise in the supply of specified raw material to industries and practitioners.

2.3.1. The Western Ghats: Bastion of Medicinal Plants

The Western Ghat region of Karnataka is designated as one of the 18 biodiversity hot spots in the world. It is estimated that two-third of India's endemic plants are located in this rich tropical evergreen forested region. These unique ecosystems are storehouses with untapped potential for biological and chemical development in the fields of medicine, biochemistry and industry. About 60 per cent of Karnataka's forests comes under the Western Ghats and this region is termed as the varietal emporium of medicinal plants. The entire plant kingdom consists of more than 200,000 species originated in 12 centres around the world. One such centre is located in the Western Ghats. About 700 species of medicinal herbs are found here and are used in indigenous systems of medicine. Although the Western Ghat region occupies only a small portion of the state's geographical area, it accounts for a large amount of endemic species found in Karnataka. Medicinal and aromatic substances present in plants/animals are secondary metabolites produced by these organisms growing under specific environmental stretches. Medical and aromatic plants found in the western ghat region include species of high ecological and economic potential

(high value, low volume crops). But still medicinal plants are not favoured for replacing the traditional crops in this region, both due to abundant availability in natural habitats and the distance from the processing centres.

2.3.2. Medicinal Plants as a Part of Culture

There are many traditional systems of medicine being practised in Karnataka. In medical literature, these could be classified into three broad categories: (1) Traditional Medical Systems, with formal documentation of knowledge, pharmacopoeias for doctors and institutions for training doctors; (2) Traditional Medical Knowledge (Folk Medicine), which is orally communicated and associated with specific households, communities or ethnic groups; and (3) Medicines, with a strong spiritual element and which can only be applied by specialist practitioners along with spiritual training. In Karnataka, all these categories can be seen in many part (Sunitha and Chandrakanth,, 2001). It can be seen from the history of Karnataka that a large number of people engaged in this field practice one of these themes of practice. Medicinal herbs are used for a wide range of health related applications from the common cold to memory improvement, treatment of poisonous snake bites, cure for muscular dystrophy, to enhancement of body's general immunity and many such conditions. It is the traditional medicine culture that has significant contemporary relevance because it can, on one hand, ensure health security to millions of people and, on the other hand, provide new and safe drugs. Also we can find several traditional practitioners living in rural areas, where they have been serving local people over generations by giving medicines collected from the surrounding forests. This is a family tradition for many practitioners and traditionally rendered gratis yet to get fully commercialised. But slowly the traditional outlook of the practitioners is getting replaced by commercial motives as some of these institutions are collapsing. Under the pressure of commercialisation the medicines are being prepared and sold on a larger scale with scant attention to established procedures as well as the plants are being exploited commercially. The popularity of these medicines has given a boost to the firms manufacturing traditional medicines.

Industries producing medicines and products based on herbs are becoming a strong force now in the industrial sector of the State. Among these prominent are the nutritional industry, units providing concentrated extracts or isolated components, and major Ayurvedic medicine manufacturers. These include Himalaya Drugs, Natural Remedies, Dabur India, Dhoot Papeswar, V B Pandit and many others. But most of them face

bottlenecks in the supply of raw material of the required quality. It is, therefore, a possibility that cheap substitutes are used in the place of genuine ingredients and the *samhitas* (methods of preparation) are given a go-bye. But present emphasis on the scientific evaluation of traditional remedies requires to use "proven" substances, regardless of which medical system they have been derived from. With the absence of any testing facilities and supply bottlenecks, the industry's reputation is at stake, if sub-standard inputs or cheap substitutes are used.

2.3.3. Commercial Cultivation

Large scale cultivation of medicinal and aromatic crops has been taken up sporadically indicating a step towards commercialisation. There are a few industrial houses initiating the cultivation of medicinal crops to augment supply through contract farming. Farmers are also taking up production of medicinal crops for supplying high-value plants to pharmaceutical companies either within Karnataka or in other markets. Commercial cultivation of medicinal crops as mono-crop is taken only on a limited scale. Some farmers are growing medicinal crops as intercrops in some parts of the state. Some of the medicinal crops are cultivated as intercrop with coconut, arecanut, rubber and in other plantation crops. But cultivation on large scale is yet to begin in the State.

Cultivation and processing of medicinal plants are labour intensive processes and have a good potential for employment generation and through that poverty alleviation. Many labourers are engaged in gathering, processing, manufacturing and marketing of medicinal drugs. Cultivation of medicinal plants is also a potential resource for providing employment as well as income to the farmers. Cultivation of medicinal plants as pure crops is a relatively recent phenomenon. The industry prefers raw material from well known sources as it ensures quality, reliability and continuity. Non-availability of quality planting material, coupled with poor development and extension support in the cultivation and processing causes difficulties in taking up cultivation of the crops. Added to this the unorganised markets are posing a few hurdles and inhibit commercialisation of the crop economy.

The most important question that arises here is whether the cultivation of medicinal and aromatic plants could be a solution to sustain farm income through conventional crops. Will that boost the sagging farm economy? It is hypothesised that the medicinal and aromatic crops could easily replace the traditional crops on a selective basis and provide

increased net income. Karnataka has tremendous potential and a favourable agro-climate for growing these crops. The initiative has been already taken by many progressive farmers of Tumkur, Kolar, Kodagu, North Kannada, South Kannada and in many other districts of Karnataka. They have started to grow medicinal and aromatic plants, like sweet flag, safed masli, tulasi, patchouli, black pepper, etc. that has led to initiation towards diversification.

Diversification in the cropping pattern towards high value medicinal and aromatic crops can enhance profit, both by providing a higher income from alternative crops, and by boosting the yield of other crops by adopting crop rotation. A number of farmers have benefited by growing medicinal and aromatic crops that go into the market other than the traditional seasonal crops' market. The area under these crops has been increasing steadily and presently about 12 thousand hectares are cultivated under this crop group.

Table 2.2: Area, Production of the Major Horticultural Crops in Karnataka

Year	Fruits		Vegetables		Spices		Garden/ Plantation		Commercial flowers		Medicinal plants		Aromatic plants	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
1997-98	3.05	42.9	3.05	41.95	2.84	7.16	5.9	3.33	0.19	0.97	Neg	Neg	Neg	Neg
1998-99	3.01	48.62	3.21	47.74	2.51	8.61	6.13	3.85	0.2	1.28	Neg	Neg	Neg	Neg
1999-00	3.13	46.41	3.29	43.91	2.81	8.84	6.16	3.41	0.21	1.32	Neg	Neg	Neg	Neg
2000-01	2.61	41.62	3.77	66.54	2.45	4.97	6.26	3.34	0.21	1.57	0	0.05	0.01	0.09
2001-02	2.57	40.29	3.83	48.9	2.57	4.92	6.69	3.12	0.18	1.42	0.01	0.05	0.01	0.07
2002-03	2.55	40.39	3.67	44.94	2.38	5.44	7.02	3.5	0.18	1.47	0	0.03	0.01	0.05

Note area: in lakh Hectares, Production: in lakh tons, Neg: negligible,
Source: Horticultural crop statistics of Karnataka State at a glance 2002-03. Figures are converted to lakh hectares.

Table 2.2 refers to area, production of the major horticultural crops in Karnataka. It comes out from the table that the production patterns have been changing over years. Due to declining returns from traditional crops, farmers of Karnataka are moving towards non-traditional crops and medicinal and aromatic crops is one such option. Slowly but surely, medicinal and aromatic plants are entering the scene, as one of the important crop groups in agriculture. The table also highlights how agriculture diversification is tacking place, year by year. Up to 1999-00 the cultivation of medicinal and aromatic crops was growing at a negligible rate in Karnataka. After that there has been some increase and now these have come to be accepted both as mono cropla and intercrops in many districts like Tumkur, Kolar, North Kannada, Bijapur and Dakshina Kannada. In fact, the demand for medicinal

and aromatic crops has grown rapidly because of accelerated local, national and international interest, notably from the Western pharmaceutical industry. Public-private collaboration is being suggested as a way to reduce some of the capital bottlenecks and secure market access to small producers. Such collaboration can provide a promising mechanism for establishing the conditions for the establishment of supply chains in the initial stages of development. Therefore, inter-country collaboration, multi-sectors involvement and technical support by national organisations will be needed for the cultivation of good quality, safe and easily available medicinal plant. *Coleus forskholli*, *sweet flag*, *isabgol*, *kokum*, *long pepper* are the main medicinal crops being grown. The area under these crops is estimated with crude generalisation and there is no systematic methodology laid down for this purpose.

Table 2.3: Details of Medicinal and Aromatic Crops in Karnataka - 2003-04

Sl.No.	Name of the Crop	Area in hectares	Production in tons.	Yield in Tons / hectare	Value in lakh Rupees
VI. MEDICINAL PLANTS					
1	Ashwagandha	NA	NA	NA	NA
2	Sarpagandha	NA	NA	NA	NA
3	Sweet Flag	38	380	10	57
4	Coleus Forskholli	73	94	1	38
5	Glory Lilly	NA	NA	NA	NA
6	Long Pepper	66	22	0.34	6
7	Periwinkle	25	58	2	12
8	Roselle	NA	NA	NA	NA
9	Kokum	51	162	3	49
10	Isabgol	48	96	2	10
11	Others	278	277	1	8843
TOTAL - MEDICINAL PLANTS (VI)		580	1089	2	9014
VII. AROMATIC PLANTS					
1	Dhavana	105	1129	11	80
2	Kasthuri Bendi	NA	NA	NA	NA
3	Lemon Grass	246	1395	6	111
4	Rosemary	NA	NA	NA	NA
5	Patchouli	NA	NA	NA	NA
6	French Jasmine	NA	NA	NA	NA
7	Lavender	49	2	0.03	0.13
8	Vetiver	109	317	3	75
9	Citronella Grass	49	1058	22	83
10	Geranium	45	389	9	193
11	Others	367	1362	4	138
TOTAL - AROMATIC PLANTS (VII)		970	5652	6	681
GRAND TOTAL - (I to VII)		1541103	8938775	6	1207303

Source: Department of Horticulture Govt. of Karnataka

It can be seen from the table 2.4 that Bangalore urban, Kodagu, Tumkur, Belgaum and Kolar are the main districts where medicinal crops are grown over large areas. But this only shows medicinal crops being grown commercially; it does not include the value of production that is collected from the forest which is substantial but difficult to comprehend through the present statistical system.

Table 2.4: Area, Production, Yield and Value of Medicinal Crops: 2000-01

Districts	Medicinal Plants			
	Area	Production	Yield	Value
Bangalore Urban	22	51	2	66
Bangalore Rural	-	-	-	-
Kolar	2	1	1	0
Tumkur	56	560	10	56
Chitradurga	-	-	-	-
Davanagere	3	3	1	0
Shimoga	-	-	-	-
Mysore	-	-	-	-
Chamarajanagar	-	-	-	-
Mandya	-	-	-	-
Kodagu	255	3825	15	698
Dakshina Kannada	3	1	0	0
Udupi	-	-	-	-
Hassan	-	-	-	-
Chikkamagalur	-	-	-	-
Belgaum	32	61	2	8
Bijapur	-	-	-	-
Baḡalkot	-	-	-	-
Dharwad	-	-	-	-
Gadag	-	-	-	-
Haveri	-	-	-	-
Uttara Kannada	-	-	-	-
Gulbarga	-	-	-	-
Raichur	-	-	-	-
Koppal	8	24	3	5
Bellary	-	-	-	-
Bidar	-	-	-	-
Karnataka	381	4525	12	832

Note: Area: Hectares, Production: in tons, Yield: tons/hectare, Value: Rs in lakhs. Source: www.indiastat.com

When compared with other crops, medicinal and aromatic crops are grown usually on marginal lands as these are new crops and people are still comfortable with conventional crops. The risk-averse attitude of the farmers restricts them from taking up these new crops readily and hence only marginal resources are allocated to these crops.

But since the past few years, the trend has been changing and slowly farmers are starting to grow medicinal and aromatic plants either as mono crop or intercrop and substantial area is being allocated. This can be seen from table 2.5 that gives a clear picture of the emerging trends. An interesting fact to note here is that the aromatic crops are also getting an important place. We have noted in Karnataka that in a few districts the proportion of land where paddy and tomato were grown has decreased and that land is being used for cultivating medicinal and aromatic crops.

Table 2.5: Area Under Medicinal Crops in the state

Years	Medicinal Plants**	Aromatic Plants**
1993-94	NA	NA
1994-95	NA	NA
1995-96	NA	NA
1996-97	NA	NA
1997-98	53	36
1998-99	48	65
1999-2000	189	1
2000-2001	56	14
2001-2002	384	665
2002-2003	457	775
2003-04	580	970

Note: NA (Not Available), ** Area in Hectares
Source: Department of Horticulture, Govt. of Karnataka

Almost 90 per cent of the industrial requirement of plant material was coming from forests. The conservation of threatened medicinal plants called for protective policies for these species. In addition, if trade requirements are to be met on a sustainable basis, it is necessary to take steps to enhance production of the crops on a commercial basis and reduce dependence on forest resources. The Karnataka Forest Department has initiated creation of several gardens of medicinal herbs, shrubs and trees associated with Ayurvedic and the herbal system of medicines. These gardens serve as sources for seeds and saplings for herbal cure. Many medicinal gardens viz; *Triphala vana*, *Panchavati Vana*, *Panchapallya Vana*, *Ashoka Vana*, *Saraswatu Vana*, *Anti-Diabetics Vana*, *Krishna Vana*, *Pushpa Vana*, *Chyavana Vana*, *Ramchandra Vana*, *Kalpavriksha Vana*, *Dhanavanthri Vana*, etc. have been established. The Forest Department has taken up large-scale cultivation of medicinal plants under the centrally sponsored scheme, "Minor Forest Produce". The total area covered under this scheme is 4,274 ha in the state. With the help of the Foundation for Revitalization of Local Health Traditions (FRLHT) Bangalore, 13 Medicinal Plant

Conservation Areas (MPCA) have been established since 1993 (see table 2.6) and the Karnataka Forest Department has taken up a public awareness and dissemination of information programme "*Sasya Sanjeevini*". This has been designed to convey the importance and usages of medicinal plants. Further, the Department has brought out books on medicinal plants called "*Sacred Plants*" in English and "*Sasya Sanjeevini*" in Kannada. Another book on Red listed Medicinal plants of Karnataka and their distribution across forest types and their threat status was also brought out by FRLHT in 2000.

Table 2.6: Location of Medicinal Plant Conservation Areas (MPCA) in Karnataka

Sl.No	Name of the MPCA	Height about MSL (m)	Forest type sub-group
1	BRT Hills	790-1050	Southern dry mixed deciduous sorest
2	Sandur	550-773	Southern dry mixed deciduous forest
3	Savanadurga	800-970	Dry deciduous scrub
4	Karpakapalli	600-750	Dry deciduous scrub
5	Talacauvery	1000-1355	West coast semi-evergreen forest
6	Subramanya temple	250-800	West coast semi evergreen forest
7	Charmadi	300-1250	West coast semi evergreen forest
8	Devimane	50-500	West coast semi evergreen forest
9	Kudremukh	760-820	Southern hill top tropical evergreen forest
10	Kemmangundi	1300-1700	Southern hill top tropical evergreen forest
11	Devarayandurga	850-1040	Southern thorn forest
12	Agumbe	600-700	West coast tropical evergreen forest
13	Kollur		West coast tropical evergreen forest

Source: Department of forest, Govt of Karnataka.

Today the Ayurvedic medicinal system as an holistic health system is becoming quite popular. It is one of the fastest growing industries in India, so also in Karnataka. Several companies in the State produce Ayurvedic medicines, but many of them have low capacity. Less than a dozen major companies have dominated the industry for decades, joined recently by a few others. Most of the larger Ayurvedic medicine suppliers provide materials other than Ayurvedic indigenous medicines, particularly in the areas of foods and toiletries (soap, toothpaste, shampoo, etc. eg: Dabur) where there may be some overlap with Ayurveda and these products contain traditional herbal ingredients therefore get associated with the medicinal sector.

The key suppliers in Ayurvedic medicines are Dabur, Baidyanath, Natural Remedies, Amrutanjan, Dhootpapeswar, Sami and Zandu, which together garner about 85 per cent of India's domestic market. Writers have repeatedly mentioned these handful companies in the context of the Ayurvedic business in India. Despite our best efforts we could not get details of all these manufacturers and their business in Ayurvedic medicines.

Table 2.7: List of Major Medicinal Crop-Processing Units in the State.

Name of the process unit	Products	Major inputs (medicinal plants)
The Himalaya Drugs Co.	Pharmaceutical, baby care, hair care, skin care, animal health, well-being	Long pepper, amla, kalmegh, tulasi, shatavari
Natural Remedies (P) Ltd.	Human health care, animal health care, standardised extracts	Coleus, tulasi, solamum nigrum, kalmegh, bringraj, shatavari, brahmi.
Sami Labs (P) Ltd.	Standardised extracts, natural cosmeceuticals, spice extracts, oil	Garcinia, ashwagandha, brahmi, mucuna, guggal, gloriosa, coleus, kalmegh

Source: Personal interviews with suppliers of raw materials.

The first level of processing is carried out at collection centres/packing houses. Once the produce is collected at the farm or the forest, it is packed prior to being taken to the processing centres or for direct exports. Such centres are equipped with facilities for cleaning, drying under controlled conditions, sizing, grading and sorting, packaging (including consumer packs) and storage. These units will also be suitably linked with adequate storage and arrangements for transport to move the packaged produce for further processing or export. The supply chain is often long with as many as six or seven marketing stages, involving primary collectors and producers, local contractors, regional wholesale markets, large wholesale markets and specialised suppliers. The long supply chain means larger market margins and consequently low prices for the primary collector and farmer. As collection is still common than cultivation, there is a huge difference in the quality of raw material supplied by these sources. The differences concern the amount of active ingredients (that depends on the area in which the plants were grown), specific parts

of the plants being used, method of harvest and how they were stored. Raw material is at times adulterated, as the collected material from the wild cannot guarantee uniformity. Raw material is procured from suppliers and rather than the collector/grower directly because of the substantial quantity and broad range of raw material required.

The Himalaya Drugs Co., Natural Remedies (P) Ltd., Sami Labs (P) Ltd., are the main players in the state economy and the main sources of demand. These three companies share around 95 per cent of the state Ayurvedic medicine market (Suneetha and Chandrakanth 2004). They manufacture products related to human health, animal health and extracting, etc. Despite these promising indications, however, it can be said with a certain degree of confidence that Karnataka is not exploiting its comparative advantage in the medicinal plants sector. The state still has a huge untapped potential in the cultivation sector, if not from forest collections. We present a review of a few producers of Ayurvedic medicines here to buttress the fact that the trend has been quite encouraging for commercial cultivation of the crops.

2.3.4. Major Producers of Ayurvedic Medicines in India.

i. Amrutanjan Ltd

Amrutanjan Depot began as a Patent Medicine business in 1893 at Mumbai. The headquarters of Amrutanjan shifted to Chennai in the subsequent and it became a public limited company in 1936, with the name of Amrutanjan Limited, which markets a wide range of health care products. The products have already been registered as per norms prescribed by the FDA (Food and Drug Administration). The brand name Amrutanjan soon became popular household name for pain balm. It includes the herbal extracts from menthol and lemon grass. It has a wide range of Ayurvedic and Allopathic products starting from pain balms to revitalisers. Amrutanjan has helped millions of people to relieve themselves of pain and discomfort of headache, cold, sprain, muscular pain, rheumatic pain and lumbago. The company has a wide and well-established network of distribution and caters to the needs of its customers promptly and effectively. There are about 3.5 lakhs retailers and 1,750 stockists spread over the country. Table no. 2.8(a) and 2.8(b) show the financial performance and product sales of the company. It is clear that the company has improved in its revenue substantially during the last five years. The raw material cost peaked during 2003-04 but dropped down subsequently. At the same time, some of their special products are going out of the market.

Table 2.8(a): Financial Performance of Amrutanjan Ltd (Rs in Crs)

Particulars	2001	2002	2003	2004	2005
Long Term Debt-Equity Ratio (in percent)	0.27	0.16	0.17	0.31	0.36
Fixed Assets	3.31	2.88	2.92	2.76	2.66
Inventory	15.37	14.84	13.41	12.12	12.11
Total Sales Turnover	65.42	70.69	77.75	76.94	75.92
Total Income	65.82	71.71	80.91	77.16	77.29
EXPENDITURE					
Total Raw Material Consumed	20.53	25.87	29.89	23.48	23.28
Total Other Manufacturing Expenses	0.59	0.75	0.76	0.9	0.83
Total Employee Cost	6.75	7.77	8.75	9.65	9.35
Total Selling and Administration Expenses	17.89	17.89	22	20.13	19.42
Total Miscellaneous Expenses	0.77	0.78	0.68	4.23	4.84

Source: www.capitalmarket.com

Table 2.8(b): Products and Values of Sales of : Amrutanjan Ltd

Product Name	Unit	2003				2004				2005			
		Installed Capacity	Production	Sales Quantity	Sales (Rs Cr)	Installed Capacity	Production	Sales Quantity	Sales (Rs Cr)	Installed Capacity	Production	Sales Quantity	Sales (Rs Cr)
Pain Balm- Ayurvedic- Amrutanjan	MT	403.00	580.70	576.67	59.69	403.00	497.28	494.52	59.73	0.00	0.00	490.36	61.01
Chemicals	MT	0.00	65.02	59.71	10.63	0.00	39.21	43.02	9.49	0.00	0.00	35.00	8.01
Inhalers	MT	0.00	62.31	58.58	4.46	0.00	73.87	76.33	4.57	0.00	0.00	59.08	3.96
Agency Products	MT	0.00	197.32	198.71	2.97	0.00	175.74	175.14	3.15	0.00	0.00	210.50	2.94
Fine Chemicals	MT	91.00	0.00	0.00	0.00	91.00	0.00	0.00	0.00	91.00	0.00	0.00	0.00
Cough Mixture 60ml CETOMIX	No	20,000.00	0.00	0.00	0.00	20,000.00	0.00	0.00	0.00	20,000.00	0.00	0.00	0.00
Dermal Ointment 16gms	No	180,000.00	0.00	0.00	0.00	180,000.00	0.00	0.00	0.00	180,000.00	0.00	0.00	0.00
Tablets-Jiffy	No in Milli	12.8	0.00	0.00	0.00	12.8	0.00	0.00	0.00	12.8	0.00	0.00	0.00
Vinblastine Vials (10mg)	No in Milli	2	0.00	0.00	0.00	2	0.00	0.00	0.00	2	0.00	0.00	0.00
Vincristine Vials (1mg)	No	200,000.00	0.00	0.00	0.00	200,000.00	0.00	0.00	0.00	200,000.00	0.00	0.00	0.00
Inhalers- Ayurvedic	No in Milli	2	0.00	0.00	0.00	2	0.00	0.00	0.00	2	0.00	0.00	0.00
Cold Rub- Ayur.-Bottles- 20 gr.	No in Milli	3	0.00	0.00	0.00	3	0.00	0.00	0.00	3	0.00	0.00	0.00
Cold Rub- Ayur.-Tin-5 gr.	No in Mill	5	0.00	0.00	0.00	5	0.00	0.00	0.00	5	0.00	0.00	0.00
Pain Balm- Ayur.- Amrutan.(Hyd)	MT	240.00	0.00	0.00	0.00	240.00	0.00	0.00	0.00	240.00	0.00	0.00	0.00

Source: www.capitalmarket.com

ii. Shree Dhootapapeshwar Ltd

Shree Dhootapapeshwar Ltd has been in the business of manufacturing and marketing ayurvedic formulations for over last 130 years. Founded by late Vaidya Krishnashastry Puranik a physician devoted to Ayurveda in 1872. The first factory was located at Panvel near Mumbai. The enterprise has grown from substantially and today it has become one of the major ayurvedic medicine producers in India. Dhootapapeshwar is well known among Ayurvedic practitioners for its meticulous preparations and priority to medicines. Table no. 2.9(a) and 2.9(b) reveal the financial performance and products of sales of the company, respectively. The company has recorded doubling of its total income during the last five years. The sales have also increased substantially, especially of the medicinal preparations.

Table 2.9(a): Financial Performance of Shree Dhootapapeshwar Ltd (Rs in Crs)

Particulars	2000	2001	2002	2003	2004
Long Term Debt-Equity Ratio (in percent)	0.58	0.74	0.96	1.52	2.02
Fixed Assets	1.57	1.79	2.4	2.88	3.81
Inventory	3.33	3.44	4.07	3.91	4.91
Total Sales Turnover	4.45	5.67	7.07	7.41	10.05
Total Income	5.51	8.08	8.48	7.78	10.27
Total Raw Material Consumed	0.95	1.28	2.21	2.27	3.38
Total Other Manufacturing Expenses	0.44	0.48	0.15	0.14	0.18
Total Employee Cost	1.21	1.41	1.41	1.44	1.56
Total Selling and Administration Expenses	1.3	1.49	3.47	3.2	3.97
Total Miscellaneous Expenses	0.96	1.36	0.06	0.01	0.05

Source: www.capitalmarket.com

Table 2.9(b): Production for the Last Three Years of Shree Dhootapapeshwar Ltd

	Unit	Installed Capacity (Ltrs)	Production (Ltrs)	Sales Quantity (Ltrs)
2002				
Ayurvedic Medicines	Kg	160,000.00	86,114.00	84,874.00
Liquids	Ltr	972,000.00	80,139.00	80,134.00
2003				
Ayurvedic Medicines	Kg	160,000.00	114,860.00	118,597.00
Liquids	Ltr	972,000.00	NA	68,500.00
2004				
Ayurvedic Medicines	Kg	160,000.00	124,577.00	129,158.00
Liquids	Ltr	972,000.00	NA	75,308.00

Source: www.capitalmarket.com

As compared to Amrutanjan, Dhootapapeshwar does not have wide sale network but it has large number of preparations than Baidyanath. It is one of the users of sweet flag and patchouli in substantial quantity. The sales turnover of the company has been increasing at faster rate during the last five years compared to the other similar units.

iii. Southern Herbals Limited

Southern Herbal Ltd is a new generation processing unit for herbal medicines. It takes help from samhitas but tried a hybridization process of chemical methodology with herbal drugs. Southern Herbals Limited not only manufactures High Value Anti Cancer Chemotherapy Bulk Drugs but also produces drugs for hypertension, heart disease, diabetes etc., ingredients for these all drugs are extracted from herbal sources. Southern Herbals Limited process involves extraction, isolation of fine chemicals from plants through a sophisticated Counter Current Carousel Extractor and Centrifugal Partition Chromatography for the isolation of active compound. It has had an independent R&D, Pilot production facility in order to scale up for the commercial production of Fine Chemicals. The result is a fully integrated unit contributing its mite in the continuous combat against cancer. Company has diverted itself from the methodology of Ayurveda and hybridised the system with bio-chemistry to reach the active ingredients. Table no. 2.10(a) and 2.10(b) show the financial performance and products of sales of the company, respectively. The company was doing quite well till 2000, but fell into some problems thereafter. The data are not available from companies' records and therefore, collected from the website of capital markets.

Table 2.10(a): Financial Performance of Southern Herbal Company (Rs in Crs)

Particulars	1995	1996	1999	2000	2001
Long Term Debt-Equity Ratio (in percent)	0.61	0.34	0.29	0.27	0.41
Fixed Assets	1.85	1.92	0.87	1.89	NA
Inventory	111.9	60.71	10.4	44.98	NA
Total Sales Turnover	34.13	35.82	20.39	48.58	NA
Total Income	34.23	35.82	22.21	48.58	10.27
Total Raw Material Consumed	0.65	1.1	15.85	11.29	10.27
Total Other Manufacturing Expenses	5.75	5.35	0.03	0.05	0.01
Total Employee Cost	0.06	0.05	0.03	0.07	0.07
Total Selling and Administration Expenses	0.38	0.38	0.13	0.24	0.15
Total Miscellaneous Expenses	0.01	0.03	0	0.04	N.A.

Source: www.capitalmarket.com

Table 2.10(b): Products and Values of Sales of: Southern Herbal Company

Product Name	Alkaloids-Purified							
	1995	1996	1999	1999	2000	2000	2001	2001
Unit	Kg							
Installed Capacity	5,000.00	5,000.00	0.00	5,000.00	0.00	5,000.00	0.00	5,000.00
Production	4,000.00	4,500.00	1,336.22	2,000.00	3,150.00	4,700.00	3,537.00	4,500.00
Sales Quantity	4,000.00	4,500.00	1,336.22	0.00	3,150.00	0.00	0.00	0.00
Sales (Rs Crs)	34.13	35.82	20.39	0.00	48.58	0.00	0.00	0.00

Source: www.capitalmarket.com

iv. Dabur India Ltd

Dabur India Limited is one of the leading firms in manufacturing and marketing herbal-based products. It is one of those few firms that operate in this field for more than 100 years. The company is among top FMCG companies in the country. Dabur's products are exported to more than 50 countries and it is one of the net forex-earning firm. Dabur focuses on manufacture of health care, personal care and food products, these include brands like Dabur Amla Thaila, Dabur Chyawanprash, Vatika hair oil, Hajmola and have been market leaders in their respective segments. Dabur Ayurvedic Specialities markets, classical Ayurvedic medicines contributes, 7 per cent to the Company's revenue. Table no. 2.11 shows the financial performance of the company for two years. We could not get the earlier annual reports despite our best efforts.

Table 2.11: Financial Performance of Dabur India Limited (Rs in Crs)

Particulars	2003-04	2004-05
Net Sales	1148	1268.7
Other Income	11	11.5
Total Revenue	1159	1280.2
Total Income	115902.3	128021.8
Shareholders' Funds	26,865.81	33,807.35
Reserves and Surplus	24,003.32	30,943.15
Total Asset	43,293.12	54,281.12
Investments	17,122.67	27,094.25
Miscellaneous Expenditure	659.7	581.04
Sales and Other Income	1,104.59	1,150.32
Cost of Materials	50,319.20	54,365.36
Manufacturing & Operating Expenses	2,548.52	2,919.46
Selling & Administrative Expenses	35,117.32	39,488.95
Financial Expenses	689.77	429.57

Source: Annual Report 2004-05

v. Natural Remedies Private Limited

Natural Remedies formerly known as Indian Herbs was founded in 1951. Natural Remedies produces medicines for human as well as veterinary health care system. Company has started an Agronomy Department for conservation of valuable bio-resources. To achieve this goal, the agronomy unit started its activities in 1999. Development of planting material, nursery raising, studying seasonal variation, ex-situ manipulation of secondary metabolites, studying phytochemical variation due to ageing and development of suitable post harvest technology are the prime activities of this firm. They have developed technology for many medicinal plants, herbal veterinary medicines, human health supplements and standardized herbal extracts. Even though the firm has been relatively new, they have purchased Rs. 10.5 crores worth of raw materials.

Table 2.12: Products and Quantity of Products Sold by Natural Remedies Private Limited 2005

Products	Unit	Quantity of Products sold
a) Veterinary Medicines		
Powder	Tons	485
Tablet, Capsules, Bolus	No in milli	16.9
Liquids	Liters	112287
Ointments	Tons	91
b) Feed Supplements		
Powder	Tons	647
Tablet, Capsules, Bolus	No in milli	3.71
Liquids	Liters	161526
c) Standardized Herbal Extracts (domestic)		
Powder	Tons	7.46
d) Standardized Herbal Extracts and Human Health Products for export		
	Tons	51.23
Approximate Quantity of Different Raw Materials and its value	Tons/ Rs	5500/ Value 10.5 Crs

Source: Natural Remedies Private Limited

Many producers of medicinal products are importing raw material from outside the State. The availability of raw material is a major constraint in the State, as demand is ever increasing. The demand and supply parameters of the medicinal plant trade in Karnataka are not rigorously estimated and, consequently, they provide little policy guidelines (Workshop on Medicinal and Aromatic Crops, 2003). Despite a substantial domestic trade and significant processing facilities for herbal medicines, Karnataka has not been able to capitalise on this by promoting more area under these crops. In order to improve on this

front, it is necessary to identify products that have better comparative advantages and can replace the traditional non-remunerative crops. This would enable rapid access of herbal medicines to the market.

2.3.5. Cultivation and Conservation

Medicinal plants are valuable natural resources and their unplanned development and over-exploitation have not only resulted in a shortage of various herbs, but also the extinction of several species in nature. In order to meet the growing demand for these plants, it becomes important to conserve these species either by way of large-scale cultivation or through forest conservation measures for their sustainable use. The emphasis should be on cultivation as regular crops, rather than collecting from the wild to ensure botanical identity, genetic improvement, quality and continuity in supply. As we observed from the earlier discussion, the demand for medicinal plants in Karnataka is large and increasing at a fast rate. But supply has not kept pace with it. Undertaking cultivation of medicinal crops on private land is needed both to conserve the species and to ensure the supply of quality raw material to the industry. Cultivation of medicinal plant species in private land by farmers has been successful in many places as these enhance income flow as well as provides employment. Some of these are undertaken directly at places where the plants are found, while others are cultivated as completely new crops. Our discussions with many farmers and manufacturers revealed the factors that justify cultivation of medicinal crops on a commercial scale. These are:

- Considerable size of demand and strong probability of growing demand;
- Culturally well entrenched cultivation practices;
- Better relative income to cultivators compared to other crops;
- Cultivation of medicinal and aromatic crops is relatively easy and requires less resources than traditional seasonal crops;
- These crops provide assured markets and prices.
- These crops generate larger employment than the seasonal crops.

But supply has not grown as much is needed. If only we had capitalised on the opportunities, we could have boosted our Ayurvedic medicine industry. Many firms in the Ayurvedic industry have started contracting the cultivators directly by providing planting material and know-how. But a sizeable share also goes to the private contractors. The opportunities for the supply side of medicinal plants market include:

- Availability of planting material on commercial farmlands;
- Availability of large amounts of under utilised forest lands;
- Cultivation of medicinal plants on community lands;
- Good processing, and marketing expertise;
- Access to international as well as traditional markets;
- Progressive farmers having an easy access to resources; and
- The robust nature of some of these crops to stand testing weather conditions.

2.4. SWOT Analysis of Collection and Cultivation

On the basis of discussions with three stakeholder groups, namely farmers, users, contractors and processors, we carried out a brief SWOT (Strength, Weakness, Opportunity, Threats) analysis of cultivating medicinal and aromatic crops in Karnataka. They have an immense potential in the domestic and export market in India, in general, and Karnataka in particular. The soil and climatic conditions in Karnataka are highly suitable for cultivation of medicinal plants. The forests of Western Ghats and the deciduous forests of Deccan are rich in medicinal plant biodiversity and are suitable for managed collection. A SWOT analysis to examine the suitability of the region for collection and cultivation of medicinal plants revealed the following:

i. Strengths

- The existence of deep cultural and historical roots of traditional Indian medicine and the knowledge of the properties and therapeutic use of plants;
- A positive policy of state and union Governments for the development of medicinal and aromatic plants cultivation;
- The availability of vast forest resources in the Western Ghats, hilly areas and man made forests, with rich sources of medicinal plants;
- Progressive farmers, scientific, trading and processing community, willing to share responsibilities; and
- The availability of research and development support from the existing institutions and many private and public sector organisations.

ii. Weaknesses

- Over-exploitation of natural resources from their wild habitats.
- Lack of information in cultivation and marketing.

- Inadequate information on international demand and supply.
- Inadequate research on sustainable harvest, collection, processing and value addition.
- Lack of infrastructure facilities for collection, drying, storage, marketing and processing.
- Lack of planning and management at industry and supply institutions.

iii. Opportunities

- The international market for herbal products is growing at an annual growth rate of seven per cent per annum.
- A growing market demand for high quality products certified for sustainable, environment-friendly collection and production.
- Consumer preference and concerns for organically grown products is increasing.
- Availability of stretches of virgin dry lands suitable for organic cultivation of medicinal plants.
- A large number of farmers are coming towards growing medicinal plants.

iv. Threats

- Depletion of natural resources at an alarming rate and substitution of sub-standard raw material.
- Development of extra legal market mechanisms.
- High fluctuations in the market prices and emergence of usurious contractors.
- Impact on food security.
- Vagaries of nature like droughts, floods and forest fires.

2.5. Policy Prospects and Limitations

Some major opportunities lie ahead for cultivators of medicinal crops in Karnataka. Being a major user and producer of many traditional medicinal crops, Karnataka has the potential to grow even further. But there are some constraints that have to be addressed in a proper manner. Thus, here we are enlisting some of the constraints and policy initiatives opportunities that may impact the growth of medicinal crops in Karnataka.

i. Policy Constraints

The State provides only limited support for the trade and cultivation of medicinal crops. The National Board of Medicinal Plants, Departments of Agriculture, Forest, Health, and Environmental Affairs are providing support to the trade of medicinal and aromatic crops in Karnataka. The forest department has taken bold steps and constructed 14 major medicinal plant conservation parks throughout the State. But that is not sufficient, as demand for the medicinal raw materials is growing day by day and we have to hike its supply. Consequently, initiatives for promoting the marketing of plants require official support in terms of a long term policy.

ii. Supply Constraints

The supply of popular plant species is declining as a result of intense harvesting pressure. The declining plant availability results in irregular supply and reduces the opportunities for developing new products associated with these species. The decline in forest species is quite acute, and is further exacerbated by the long period required to grow usable crops for the market. There are a few established medicinal plant production centres, with some demonstration farms and nurseries producing information and source materials for interested farmers and practitioners. Medicinal plants are also relatively slow-growing species with most of the popular species taking several years to come to the harvestable age. The total reliance on species in the wild for market supply will naturally result in an irregular supply of plant quality and quantity, making product and market development difficult. That makes it necessary to grow some of these on commercial basis on the farm land.

There is clear evidence that middlemen and agents are exploiting collectors and cultivators while managing the raw materials. As a result, the raw material supply situation is unsound and unsustainable. It is, therefore, in the interest of the industry to develop a long term "social contract" with producers, collectors and suppliers of medicinal crop material.

iii. Marketing Information Constraints

There is little coordination in the marketing of medicinal plants and products. Practitioners and consumers, who may inform gatherers or traders of the plants they

require, practise the most common marketing activity. Sometime the practitioners go to the forest and collect what they require. The supply of these products can take a long time, with gatherers having to return to their collecting areas and then sending these to the market with the desired quality. The trade is largely based on the gatherer's knowledge and ability to sell their products at a reasonable price. Market information is largely shared by word-of-mouth, leading to a long 'turn-about' time in the market, contributing to a high risk situation where suppliers may not know whether the requested products are still in demand by the time they reach the market. The economic feasibility of cultivating plants for the market is currently being explored. However, market dynamics has been changing fast. The main demand for medicinal crop comes from producers of medicines, and now they are entering into contracts with farmers for the supply of raw materials. But still the share is very low and it is participated only by a few.

iv. Awareness and Limitations

- A narrow perspective about the traditional medicines and methods.
- These are new crops and hence cultivators are sceptical.
- Large and continued reliance on forest harvested plants for the trade.
- A declining plant population which results in many high value species becoming increasingly inaccessible.
- Diminishing product development opportunities due to limited access to sufficient plant stocks.
- The supply of plant products is irregular and that impacts the quantity and quality.
- The distance between major markets and various plant sources is big, generating large costs.

2.6. Summary

Medicinal and aromatic crops are emerging strongly as one of the income avenues however, a large part of the demand for these plants is met from the forests. As a result, there are a good number of species that are over-exploited and at the same time the collectors/suppliers do not get good price for the product supplied. As a result, the trade prospect in the domestic and international markets of these crops is affected. Recently, in a Planning Commission report, it is emphasised that the cultivation of medicinal and aromatic crops on commercial basis would be a better way to overcome the inadequacies. The cultivation of these crops will not only provide better income avenues but also

generate employment in the rural areas. Karnataka is one of the states that has a good stock of medicinal and aromatic crops in its forests and on the farms. Now, these have also entered in the farmers' decision-making calculus and area allocated to these crops is increasing in the recent past.

Commercial cultivation of these crops help farmers to directly participate in the market and provide direct link to the processing of the crop. There are a few companies producing Ayurvedic medicines and operating in the State. They procure a large part of the produce. It is observed that the business and net profits of these companies are increasing sharply in the recent past and therefore, that should give a boost to the cultivation of medicinal and aromatic crops on the commercial basis. The SWOT analysis undertaken in this chapter to look into the major policy issues for cultivation of medicinal and aromatic crops in the place of traditional crops indicate quite a few important issues. Therefore, in policy front, it is essential to emphasise information (cultivation, marketing and processing), reduction in market margins and establishment of proper supply chain. These policies emerge out of the quick analysis of medicinal and aromatic crops in Karnataka. However, it is essential to look into the micro level issues to arrive at policy initiatives grounded in the micro realities.

CHAPTER III

RELATIVE ECONOMICS OF MEDICINAL CROPS

3.1. Introduction

An analysis of crop economy can be undertaken from two perspectives, first by the absolute economic behaviour in terms of the cost and income flows along with institutions, and second, in a relative perspective, by comparing with a competing crop on all these parameters so as to understand the relative merits of accepting the crop in question as an alternative. Our focus here is to understand the process through which farmers will be provided incentives to grow medicinal and aromatic crops. Diversification to more productive and remunerative crops has emerged as a new strategy in the agriculture sector due to the low income generating capability of the traditional crop sector. Thus, recently a shift in favour of horticultural crops, particularly medicinal and aromatic crops, as a more viable and attractive alternative can be found in many States including Karnataka. We have undertaken here an analysis of the relative economics of cultivation of the selected medicinal and aromatic crops to reflect their economic viability and profitability in the given situation and compared that with the closest competing crop. It may be needed here to clarify that we have used the concept of competing crop in a reverse engineering perspective; actually it is the medicinal and aromatic crops that compete with the traditionally established crops and not the other way. But in order to understand the relative economics we have used these 'competing crops' to make clear the points about the subject. Thus, the present chapter provides a comprehensive view of the cost structure and returns in the cultivation of the competing crops in the light of their socio economic conditions.

3.2. Economics of Sweet Flag (*Acorous calamus*)

Sweet flag (*acorous calamus*) was selected for the purpose of an analysis as a medicinal crop on the basis of the criteria that is explained elsewhere. As a competing crop, we selected paddy from Tumkur district, since most of the area under sweet flag was earlier under paddy. A healthy sweet flag (*acorous calamus*) yield needs on average minimum annual temperature of 40°F, permanently wet soil, and good sunlight. Thus paddy and sweet flag require the same type of land and agro-climatic conditions, but the

economics of the two differ significantly. It was observed that farmers growing paddy have been shifting land under sweet flag of late and hence paddy rightfully emerges as the competing crop for sweet flag. As explained earlier, the concept of competing crop is used in a reverse engineering perspective than the common understanding of the concept. Initially we discuss the general features of the growers of these two crops, followed by the economic features of the two separately.

3.2.1. General Features of Cultivation of Sweet Flag

The general socio-economic conditions of the farmers greatly affect the kind of the crops chosen and the technology used. Table 3.1 presents the household level socio economic condition of the growers of sweet flag (*acorous calamus*). The age of the head of the family, who is generally involved in cultivation, can be taken as the indicator of experience in the field (agriculture). In the case of our sample, the average age of the head of a household is around 45 years and the average size of the family is around four. Literacy is an important factor determining the adoption of technology. We have presented these general features in the table 3.1 and that shows about 32 per cent of the selected farmers as illiterate. And among the literates around 46 per cent are educated up to the primary level. Only 16 per cent have studied up to the high school level. Very few (6 per cent) of the sample population are studied till college, whereas none of them is a graduates.

The low literacy level may be due to the work burden on them or the increasing demand for workers in the field. Here what is noticeable is that most of them have just gone up to the primary level. Table 3.2 carries the general features of the growers of competing crop paddy for sweet flag (*acorous calamus*) growers. The average age of the head of the household is around 43 years. Similarly, the average size of the household is around four, which is higher than that of sweet flag growers (3.96). Around 20 per cent of the sample paddy grower's family members are illiterate. Among the literates, around 25 per cent have gone up to the primary level, compared to 46 per cent of sweet flag growers. While approximately 35 per cent have gone up to high school level, only 16 per cent of sweet flag growers went up to that level. In case of paddy growers, around 20 per cent have gone up to college, but in case of sweet flag (*acorous calamus*) growers, it is lower (six per cent). The hypothesis that education will make any difference in diversifying to a new crop does not seem to hold any water here.

Table 3.1: General features of crop growers: Sweet Flag (Acorous calamus)

Sl. No.	Items	Unit	Average	Explanations
1	Age (H H)	Years	45.02	Average age of the head of the household
2	Size of the family	Number	3.96	Average size of family
3	Education level (a) Illiterate	Number	16	Average No. of Illiterate family members per H H
4	Literate			Same as above for different levels (Average No. Per family)
	(a) Primary school	Number	23	
	(b) High school	Number	8	
	(c) College	Number	3	
	(d) Degree	Number	0	

Source: Primary survey

Table 3.2: General feature of the competing crop: Paddy

Sl.No.	Items	Unit	Average	Explanations
1	Age (H H)	Years	43.2	Average age of the head of the household
2	Size of the family	Number	3.86	Average size of family
3	Education level			
4	(a) Illiterate	Number	8	Average No. of Illiterate family members per H H
5	Literate			
6	(a) Primary school	Number	8	Same as above for different levels (average No. Per family)
	(b) High school	Number	23	
	(c) College	Number	9	
	(d) Degree	Number	2	

3.2.2. Land Holding of the Farmers

Land holding plays an important role in decision making while diversifying to a new commercial crop. Tumkur district is dominated by small and marginal holdings and hence the reflection of the general trend is quite visible in the selected sample of sweet flag and the paddy growers. All the farmers of the sample who grow sweet flag (acorous calamus) own land and the incidence of tenant farming is negligible. An average total land holding of sweet flag cultivations is 2.93 acre. Of the total owned land, around 73.72 per cent of sweet flag is grown in dry land.

Table 3.3: Details of land holding sample farmers: sweet flag

Particulars	Area (Average per HH)	Percentage	Explanation
Total Owned Land	2.93	100.00	
Dry land	2.15	73.72	Percentage to owned area
Irrigated Land	0.77	26.28	Percentage to owned area

Source: Primary survey

As per the established agronomic practices, sweet flag needs a good irrigation for a good yield. But in the study area only 26 per cent of the total sweet flag cultivated land had irrigation facilities. Around three-fourth of the crop area is rainfed which might have important implications on cost and returns.

Table 3.4: Details of land holding of the sample farmers of the competing crop: Paddy

Particulars	Area (Average per H H)	Percentage	Explanation
Total owned land	3.79	100.00	
Dry land	2.04	53.83	Percentage to owned area
Irrigated land	1.75	46.17	Percentage to owned area

Table 3.4 gives details about land holding of the sample farmers of paddy. The average size of holding is 3.79 acre. Out of that about two acre of paddy area is cultivated under rainfed condition, which constitutes about 54 per cent to total owned area. In the case with sweet flag, it is around 74 per cent of the total owned land. Around 46 per cent of the paddy growing land has irrigation facility while only 26 per cent of the sweet flag cultivated area receives irrigation. Sweet flag is a new crop and hence there is always an apprehension to allocate best lands for the cultivation of this crop. Therefore, it is quite expected that the crop received secondary treatment in the allocation of resources. But it is picking up steadily in the region due to the assured market.

3.2.3. Cost and Returns from Sweet Flag

Most of the area under paddy is irrigated and hence the cost of irrigation is less as compared to that of sweet flag. The cost of cultivation of the crops also differs significantly. We have provided the details of labour employed in sweet flag cultivation per acre and per farm to get a rough assessment of the employment generated in the crop economy.

Table 3.5: Details of labour employed in cultivation of sweet flag per farm

Sl No	Operation wise labour	Per Farm				Per acre			
		M	W	Bp	Mp	M	W	Bp	Mp
1.	Land preparation	12.08	5.32	3.09	1.26	9.30	4.10	2.38	0.97
2.	FYM/compost-transportation and application	2.06	3.13	0.00	0.00	1.59	2.41	0.00	0.00
3.	Planting/sowing	4.70	14.47	0.00	0.00	3.62	11.14	0.00	0.00
4.	Chemical fertiliser	7.01	5.17	0.00	0.00	5.40	3.98	0.00	0.00
5.	Weeding – manual	16.65	39.04	0.00	0.00	12.82	30.06	0.00	0.00
6.	Irrigation	80.99	0.00	0.00	0.00	62.36	0.00	0.00	0.00
7.	Harvesting	39.51	40.18	0.00	0.00	30.42	30.94	0.00	0.00
8.	Processing	19.53	27.30	0.00	0.00	15.04	21.02	0.00	0.00
9.	Packing	2.49	0.00	0.00	0.00	1.92	0.00	0.00	0.00
10.	Transportation	3.00	0.00	0.00	0.00	2.31	0.00	0.00	0.00
11.	Marketing	1.38	0.00	0.00	0.00	1.06	0.00	0.00	0.00
	Total	189.4	134.6	3.09	1.26	145.84	103.65	2.38	0.97

Note: M– Male; W – Women; Bp – Bullock Power; Mp – Machine Power; FYM – Farm Yard Manure

Labour used for different activities can be seen from table 3.5 and one can find all aspects of labour use per farm and per acre. Coming to the nature of labour use, we find that of the total labour both per acre and per farm used around 43 per cent male labour in irrigation. And of all the activities, female labour use is more than male labour in weeding, manual processing and harvesting. And one can see that of the total labour force used, irrigation activity requires around 25 per cent. We find that this 25 per cent of labour is male and wage differentials, if taken into account, would escalate the value of the labour used for irrigation as compared to that for any other activity. This aspect has wide implications in the cost analysis of this crop.

We can also see that harvesting is another labour intensive activity but irrigation requires more labour. The other farm activities like weeding, manual processing and land preparation use significant amount of labour. Using chemical fertiliser is needed for plant growth and that is a common practice among cultivators. In our sample area, farmers use seven man-days and five women days for this work. None of them uses any bullock power or machine power for this work. For packing, transportation or marketing of sweet flag nobody uses women labour. In total, 189 labour days are used in cultivation by the farmer. But only seven man-days are used for this work. In case of per farm, it comes to only five out of 146 labours. What is noteworthy here is that only a portion of machine and bullock power is used for cultivating sweet flag.

Table 3.6: Details of Labour Employed in Cultivation Per Acre: Paddy

SI No	Operation wise labour	Per acre				Per farm			
		M	W	Bp	Mp	M	W	Bp	Mp
1.	Land preparation	7.29	0.89	1.20	0.87	12.75	1.55	2.10	1.53
2.	FYM/compost-transportation and application	2.06	0.74	0.00	0.00	3.60	1.30	0.00	0.00
3.	Planting/sowing	0.00	9.86	0.00	0.00	0.00	17.25	0.00	0.00
4.	Chemical fertiliser	4.00	2.69	0.00	0.00	7.00	4.70	0.00	0.00
5.	Weeding – manual	0.00	12.34	0.00	0.00	0.00	21.60	0.00	0.00
6.	Irrigation	12.23	0.00	0.00	0.00	21.40	0.00	0.00	0.00
7.	Harvesting	4.06	14.11	0.00	0.00	7.10	24.70	0.00	0.00
8.	Processing	3.27	7.20	0.00	0.00	6.25	12.60	0.00	0.00
9.	Packing	4.89	0.00	0.00	0.00	8.56	0.00	0.00	0.00
10.	Marketing	1.03	0.00	0.00	0.00	1.80	0.00	0.00	0.00
	Total	39.12	47.83	1.20	0.87	68.46	83.70	2.10	1.53

Note: M – Male; W – Women; Bp – Bullock Power; Mp – Machine Power; FYM – Farm Yard Manure
Based on sample Survey data.

Table 3.6 presents the details of labour employed in cultivation per acre by sample farmers cultivating paddy. Being a competing crop of sweet flag, the labour usage is only around 27 per cent of the total labour usage for sweet flag and that indicates the labour intensive activity of cultivating sweet flag. Cultivation of paddy requires around 55 per cent of female labour as compared to 41 per cent for sweet flag. This makes a substantial difference in the cost of cultivation. When we take the wage differential between female and male labour, sweet flag cultivation yields low income to the female labour force, but that happens usually with the introduction of a new crop. The most important issue here is women workers are participating more in sweet flag cultivation. The table shows that paddy takes lesser labour in aggregate when compared with sweet flag. A major part of the labour is being used for harvesting paddy and that is well-known. Together per acre and per farm labour use indicates around 21 per cent of total male and female labour for harvesting alone. Per acre, around four and 14 male and women labour, respectively are being used.

Irrigation is another area where the more workers are required. Around 31 per cent of male workers are engaged in irrigation in terms of both per acre and per farm for paddy. But in the case of sweet flag about 43 per cent of male labour is needed for both per acre and per farm respectively. Largely male workers are used in the cultivation of sweet flag. For planting and sowing of paddy, only women workers are used and about 10 women

days are needed per acre and around 17 women days per farm. But in the case of sweet flag per acre labour usage is around four women days and 11 male days and per farm takes around 14 male and four women days of labour respectively.

Land preparation of paddy requires six per cent of male and around two per cent of women labour to the total labour force per acre. But land preparation for sweet flag cultivation takes about 6.5 male and around four per cent of women labour per acre. Both the crops need bullock and machine power for land preparation. In general, sweet flag cultivation absorbs larger labour days per acre than paddy. In processing, paddy (harvesting) takes around three and seven male and women days respectively, per acre. Whereas, around 19 male and 27 days of women labour are needed per acre for processing sweet flag. In the total cultivation process, sweet flag takes 324 man days per farm, as against 152 man days for paddy per farm. That means the generation of 172 man days of additional employment per farm and 162 man-days of employment per acre. The income transfer to the agricultural labour by shifting towards sweet flag comes to about Rs 8,910 to Rs 10,000 per acre.

In order to understand the income generation out of sweet flag cultivation one should compare the cost and returns from the crop. The table 3.7 summarises the cost and return pattern of sweet flag. We find that the total cost per farm comes to Rs 44,876.58, which includes the total fixed cost (depreciation charges and imputed rental value of land) of Rs 4,717.83 per farm and a total variable cost of Rs 40,158.75 per farm. It can be noted that per farm cost in every aspect is higher than the per acre cost. The per acre total cost of production of sweet flag comes to Rs 44,876.58, of which Rs 40,158 is towards variable cost and Rs 4,717 is towards fixed cost.

The fixed cost comprises the rental value of land and depreciation charges, whereas, variable costs includes the cost of planting material, chemical fertiliser, labour, irrigation, packing material cost, etc. Among the total cost of production, around 57 per cent of the expenditure goes towards wages. Thus we can say that sweet flag is a labour intensive crop. The next major head of expenditure is irrigation charges, followed by the interest on working capital, amounting up to 11 and eight per cent of total cost of production respectively. The production cost is Rs 12.76 per kg that leaves Rs 8.09 profit to the farmer.

In the case of paddy, the total cost of cultivation comes to Rs 19,065 per acre in which Rs 14,913 is variable cost and Rs 4,151 goes towards fixed cost. The cost per kg of yield works out to be Rs 9.31 and as the price of paddy received by the farmer is Rs 6 per kg, he incurs a loss of Rs 2.65 per kg. Since the farm management concept used here allows us to include the imputed cost in the cultivation of the crop, farmers do not feel the pinch of the loss incurred.

Table 3.7: Economics of sweet flag (acorous calamus) cultivation

Sl. No	Cost of cultivation	Quantity		Value (Rs.)	
		Per acre	Per farm	Per acre	Per farm
A	<i>VARIABLE COST</i>				
1	Planting material	93.4	71.92	1148.82	884.59
2	Farm Yard Manure (FYM)	5.57	4.29	1392.50	1072.23
3	Chemical Fertilizer				
a)	Urea	1	0.77	560.00	431.20
b)	DAP	0.47	0.36	352.50	271.43
c)	17:17:17 or any other	0.31	0.24	254.20	195.73
4	Labour				
a)	Male	189.40	145.84	18940.00	14583.80
b)	Female	134.61	103.65	6730.50	5182.49
c)	Bullock pair	3.09	2.38	927.00	713.79
d)	Machine labour	1.26	0.97	567.00	436.59
5	Amortized cost of irrigation	-	-	4969.74	3826.70
6	Packing material, packing, loading, trans.	-	-	588.63	453.25
7	Interest on working capital (% per annum)	-	-	3727.85	2870.45
	Total variable cost	-	-	40158.75	30922.23
B	<i>FIXED COST</i>				
8	Rental value of land	-	-	3446.00	2653.42
9	Depreciation	-	-	1271.83	979.31
10	Total fixed cost	-	-	4717.83	3632.73
11	Total cost	-	-	44876.58	34554.96
C	<i>OUTPUT AND NET RETURNS</i>				
12	Yield of main product(Kgs)	-	-	-	2709
13	Price per kg	-	-	21.94	21.94
14	Gross returns	-	-	77185	59432.39
15	Total cost of cultivation	-	-	44288	34101.72
16	Net returns over variable cost	-	-	33166.93	25538.53
17	Net returns over total cost	-	-	28449.10	21905.81
18	Cost of production per kg	-	-	12.76	9.82
19	Net returns over variable cost per kg	-	-	-	7.26
20	Net returns over total cost per kg	-	--	-	6.23
21	Returns per rupee over variable cost	-	-	-	1.48
22	Returns per rupee over total cost	-	-	-	1.32
23	Commission @ 5 % payable to commission agents	-	-	3859.25	2971.62

Source: Primary survey

Table 3.8: Economics of cultivation of paddy

Sl. No	Variable cost	Quantity		Value (Rs.)	
		Per acre	Per farm	Per acre	Per farm
A	<i>VARIABLE COST</i>				
1	Seed material	28.31	49.54	141.55	247.71
2	Farm Yard Manure (FYM)	4.97	8.70	1242.50	2174.38
3	Chemical Fertilizer				
a)	Urea	1.3	2.28	728.00	1274.00
b)	DAP	0.45	0.79	337.50	590.63
c)	17:17:17	0.53	0.93	434.60	760.55
4	Labour				
a)	Male	39.12	68.46	3912.00	6846.00
b)	Female	47.83	83.70	2391.00	4185.13
c)	Bullock pair	1.20	2.10	360.00	630.00
d)	Machine labour	0.87	1.52	391.50	685.13
5	Amortized cost of irrigation	42.01	73.52	3096.56	5418.97
6	Packing material, packing, loading, trans.	-	-	537.43	940.50
7	Interest on working capital (11% per annum)	-	-	1340.80	2346.40
	Total variable cost	-	-	14913.94	26.99.39
B	<i>FIXED COST</i>				
8	Rental value of land	-	-	3167.16	5542.53
9	Depreciation	-	-	984.36	1722.63
10	Total fixed cost	-	-	4151.52	7265.16
11	Total cost	-	-	19065.46	33364.55
C	<i>OUTPUT AND NET RETURNS</i>				
12	Yield of main product	-	-	2047.00	3582
13	Price per kg	-	-	6.00	-
14	Byproducts (Hay)	-	-	3.60	-
15	Price per cartload	-	-	375.00	-
16	Gross returns	-	-	13632	23856
17	Total cost of cultivation	-	-	18528	32424
18	Net returns over variable cost	-	-	-1281.94	-2243
19	Net returns over total cost	-	-	-5433.46	-9509
20	Cost of production per kg	-	-	9.31	-
21	Net returns over variable cost per kg	-	-	-0.63	-
22	Net returns over total cost per kg	-	-	-2.65	-
23	Returns per rupee over variable cost	-	-	0.91	-
24	Returns per rupee over total cost	-	-	0.72	-

Source: Primary survey

The price of sweet flag (acorous calamus) is Rs 21.94 per kg and the net returns over total cost are put at Rs 21,905.81 per acre and Rs 28,449.10 per farm. One can also notice that farmers are getting almost double the variable cost they incur in return. Another

factor that calls for attention in the table is the commission at five per cent paid to commission agents. Here per acre commission is more than the per farm commission. One can find in the table that for every rupee invested in the cultivation, the farmer gets a gross return of Rs 0.91 bearing a loss of Rs 0.09. It shows that though sweet flag needs more investment, the returns from it are better than paddy. We can see from the table that net returns from paddy is in the negative, and hence farmers are switching on to some other crops like sweet flag. One learns a few important lessons from the analysis above. First, sweet flag cultivation is a labour intensive activity and it generates more employment. Moreover, the returns per farm and per acre are quite attractive when compared to the competing crop and hence its acceptance is expected to increase. But as the demand is limited the area under sweet flag may not increase fast.

3.3. Economics of Patchouli (*Pogostemon cablin*)

Patchouli is a two-three foot perennial bush with purple flowers, a member of the mint family native to the East and West Indies. The Kolar region is bestowed with diverse agro-climatic conditions. These conditions help in the introduction, acclimatisation, and cultivation of a number of aromatic plants with minimum efforts. There are a few commercial crops, which can be cultivated without disturbing the existing condition and have the potential to establish themselves as cash crops in this region. Patchouli oil is used as a base in many of the aromatic preparations and scents. It is used to control diarrhoea, vomiting, obesity and anxiety. It is used as a base in the creams for skin cracking.

3.3.1. General Features of the Cultivators of Patchouli

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The crop is quite common in Kolar district and is usually grown on well drained soil. Unlike sweet flag, patchouli does not require much maintenance. It can be cultivated as an intercrop or pure crop, and planting can be done at any time, except in the summer months. Patchouli cultivation requires preparation of land, levelling and ploughing twice. The labour component is not as high as in sweet flag. The crop requires farmyard manure and control of nematodes. It is harvested as cuttings and the harvest can be done every month 3-4 times. The crop requires protective irrigation and demands labour only while planting and harvesting.

Table 3.9: General features of crop growers: patchouli

Sl.No.	Items	Unit	Average	Explanations
1	Age (H H)	Years	43.2	Average age of the head of the household
2	Size of the family	Number	3.86	Average size of family
3	Education level			
4	(a) Illiterate	Number	8	Average No. of Illiterate family members per H H
5	Literate			
6	(a) Primary school	Number	8	Same as above for different levels (average No. Per family)
7	(b) High school	Number	23	
8	(c) College	Number	9	
9	(d) Degree	Number	2	

Source: Primary Survey

Patchouli has been identified as an essential oil bearing aromatic qualities with an immense export potential. Patchouli oil production could be a rural based, labour saving, low cost agro-base cottage industry, which will give large-scale employment in rural and hilly areas. Patchouli, being a shade loving plant, can easily be grown as an intercrop amidst fruit trees, arecanut, coconut plantation, etc. It can also be easily cultivated in flood free fallow or wastelands. This will provide some extra income for farmers. Table 3.9 reveals the general features of the household in our study area, Kolar. The average age of the head of the household is around 43.5 years. Almost every household has an average four of members per family. The table also includes the level of education of a family. Around 16 per cent of family members are illiterate. Out of the literate, only 16 per cent are educated up to the primary level. Some 46 per cent reached till high school. And only 18 per cent went to college and four per cent pursued graduation. So the majority attained only secondary education. This situation is similar to that of sweet flag cultivators.

Table 3.10: General features of growers of tomato

Sl.No.	Items	Unit	Average	Explanations
1	Age (HH)	Years	44.05	Average age of the head of the household
2	Size of the family	Number	4.05	Average size of family
3	Education level			
4	(a) Illiterate	Number	4	Average No. of illiterate family members per HH
5	Literate			
6	(a) Primary school	Number	5	Same as above for different levels (Average No. Per family)
7	(b) High school	Number	5	
8	(c) College	Number	4	
9	(d) Degree	Number	2	

Source: Field survey data

Here we have taken tomato as a competing crop for patchouli. Tomato is the traditional crop in this area and many farmers are growing it. But because of uncertainty in the prices of tomato, farmers are searching for alternative crops that will provide returns at the same level. Table 3.10 shows the socio-economic features of growers of the competing crop tomato. The average age of the head of the household is around 44 years. The average size of the family is around four members. As for literacy, which is an important factor, the table reveals that of the total 20 per cent of the sample farmers are illiterate. But in the case of patchouli, this percentage is around 16. Around 25 per cent of tomato growers have gone up to the primary and high school levels, whereas, it is around 16 and 46 per cent respectively, in the case of patchouli growers. Tomato is a traditional crop of Kolar district and largely grown by farmers who have an exposure of the urban market. Kolar being a district close to Bangalore city, the demand for tomato comes from Bangalore consumers. The entire tomato production of Kolar district goes to Bangalore, and from there to many places. As the crop matures more or less simultaneously in all the fields, prices usually crash in the Bangalore market. That makes it difficult for farmers and at times they are compelled to throw the produce without going to the market because of the transportation cost. Patchouli has emerged as an aggressive alternative to tomato and is being adopted by farmers readily.

3.3.2. Land Holdings of the Patchouli Growers

Table 3.11 describes the land holdings of farmers from our study area, Kolar. In the sample, the household average land holding is 3.89 acre. Of which, 2.76 acre is rainfed,

which is around 71 per cent of total owned land. The percentage share of irrigated land in total land holding is 29. The crop for good yield requires partial sunlight and low water so the majority of dry land cultivation might not affect the yield much as in the case of sweet flag.

Table 3.11: Details of land holding of sample farmers: Patchouli

(In acres)

Particulars	Area (average per HH)	Percentage	Explanation
Total owned land	3.89	100.00	
Dry land	2.76	70.95	Percentage to owned area
Irrigated land	1.13	29.05	Percentage to owned area

Source: Field survey.

Table 3.12: Land holding of sample farmers of the competing crop: Tomato

(In acres)

Particulars	Area (Average per HH)	Percentage	Explanation
Total owned land	3.46	100.00	
Dry land	2.76	70.95	Percentage to owned area
Irrigated land	1.44	37.02	Percentage to owned area

Source: Field survey.

Table 3.12 details land holding of sample farmers of tomato. On an average, around 3.46 acre of total owned land is used by the sample household. In that around 2.76 acre of area is cultivated under rainfed condition, which consists of around 80 per cent of the total owned land. In the case of patchouli, it is around 71 per cent to the total owned land used for cultivation. Among the total land, around 1.44 acre or 37 per cent of land have irrigation facility. Patchouli growers use the same amount of land as tomato growers. But in order to comment on the use of resources we need to analyse the relative economics of the two crops.

3.3.3. Cost and Returns from Patchouli

The labour use per acre for patchouli and tomato are presented in tables 3.13 and 3.14, respectively. It can be seen from the tables that patchouli uses more labour, as compared to tomato. A large part of the labour use is for inland preparation and harvesting. Patchouli also uses larger bullock labour and machine labour, as compared to tomato. Totally, patchouli uses 109 man days of labour as against 52 man days in tomato and that creates employment of 57 man days per acre by adopting patchouli crop. In other words, this will provide income transfer of Rs 3,125 per acre to agricultural workers in the region. In addition, patchouli cultivation requires more women labour, as compared to tomato, women labour is required for the harvesting, planting and sowing. The tables make it very clear that cultivation of patchouli is more labour-intensive and provides a larger income spread effect in the area than the traditional tomato crop.

Table 3.13: Labour use in patchouli cultivation

Sl.No	Operation wise labour	Per acre				Per farm			
		M	W	Bp	Mp	M	W	Bp	Mp
1.	Land preparation	11.06	5.77	1.18	0.92	12.50	6.52	1.33	1.04
2.	Fym/compost-	3.38	2.32	0.00	0.00	3.82	2.62	0.00	0.00
3.	Planting/sowing	21.68	20.94	0.00	0.00	24.50	23.66	0.00	0.00
4.	Chemical fertilizer	8.88	8.37	0.00	0.00	10.03	9.46	0.00	0.00
5.	Weeding - manual	10.85	17.40	0.00	0.00	12.26	19.66	0.00	0.00
6.	PPC	4.21	0.00	0.00	0.00	4.76	0.00	0.00	0.00
7.	Irrigation	11.45	0.00	0.00	0.00	12.94	0.00	0.00	0.00
8.	Harvesting	21.24	29.93	0.00	0.00	24.00	33.82	0.00	0.00
9.	Processing	8.48	14.64	0.00	0.00	9.58	16.54	0.00	0.00
10.	Packing	4.65	0.00	0.00	0.00	5.25	0.00	0.00	0.00
11.	Transportation	3.13	0.00	0.00	0.00	3.54	0.00	0.00	0.00
	Total	109.01	99.37	1.18	0.92	123.18	112.29	1.33	1.04

Note: M – Male; W – Women; Bp – Bullock Power; Mp – Machine Power, Based on Field survey
Fym – Farm Yard Manure

One of the important components of work in patchouli cultivation is labour intensive, planting and sowing. This is a very important activity for patchouli, because it needs partial sunlight and moist conditions for better and healthy growth. If we look at our sample farmers, we see that they use around 22 and 21 male and women workers per acre respectively. Per farm uses approximately 24.5 and 24 male and women labour respectively. No farmer has used bullock or machine power for this reason. For weeding and manual operations, the labour usage is around 11 male and 18 women.

Table 3.14: Labour use in the cultivation of tomato

Sl No	Operation wise labour	Per acre				Per farm			
		M	W	Bp	Mp	M	W	Bp	Mp
1.	Land preparation	0.83	0.00	1.01	0.79	1.20	0.00	1.45	1.14
2.	Fym/compost-transportation and application	3.26	3.96	0.00	0.00	4.70	5.70	0.00	0.00
3.	Planting/sowing	4.62	8.16	0.00	0.00	6.65	11.75	0.00	0.00
4.	Chemical fertiliser	5.38	6.88	0.00	0.00	7.75	9.90	0.00	0.00
5.	Weeding - manual	4.06	8.72	0.00	0.00	5.85	12.55	0.00	0.00
6.	Irrigation	16.28	0.00	0.00	0.00	23.44	0.00	0.00	0.00
7.	Harvesting	11.25	17.74	0.00	0.00	16.20	25.55	0.00	0.00
8.	Packing	2.28	6.35	0.00	0.00	7.60	9.15	0.00	0.00
9.	Marketing	1.77	0.00	0.00	0.00	2.55	0.00	0.00	0.00
	Total	52.74	51.81	1.01	0.79	75.94	74.60	1.45	1.14

Note: M – Male ; W – Women ; Bp – Bullock Power ; Mp – Machine Power; Field survey.

Table 3.14 gives details of labour employed in the cultivation of the competing crop, tomato. The table highlights that for tomato growers there is an overall need of around 53 and 52 days of male and women workers respectively with some bullock and machine powers. Ironically, although tomato needs less labour, it produces lower returns than patchouli. Around 11 male and 18 female labours are needed for harvesting. A major share of the labour was employed towards irrigation, comprising 16 man days per acre and 23 man days for per farm. For manual weeding around four man days and nine women days are required per acre. The application of chemical fertilisers needs around five male and nine women days and eight and 10 male and women days for per acre and per farm respectively. Packing and marketing needs around 14 per cent of male and 20 per cent of women workers to the total labour days.

Once the material is harvested, there is the critical issue of drying the harvested material. This processing is another area where the patchouli farmer uses more labour.

Table 3.15: Economics of the cultivation of patchouli

Sl.No	Variable cost	Quantity		Value (Rs.)	
		Per acre	Per farm	Per acre	Per farm
A	<i>VARIABLE COST</i>				
1	Planting material	11952.21	13506.00	23904.42	27011.99
2	Farm Yard Manure (FYM)	2.88	3.25	792.00	984.96
3	Chemical Fertiliser				
a)	Urea	0.53	0.60	280.90	317.42
b)	MOP	0.12	0.14	67.20	75.94
c)	20:20:20	0.16	0.18	155.20	175.38
d)	Ammonium sulphate	0.32	0.36	201.60	227.81
4	PPC-Monophrotopus	1.29	1.46	171.57	193.87
5	Labour				
a)	Male	109.01	123.18	6540.60	7390.88
b)	Female	99.37	112.29	3477.95	3930.88
c)	Bullock pair	1.18	1.33	354.00	400.02
d)	Machine labour	0.92	1.04	239.20	270.30
6	Amortised cost of irrigation	15.48	17.49	4568.61	5162.53
7	Packing material, packing, loading, trans.	-	-	237.14	267.97
8	Interest on working capital (% per annum)	-	-	4508.94	5095.11
	Total variable cost	-	-	45499.34	51414.25
B	<i>FIXED COST</i>				
9	Rental value of land	-	-	2471.26	2792.52
10	Depreciation	-	-	447.28	505.43
	Total fixed cost	-	-	2918.54	3297.95
	Total cost	-	-	48417.88	54712.20
C	<i>OUTPUT AND NET RETURNS</i>				
11	Yield of main product	-	-	2434.00	1874.00
12	Price per kg	-	-	20.00	20.00
13	Gross returns	-	-	48680.00	37483.60
14	Total cost of cultivation	-	-	48180.74	54444.23
15	Net returns over variable cost	-	-	3180.66	2449.11
16	Net returns over total cost	-	-	262.12	201.84
17	Cost of production per kg	-	-	19.89	15.32
18	Net returns over variable cost per kg	-	-	1.31	1.01
19	Net returns over total cost per kg	-	-	0.11	0.08
20	Returns per rupee over variable cost	-	-	1.07	0.82
21	Returns per rupee over total cost	-	-	1.01	0.77
22	Commission @ % payable to commission agents	-	-		

Source: Field survey

Patchouli requires 2-3 cutting and should be dried in a proper way. In our sample area, around eight and 15 male and women labour respectively are used per acre for this operation alone. Here what is noticeable is that more women are employed in this operation. While for transportation, packing and compost-transportation put together around 10 per cent of male and two per cent of women labour is used.

In patchouli cultivation the major cost component is planting material, which takes up around 52.54 per cent of the total variable cost and 49.37 per cent of the total cost. The second major expenditure is labour, which takes up around 20.69 per cent of the cost per acre and per farm. Irrigation and interest on the working capital comprise the next major expenditure each amounting to around 10 per cent of total expenditure. The total cost per acre considering both the fixed and variable cost comes up to Rs 48,417.88 for per acre and Rs 54,712.20 per farm. Yield always determines the selection of a crop and so it is necessarily to look at the net returns. The net returns over variable cost per acre is Rs 3,180.66 and per farm is Rs 2,449.11 whereas the net returns over total cost is just Rs262.12 per acre and Rs 201.84 per farm. The cost of production per kg is Rs 19.89 per acre and Rs 15.32 per farm. Coming to net returns over the total cost, it is Rs 0.11 and 0.08 per acre and per farm respectively.

Table 3.16 throws light on the economics of the cultivation of tomato. It can be seen from the table that the total cost of cultivation per acre is Rs 16,945.19, a meagre sum when compared to the total cultivation cost of patchouli per acre. It is only 34.99 per cent of the total cost of patchouli cultivation. This cost economy comes from the fact that for tomato planting material costs less and labour costs just half of that for patchouli. The major head of cost for tomato is labour amounting up to 29.4 per cent of the total cost of cultivation per acre. The next major expenditure is irrigation, which amounts to around 28 per cent of total cost. And the interest on capital is the third major expenditure. However, the yield and price per kg for tomato crop is lesser than patchouli, and hence, the gross returns amount to only Rs 6,864.50 per acre and Rs 5,285 per farm, making the net returns negative. And the returns per rupee over total cost in the table shows that farmers are incurring a net loss of their investment, which has made more and more farmers to shift to patchouli.

Table 3.16: Economics of the cultivation of tomato

Sl. No	Variable cost	Quantity		Value (Rs.)	
		Per acre	Per farm	Per acre	Per farm
A	<i>VARIABLE COST</i>				
1	Seed material	0.10	0.14	100.00	144.00
2	Farm Yard Manure (FYM)	5.26	7.57	1315.00	1893.60
3	Chemical Fertiliser				
a)	Urea	0.82	1.18	459.20	661.25
b)	DAP	0.42	0.60	315.00	453.60
4	Labour				
a)	Male	52.74	75.95	3164.40	4556.74
b)	Female	51.81	74.61	1813.35	2611.22
c)	Bullock pair	1.18	1.70	354.00	509.76
d)	Machine labour	0.92	1.32	230.00	331.20
5	Amortised cost of irrigation	12.38	17.83	4454.57	6414.58
6	Packing material, packing, loading, trans.	-	-	568.06	818.01
7	Interest on working capital (11% per annum)	-	-	1405.09	2023.34
	Total variable cost	-	-	14178.68	20417.29
B	<i>FIXED COST</i>	-	-		
8	Rental value of land	-	-	2384.67	3433.92
9	Depreciation	-	-	381.84	549.85
10	Total fixed cost	-	-	2766.51	3983.77
11	Total cost	-	-	16945.19	24401.07
C	<i>OUTPUT AND NET RETURNS</i>	-	-		
12	Yield of main product	-	-	1372.90	1057
13	Price per kg	-	-	5.00	5.00
14	Gross returns	-	-	6864.50	5285.67
15	Total cost of cultivation	-	-	16377.13	23583.06
16	Net returns over variable cost	-	-	-7314.18	-5631.92
17	Net returns over total cost	-	-	-10080.69	-7762.13
18	Cost of production per kg	-	-	12.34	9.50
19	Net returns over variable cost per kg	-	-	-5.33	-4.10
20	Net returns over total cost per kg	-	-	-7.34	-5.65
21	Returns per rupee over variable cost	-	-	0.48	0.37
22	Returns per rupee over total cost	-	-	0.41	0.31

Source: Field survey

3.4. Relative Economics of the Selected Medicinal and Aromatic Crops

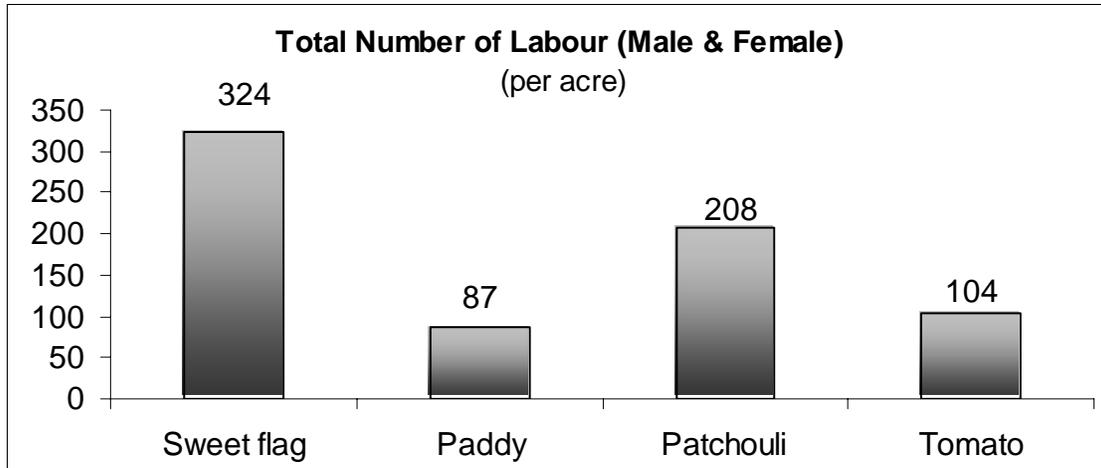
Relative economics of the crops can be studied from five perspectives. First, it is essential to compare the suitability of the crop in region and its relative advantages as far as natural sources are concerned. In order to do this, one has to choose the crop, along with the competing crop, which requires almost similar climatic conditions and resource base. In this study, we have chosen sweet flag and patchouli as the medicinal and aromatic crops as these two have been cultivated as pure crops in Karnataka. In order to

work out the relative economics of the crops, we have taken paddy and tomato as the competing crops, which are grown in similar soil and agro-climatic conditions. It is in the recent past that sweet flag and patchouli have started replacing paddy and tomato aggressively. Second, the relative economics has to be checked on the count of natural suitability and negative externalities of the selected commercial crop. It was noted that sweet flag and patchouli are most suited to the natural conditions of the selected districts. In addition, these crops also have medicinal values, and therefore, are being used by local practitioners. Third, generation of employment in rural areas is one of the major policy initiatives for the development of rural areas. In the context of labour absorption, both the crops play an important role and that is the count on which the relative economics has to be worked out. Fourth, in any process of production and one looks at the total cost and the working capital. If the need for working capital is very high, it is difficult to make the crops acceptable among farmers who have fragile liquidity. The last count of relative economics works more effectively in the process of decision making of the farmer. That is the last count on which relative economics actually operates. One must look into the income generated per unit of working capital, as well as per unit of the total cost incurred in the process of production. Here we try to look into all these four aspects to understand the relative economics of the crop.

Patchouli and sweet flag, the crops which are suited in Tumkur and Kolar district of Karnataka. Farmers are cultivating these crops after a conscious decision and the market is increasing aggressively. The crops are quite suitable to the agro-climatic conditions of the districts and do not exert any externalities in terms of environment or ecology. In the recent past, it has been noted that the prices of the crops traditionally grown in these two districts have been suppressed due to market forces. That has significantly reduced the income flow to the farmers and the distress has been quite visible. Patchouli and sweet flag are directly linked with the market and commission agents purchase the entire production at the farm gate. Prices are assured and are sufficiently high, and the demand is increasing. Therefore the cultivation of the crop is quite conducive. We have presented in figure 3.1, the number of labour days required per acre for sweet flag and patchouli as against paddy and tomato. It can be noted that sweet flag uses 324 mandates, as against 87 mandates required for paddy. That generates 237 mandates of additional employment and an income of Rs 15,405 to agricultural labourers in the region. In the case of patchouli, the additional employment generated is 104 mandates, and that provides an

additional income of Rs 6,760 to the agricultural work force. This spillover effect of income generation for the agricultural labourer has been an added attraction

Figure 3.1: Labour used for the medicinal and aromatic crop vs the competing crop



Output and returns per acre of the crop are indicators that provide the final test in the study of crop economics. In figure 3.2 and 3.3 we have provided the variable cost and fixed cost incurred in the cultivation of patchouli and sweet flag. In order to make the comparison very clear and what is also given is the total variable cost and fixed cost of the competing crops. As far as sweet flag is concerned, the variable cost is Rs 40,158, as compared to Rs 14,914 for paddy. That means an increment of Rs 25,245. In the case of patchouli, this difference is much higher, and one acre of patchouli needs an investment in terms of labour cost of Rs 45,499, as against Rs 14,178 for tomato which means an additional requirement of Rs 31,321 per acre for patchouli. In both the cases, the variable cost is quite high, and the farmer meets that through the advance payment received from the contractor or commission agent. Some of the farmers even borrow from institutions in order to meet the variable cost. As far as the fixed cost is concerned, the difference between sweet flag and paddy or patchouli and tomato is not very large. Therefore, on the cost side, both sweet flag and patchouli require a sizeable amount of investment, and that has to be met by the contractor or commission agent. In terms of gross returns, we find that sweet flag generates to the tune of Rs 59,432 as against Rs 13,632 for paddy. That leaves a net surplus of Rs 45,800 when one acre of paddy land is converted to sweet flag cultivation. In other words, sweet flag generates Rs 1.47 per rupee of investment, as against Rs 1.09 for paddy. For patchouli cultivation, the total variable cost is Rs 45,499 as against the gross returns of Rs 48,680. That does not leave a substantial surplus per acre with the farmer after the fixed cost is deducted.

Figure 3.2: Output and returns and cost per acre:

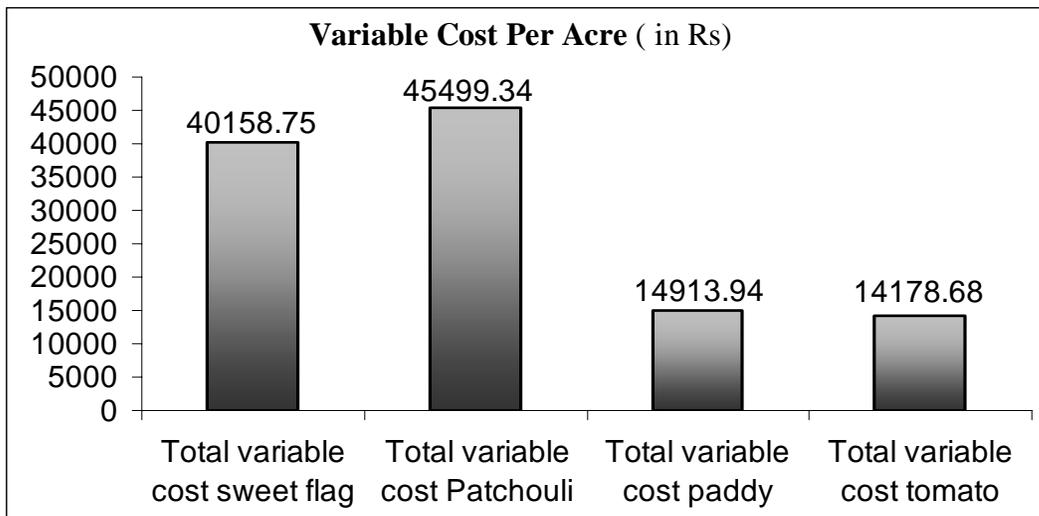
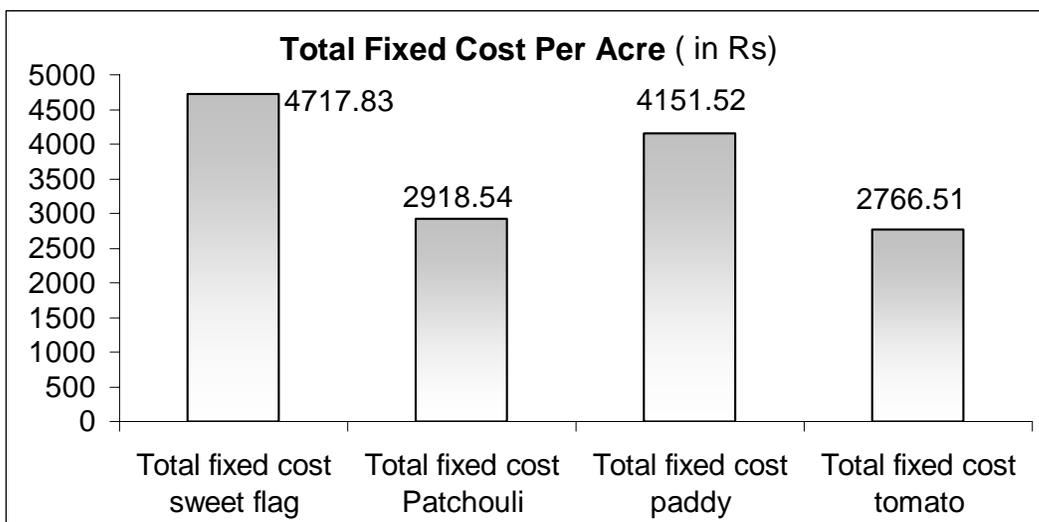


Figure 3.3



The cultivator growing patchouli earns about Rs 1.07 per rupee invested in its cultivation. But interestingly, if a cultivator decides to shift from tomato to patchouli, the incremental additional gross income is about Rs 41,816. In fact, it is due to the low price received by tomato growers that the gross income generated from patchouli is inflated substantially. Patchouli has a definite market and the commission agent or contractor purchases the entire crop. Purchasers also provide advance payment towards the crop, and the crop is harvested two to three times in the total season, which provides continuous income to the farmer. The cost of production per kilogram of sweet flag and patchouli

along with the competing crops are presented in figure 3.4. These are directly comparable with the prices received for the product and one finds that the returns are better in the case of sweet flag and patchouli as compared to paddy and tomato.

Figure 3.4

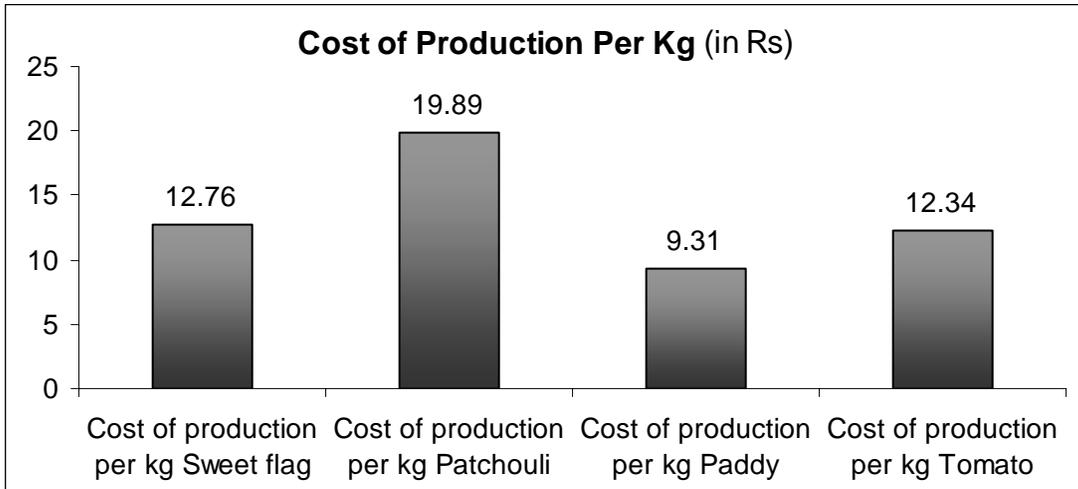
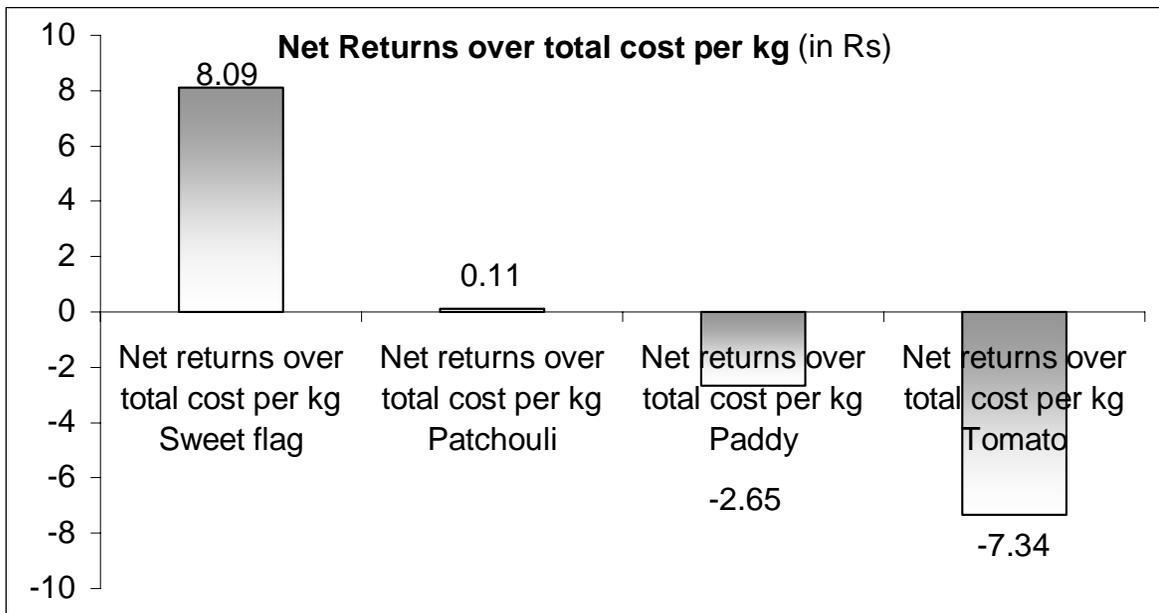


Figure 3.5



The net returns over the total cost per kilogramme are presented in figure 3.5. It can be seen that sweet flag earns a farmer Rs 8.09 per kg as against a loss of Rs 2.65 per kg in paddy. The farmer does not feel the loss as a large part of the cost of cultivation is

computed on the basis of imputed values and therefore, the farmer only calculates the paid out costs and more or less breaks even in the cultivation of paddy. Patchouli does not give one very high returns per kg and it is only Rs 0.11 but if that is juxtaposed against the loss usually incurred in the cultivation of tomato which is to the tune of Rs 7.34, the farmer is better off in cultivating this crop. Moreover, patchouli provides income at three distinct points depending on the time of harvest.

3.5. Conclusions

The related economics of patchouli and sweet flag, very clearly, brings out a few important points. First, it is evident that some of these commercial crops, specifically in the medicinal and aromatic crop group, have been making headway in the traditional crop pattern. The emergence and increase of area under these crops is mainly due to the demand increase rather than supply induced acceptance. Patchouli and sweet flag are quite highly in the demand in Ayurvedic medicines. Contractors and commission agents provide incentives by purchasing the material in advance and giving loans for the cultivation of the crop. At times, they also provide some of the latest know-how and inputs without any hassles. Second, the crops are well-suited in the agro-climatological conditions of the region, and that makes them easily acceptable to farmers. The demand on natural resources is also extremely limited, and therefore, these crops have proliferated in rural areas. However, the demand constraint will always limit their spread, as well as the participation of farmers in the cultivation of these crops. Third, sweet flag as well as patchouli have a significant employment generation effect and the cultivation of these crops helps to transfer a significant amount of income to the agricultural labourer. Therefore, the labourer is also happy to work on their fields. Fourth, even though the variable cost is high, it is largely met by commission agents or contractors. At times the farmer has also approached commercial banks to borrow crop loans. The per acre gross income generated out of the two crops is quite substantial to attract the farmer and even the returns to investment are lucrative. Therefore, it will not be erroneous to say that the area under these crops in these two districts will increase substantially in the coming few years, albeit constrained by the demand factors.

CHAPTER IV

MOTIVATIONAL FACTORS AND THE PROCESS OF DECISION- MAKING

4.1. Introduction

Demand for the crop material of patchouli and sweet flag is a derived demand and that is based on Ayurvedic medicines. This has increased substantially during the recent years due increased dependence on Ayurvedic medicines. The dramatic increase in exports of medicinal plants in the past decade upholds the worldwide demand for these products as well as in traditional health systems. The experience of the last decade shows that Indian exports of medicinal plants has trebled. But, as these plants are predominantly of forest origin, most of it is harvested unsystematically without much attention being paid to the environmental implications. Hundreds of species are now threatened with extinction because of over-harvesting, unscientific collection techniques, and conversion of traditional plant habitats to crop-based agriculture. Open access to medicinal plants in the wild is perhaps one of the main reasons for the current unsustainable levels of harvesting. India's traditional medical systems are part of a time-honoured and time-tested culture that has become popular today due to its holistic approach. Ayurvedic texts provide specifications with regard to their formulations. But in addition to that, the text also provides plant features, the precise identity of the plant, region/micro habitat from where it is to be obtained, acceptable substitutes, as well as the general standards for multi-ingredients and multi processing. Most importantly texts like *Bhrugu Samhita*, *Sharangdhar Samhita*, *Charak Samihita* also give strict instructions about the harvesting and processing of the herbs. Even the time and procedure of harvest has been detailed in the texts. However, the contemporary processing hardly respects any form of institutional norms as these have to be self-disciplinary and do not ensure that the given specifications are met.

In economics the motivational factors and the decision-making are analysed with the help of the concept of expectations. Any production process begins with *a priori* expectations about the outcome and that forms the basis of the incentive to undertake such a process. The expectations about an outcome are formed by the past experience and/or the structural conditions in the market. The Nerlovian supply response theory is built around this theoretical platform where price expectations (P^*) are taken as the main variable determining supply. However, not much has been done about the supply response

at micro level (Deshpande, 1995). The difficulties are two fold; first, the theory of Nerlovian equation is not easily modifiable at the micro level, and second, the micro level variables are numerous as well as interdependent that makes it difficult to model the behaviour. We are concerned here about the factors that enter the decision-making calculus of the farmer who cultivates medicinal crops in preference to the traditional seasonal crops.

Economic incentives can be easily grouped into factors that cause the 'push effect' or the 'pull effect'. 'Push effects' are wealthy traditional economic activities in the present context, the cultivation of paddy or tomato has significant disadvantages and these essentially cause distress to the farmer. Under the 'push effects', the current production activity is either economically non-viable or difficult to undertake with the availability of resources. In such a situation, the cultivator is pushed out of the present production system and tries to accept whatever is available as the next best alternative. In such a situation, it is not necessary that the cultivator chooses the high pay off production activity, but even satisfies with the marginal gains in the new production activity. 'Pull effects', on the other hand, provoke the farmer to adopt a new cropping activity based on the high incremental income and/or ease in the production process. The hidden uncertainties are usually not considered very seriously, and at times the cultivator has to retract later. 'Pull effects' are usually guided by higher income opportunities, the availability of new material and know-how, and usually the demonstration effect.

4.2 Motivating Factors for Sweet Flag (*Acorous Calamus*)

Sweet flag is an emerging crop and has been well-accepted by farmers. Any crop gains popularity among growers for three reasons. The availability of inputs and the planting material, the ease in cultivation and the net income generated. We ascertained the farmers' responses about the motivational factors. It comes out clearly that the ease in farming (should also be read as the low cost of cultivation), is the main deciding factor for farmers to take up sweet flag cultivation.

Table 4.1: Motivating factors for undertaking cultivation of Sweet flag

Sl. No	Particulars	Number of farmers	Percentage
1.	Easy available of inputs and easy to grow	23	46
2.	Assured market	7	14
3.	Good price	7	14
4.	Low cost of cultivation	5	10
5.	Other farmers in the village are growing	3	6
6.	Has good demand	5	10

Source: Field data

The motivating factors for sweet flag are divided into six components. These include easy available of inputs and easy to grow, financial assistance, favourable weather condition, water availability and the low initial cost of investment in sweet flag. Growing period of this crop is short but it needs more labour. Therefore, this factor is a significant incentive for undertaking sweet flag cultivation. Out of total growers, about 46 per cent felt that the ease in cultivation was the major factor dominating their decision. The cultivation of sweet flag is not as tedious as paddy and thus acceptance has been quite spontaneous. Among the other factors that govern the cultivating decision are 'good price' and 'marketing facility' both scoring 14 per cent. Demand in the market for the produce is also an important factor that has prompted farmers to undertake its cultivation. Therefore, among the 'pull effects' what is noteworthy are ease in cultivation, an assured market and a good price.

The trading season for sweet flag ranges between March and May every year. This matches with the harvesting season of the crop. Among the different channels, 80 per cent of sweet flag is sold through the first channel, namely cultivator-trader-commission agent – final destination to processing unit. Only four traders in the Tumkur market purchase about 110 quintals of sweet flag. Even though dried sweet flag can be stored for as long as one year without it affecting the quality most farmers prefer selling their crop immediately after the harvest due to the need for immediate cash and also lack of sufficient storage space. Sweet flag cultivators not only face the problem of selling the crop at a price, that is lesser than what is prevailing in the market, but also give higher commission and suffer delay in payment. Even then the pay off incentive being quite high, farmers are not deterred from cultivating sweet flag.

Table 4.2: Factors prompting farmers to shift area from under paddy

SI No	Particulars	Percent of respondents by ranks given						
1.	Price of the other crop is higher than paddy	50.0	10.0	10.0	15.0	10.0	5.0	0.0
2.	Large market margins and less profits	5.0	20.0	25.0	15.0	25.0	10.0	0.0
3.	Problems of pest and disease	15.0	45.0	20.0	10.0	5.0	5.0	0.0
4.	Problems in marketing	15.0	5.0	25.0	10.0	15.0	20.0	10.0
5.	Price fluctuations	5.0	0.0	5.0	15.0	35.0	15.0	25.0
6.	It is tedious to grow	10.0	20.0	10.0	35.0	5.0	20.0	0.0
7.	Inadequate knowledge	0.0	0.0	5.0	0.0	5.0	25.0	65.0

Source: Field survey.

Paddy being the competing crop for sweet flag, it will be interesting to know the 'push factors' in the play here. The factors that prompt farmers to shift area under paddy to other crops have been ascertained here. A large proportion of respondents gave preference to 'the price effect' (50%) followed by respondents who perceived the problems of pest and disease in the crop as the major threat. 'Inadequate knowledge about the technology' is the one of the main reasons and it scores 65 per cent score. Many have said it is tedious to grow medicinal plants and price fluctuations also play a significant role.

Table 4.3: Farmers' reasons for bringing more area under the paddy

SI No	Particulars	Percent of Respondents by Ranks given						
1.	Easy market channels	50.0	10.0	15.0	15.0	10.0	0.0	
2.	Government schemes	30.0	5.0	20.0	20.0	10.0	15.0	
3.	Price of medicinal / aromatic crops is lower	10.0	30.0	25.0	25.0	10.0	0.0	
4.	No problem of pest and diseases	10.0	25.0	30.0	5.0	20.0	10.0	
5.	Drought tolerance	0.0	10.0	10.0	25.0	35.0	20.0	
6.	Used as food crop	0.0	20.0	0.0	10.0	15.0	55.0	

Source: Field survey

Another way of looking to increase the popularity of medicinal crops is to understand the factors that govern the farmers decision in increasing area under paddy. Factors mentioned in table 4.3 indicate the other side of the story, namely the factors that sustain the cultivation of paddy. These are similar to those of sweet flag. The first reason is the obvious fact about the easy market channels (50%). It is true that the established and assured market channels help in bringing in more area under cultivation of any crop,

whether it is paddy or sweet flag. Increase in area can also take place through the various Government schemes, and that scores a positive nod of about 30 per cent of the respondents. The acuteness of the problem about pests and diseases (30%) also play a deciding role but that does not have a high score. In totality, we find graded preference of the respondents for a particular crop is largely guided by market forces, followed by technological and cultivation practices.

In order to sustain the area under sweet flag, it will be essential to ascertain the factors that provoke farmers to shift away from the cultivation of this crop. We tried to look into these factors and listed about seven factors after consultation with farmers. It was noted that the price and the profit margin is a predominant factor in the decision making. Problems of marketing and price fluctuations also occupy an important role. But farmers seem to have better knowledge about cultivation of the crop, and therefore, that receives the last rank. Similarly, cultivation practices and price fluctuations do not significantly affect the farmer's decision, but the price differential with the competing crop certainly makes a difference. These factors indicate the 'push effects' from sweet flag. In totality in the present field conditions, the combination of 'push effects' and 'pull effects' work together in the shift of area towards sweet flag. But the most dominating features include the price and the assured market.

Table 4.4: Factors that provoke farmers' to shift area away from sweet flag

Sl.No	Particulars	Per cent of Respondents by Ranks Given						
		1	2	3	4	5	6	7
1.	Price of the other crop is higher	16.0	44.0	24.0	8.0	6.0	2.0	0.0
2.	Large market margins and less profits	30.0	12.0	12.0	18.0	18.0	8.0	8.0
3.	Problems of pest and disease on the crops	8.00	20.0	24.0	30.0	4.0	12.0	2.0
4.	Problems in marketing	20.0	12.0	12.0	16.0	18.0	20.0	2.0
5.	Price fluctuations	24.0	10.0	10.0	4.0	8.0	30.0	14.0
6.	It is tedious to grow the medicinal crops	2.0	0.0	18.0	26.0	38.0	12.0	4.0
7.	Inadequate knowledge	2.0	2.0	0.0	6.0	6.0	14.0	70.0

Source: Field survey

4.3. Motivating Factors for Patchouli (*Pogostemon cablin*)

Patchouli is an important aromatic crop, and it differs significantly from sweet flag. Patchouli has been identified as one of the essential oil bearing aromatic plant, with immense export potential. The cultivation of patchouli is largely in and around Mangalore. Being an aromatic crop, it can be processed at the field itself, and requires simple oil extraction process. The crop is harvested 3-4 times in the crop season, and therefore

provides income at each time of harvest. Leaves of the plant have to be harvested and the commission agent or the contractor purchases the harvest itself. The crop does not require as much care as the competing crop of tomato. Tomato cultivation, in other words, is quite tedious as compared to patchouli. Therefore, acceptance of patchouli has been quite good, but as there are not many contractors and commission agents, farmers do not get a competitive price. Moreover, there are no oil extraction units in the area and the farmer is not keen on taking a lead in establishing oil extracting unit.

As can be seen from table 4.5 that three factors [Easy available of inputs and easy to grow (24%), market nearness (24%) and a good price (26%)] dominate the decision-making process. Out of 50 farmers, 13 farmers said that good price for Patchouli was the main motivating factor. Cost of cultivation has not been one of the main motivating factors. It is seen that the cost of cultivation of patchouli is high. Farmers cultivate patchouli primarily because of a good price, the demand, proximity to the market, and the availability of inputs, rather than any demonstration effect.

Table 4.5: Motivating factors for taking up cultivation of patchouli

Sl.No	Particulars	Number of farmers	Percentage
1.	Easy available of inputs and easy to grow	12	24
2.	Market proximity	12	24
3.	Good price	13	26
4.	Low cost of cultivation	0	0
5.	Other farmers in the village are growing	5	10
6.	Has good demand	8	16
	Total	50	100

Source: Field survey

We have seen the motivating factors as given by the respondents however, the influence of these factors is graded. Therefore, we have decided to collect the graded responses of the respondents about the factors governing the acceptance of patchouli as an alternative to tomato. The respondents were asked to rank the factors that push them away from growing tomato. The problems of pests and diseases seemed to be the most dominating factor, in addition to the low prices, market margins and price fluctuations. Farmers also indicated inadequate knowledge about the varieties and the gradation system of tomato.

Table 4.6: Factors determining farmers' decision to bring more area under patchouli

SI No	Particulars	Per cent of Respondents by Ranks Given					
		1	2	3	4	5	6
1.	Established market channels	46.0	10.0	6.0	26.0	4.0	8.0
2.	Government schemes	26.0	10.0	16.0	24.0	20.0	4.0
3.	Price of crop is higher	8.0	40.0	30.0	14.0	4.0	4.0
4.	No problem of pests and diseases	10.0	18.0	34.0	12.0	10.0	16.0
5.	Drought tolerance	10.0	18.0	6.0	16.0	20.0	30.0
6.	Useful for oil extraction in my village	0.0	2.0	8.0	8.0	42.0	40.0

From table 4.7, it is evident that the respondents have given a lot of importance to 'easy market channels (46%); the second factor had been government schemes (26%). It is true that patchouli has a good and easy market access as well as government schemes that provide incentive to farmers. The high price of the crop and low incidence of pests and diseases have been the other factors for about 40 per cent and 30 per cent of the respondents, respectively. It is well known that Kolar district has large area under tomato and almost every year we face a glut in the tomato market. Therefore, if a processing plant of patchouli is available in the region, the crop will pick up substantially and provide good income to farmers.

Table 4.7: Factors that provoke farmers' to shift area under tomato

SI No	Particulars	Per cent of respondents by ranks Given						
		1	2	3	4	5	6	7
1.	Price of the other crop is higher than medicinal crop	25.0	20.0	25.0	15.0	0.0	10.0	5.0
2.	Large market margins and less profits	10.0	20.0	15.0	20.0	35.0	0.0	0.0
3.	Problems of pest and disease on the crops	55.0	10.0	5.0	15.0	5.0	5.0	5.0
4.	Problems in marketing	0.0	20.0	25.0	10.0	10.0	5.0	30.0
5.	Price fluctuations	5.0	5.0	15.0	5.0	30.0	20.0	20.0
6.	It is tedious to grow medicinal crops	5.0	15.0	5.0	25.0	15.0	15.0	20.0
7.	Inadequate knowledge	0.0	10.0	10.0	10.0	5.0	45.0	20.0

Source: Field survey

Most of the area under patchouli has come from tomato. Traditionally, the Kolar region has been known for tomato and the crop is sold in the markets with large distances. However, there are quite a few factors now that have prompting farmers to shift area under the crop to other crops. The incidence of pests and disease (55%) emerges as the major factor that triggers the decision and patchouli has emerged as the immediate choice. Secondly, farmers indicated inadequate knowledge about the varieties and grading system (45%) as another prime reason. 'Large market margins and less profits' (35%) and 'price fluctuations' (30%) come as other important aspects.

Table 4.8: Factors determining farmers' decision to bring more area under Tomato

SI No	Particulars	Percent of respondents by ranks given					
		1	2	3	4	5	6
1.	Easy market channels	45.0	10.0	10.0	20.0	5.0	10.0
2.	Government schemes	30.0	10.0	5.0	25.0	20.0	10.0
3.	Price of medicinal/aromatic crops is higher	5.0	10.0	30.0	20.0	5.0	30.0
4.	No problem of pest and diseases	5.0	25.0	10.0	25.0	20.0	15.0
5.	Drought tolerance	5.0	35.0	10.0	5.0	30.0	15.0
6.	Useful for herbal medicines in many village	10.0	10.0	35.0	5.0	20.0	20.0

Source: Field survey

In Kolar district the area under patchouli is increasing, and this is being shifted from under tomato. This process has two angles; first, tomato has not been quite conducive for farmers to grow due to various factors and there are certain pull effects that provoke the farmer to transfer more area under patchouli. The other way of looking at this process is to locate the factors that also govern the cultivation of tomato and the factors governing decision-making at the micro level in the area allocation for tomato. We can see here in the table the factors determining the cultivation of tomato.

The determining factors are 'easy market channels' (45%), access to 'government schemes' and 'drought tolerance quality of the crop' (35%).

Table 4.9: Factors that provoke farmers to shift area away from patchouli

SI No	Particulars	Percentage of respondents by ranks given						
		1	2	3	4	5	6	7
1.	Price of the other crop is higher than medicinal crop	36.0	36.0	16.0	10.0	2.0	0.0	0.0
2.	Large market margins and less profits	12.0	22.0	20.0	16.0	18.0	6.0	6.0
3.	Problems of pest and disease on the crops	12.0	30.0	24.0	12.0	16.0	2.0	4.0
4.	Problems in marketing	12.0	4.0	12.0	12.0	22.0	24.0	14.0
5.	Price fluctuations	18.0	2.0	12.0	6.0	16.0	24.0	34.0
6.	It is tedious to grow the medicinal crops	10.0	6.0	10.0	38.0	12.0	20.0	4.0
7.	Inadequate knowledge	0.0	2.0	6.0	6.0	14.0	24.0	48.0

Source: Field survey.

From another point of view, we located the factors that provoke farmers to shift area away from patchouli. Quite expectedly, the relative price of the other crop becomes a prominent deciding factor, followed by market margins, price fluctuations and problems in the marketing. A sizeable number of farmers also indicated inadequacy of knowledge of cultivation of the crop but predominantly, it is the price and the market that govern the decision.

4.4. Conclusions

While understanding the motivating factors that govern the decision-making for area under patchouli and sweet flag, we have kept in mind the push and pull factors with respect to the competing crops. In the case of sweet flag, the area is being shifted from paddy, whereas patchouli gains area from tomato. It is in the recent past that this shift has taken place and it is not necessarily due to any scheme specifically focusing on the cultivation of sweet flag and patchouli. The trend has more to do with the assured market, relative price differential and ease in cultivation. The market channels for patchouli and sweet flag are well established. Largely, contractors and commission agents purchase the entire crop well in advance and this has been quite an attraction for farmers. Therefore, slowly and steadily contract farming has been increasing in the cultivation of these crops. Contract farming helps the farmer initially, however, as contractors get a hold on the market, the process of exploitation of the farmer begins. As yet that has not started in the study area, as the production is quite low and contractors find it difficult to collect the required quantity of the crops. Once a large number of farmers start growing sweet flag and patchouli, contractors will get an upper hand, and possibly at that time will begin exploitation of farmers by lowering the price and rejecting the produce on the pretext of quality. Therefore, a few things are essential as far as these crops are concerned; namely, the facility to process the crops and well drafted legal contracts so that farmers can benefit in the process. In the field, it was difficult to ask the farmer about contractors and the contract arrangement as the entire operation is quite personal between the farmer and the contractor. Farmers are also quite wary about divulging information to a stranger with the fear that the contractor may get offended. Therefore, most of the farmers reported that they sell directly to commission agents or contractors. One of the prime policy initiatives is to legalise the system and provide a safety net to the farmer in the case of contract arrangements.

Table 4.10: Factors that facilitate contract farming as opined by company

SI. No.	Particulars	No. of firms	Percentage to total
1.	Agro-climatic conditions	3	100.00
2.	Infrastructure facility	2	66.67
3.	Experience of the farmer	3	100.00
4.	Identification of loyal farmers	3	100.00
5.	Quality parameter	2	66.67
6.	Demand for the produce	3	100.00

Source: Field survey

CHAPTER V

PROBLEMS IN CULTIVATION AND MARKETING

5.1: Introduction

The problems faced by farmers in cultivating and marketing the medicinal crops could be understood from two angles. First, as the cultivation of medicinal crops is not yet so well established the problems faced by farmers do not come out clearly. When their density spreads it may face similar problems as that of the competing crops. Hence one can perceive the problems with the help of the competing crop. Second, the problems in cultivation and marketing are slowly emerging for these crops and these could be understood from the discussions with the stakeholders. As indicated earlier, the respondent cultivators were given open-ended as well as selected answers. We also had interviews with groups of farmers growing the medicinal crops. The problems could be classified into five groups. First, the constraints faced by farmers growing competing crops, so as to understand the background of shifting towards medicinal crops. If the parameters are not sustained, the favourable conditions get transformed into severe constraints. Second, the problems crop up in the process of cultivation. Farmers in the group meetings discussed these. It was quite clear that without a strong backup of a proper information system and technical know-how, the farmer might not reach the optimal productivity levels. Third, there are pests and diseases that afflict the crops and these are not necessarily the same as those affecting the seasonal crops. Fourth, medicinal crops are usually grown under forward a contract of purchase and the purchaser provides technology, inputs and cash advances for cultivation. That causes dependence of the farmer on the purchaser. Lastly, farmers cultivating the medicinal crops are in minority in the village and hence they cannot influence the market and prices. They are always at the receiving end, be it technology, input delivery, know-how or market access.

5.2: Understanding From Competing Crops

The constraints faced by farmers growing competing crops assume importance here from a different angle. It is these constraints that urge the farmer to shift away from the given crop towards an alternative crop. It is quite possible that the constraints may divert area towards any crop other than medicinal and aromatic crops, but in the present context, we have chosen farmers from the same regions and therefore, the ultimate crops are

sweet flag and patchouli. Price plays an important role in the farmer's decision-making. This has been theoretically strengthened in the literature on supply response, and the number of studies in the Nerlovian framework. We found that prices do matter, and the shift towards the crop is largely based on the price signals. Followed by this, is market margins.

Among the major factors that influence decision-making of the farmer in shifting away the area from under the traditional crop like paddy a few assume significant importance. High commission, imperfections in the wholesale market and harassment by and irrational directions play a significant role. In other words, it is the market failure that creates problems for farmers. The shift from the crop and the traditional crop pattern to a new crop takes place especially when the payoff in the new crop pattern is significantly high and there is an assurance of sustained payoff in future. All these could be seen, and expressed by farmers in the field. Along with these factors, harassment by the middleman also emerges as one of the important criteria in shifting away from traditional crops.

Table 5.1: Constraints faced by cultivators of competing crop: paddy

SI No	Particulars	1	2	3	4	5	6	7
1.	Quote lower price than actual prevailing rate	0.00	0.00	0.00	0.00	10.00	60.00	30.00
2.	Higher commission	0.00	25.00	35.00	20.00	15.00	5.00	0.00
3.	Wholesalers not taking consent while selling	5.00	5.00	15.00	20.00	20.00	30.00	5.00
4.	Delay in payment	15.00	25.00	20.00	20.00	20.00	0.00	0.00
5.	Irrational deductions	35.00	20.00	10.00	20.00	15.00	0.00	0.00
6.	Harassment by middlemen	45.00	25.00	5.00	20.00	5.00	0.00	0.00
7.	No problems	0.00	0.00	10.00	20.00	0.00	5.00	65.00

Source: Field Survey

Tomato is a competing crop with patchouli. Both tomato and patchouli offer a continued flow of income to farmers. But in one case, the prices are quite attractive, whereas in the case, there are significant fluctuations in prices. Tomato grown in the Kolar region always face price fluctuations and the instances of farmers selling tomato on the roads of Bangalore city are many. Whereas, patchouli offers not only continuous income, but also an assured income flow, and that makes it an attractive crop. In the case of tomato, there are many constraints and among them are low prices, high commission rates, cheating by wholesalers and harassment by middlemen are the major constraints.

Table 5.2: Constraints faced by cultivators of competing crop: tomato

SI No	Particulars	1	2	3	4	5	6	7
1.	Quote lower price than actual prevailing rate	0.00	15.00	20.00	5.00	25.00	20.00	15.00
2.	Higher commission	20.00	5.00	15.00	2.00	0.00	20.00	15.00
3.	not taking consent while selling	15.00	15.00	15.00	25.00	10.00	5.00	15.00
4.	Delay in payment	15.00	15.00	15.00	10.00	20.00	20.00	5.00
5.	Irrational deductions	20.00	5.00	10.00	15.00	15.00	20.00	15.00
6.	Harassment by middlemen	25.00	20.00	15.00	20.00	0.00	5.00	15.00
7.	No problems	5.00	25.00	10.00	0.00	30.00	10.00	20.00

Source: Field survey

There are quite a few constraints faced by farmers growing medicinal crops. From our survey, we have gathered seven important constraints and the relative importance of these in the context of the cultivation of medicinal crops. There is another interesting angle to analyse these data, and that happens to be the constraints not faced by farmers and these can be interpreted as the facilities that farmers get while cultivating medicinal crops. In other words, the complimentary set of constraints provides growing incentives for the medicinal crop. More than that, table 5.3 also offers clues to formulate policy in order to popularise the development of medicinal crops. The price factor plays an important role, followed by the emerging imperfections in the market in terms of high commissions. Here again, wholesalers and contractors do make better out of the business. As a consequence, farmers are harassed and unless the contracts are better drawn and justified, farmers may not get their due.

Table 5.3: Constraints faced by farmers in growing Sweet Flag

SI No	Particulars	1	2	3	4	5	6	7
1.	Quote lower price than actual prevailing price in the market	66.0	12.0	8.0	4.0	8.0	2.0	0.0
2.	Higher commission	2.0	44.0	38.0	14.0	2.0	0.0	0.0
3.	Wholesalers not taking consent while selling	20.0	20.0	8.0	22.0	24.0	6.0	0.0
4.	Delay in payment	4.0	8.0	12.0	32.0	38.0	8.0	0.0
5.	Irrational deductions	0.0	14.0	30.0	26.0	18.0	6.0	0.0
6.	Harassment by middlemen	38.0	0.0	2.0	2.0	0.0	0.0	0.0
7.	No problems	0.0	0.0	2.0	0.0	10.0	78.0	8.0

Source: Field survey

Thus in the case of sweet flag, we find that the prevailing problems of middlemen and contractors did work against the interest of the crop and its development. That would also impact farmers who have recently taken up its cultivation.

Patchouli does not have the constraints that confront sweet flag. There are various reasons for it. The first and foremost among these is the continuous income flow in the case of patchouli and the possibility of local processing of the crop. In addition to this patchouli is harvested dried and then sold. In that case, the harvest has a longer life and that helps the farmer decide the price and sell it at the best available price. Therefore, this crop faces fewer constraints as compared to sweet flag. However, the possibility of commission agent and contractors harassing the farmers cannot be ruled out.

Table 5.4: Problems faced by farmers growing Patchouli crop

Sl No	Particulars	1	2	3	4	5	6	7
1.	Quote lower price than actual prevailing rate	0.0	0.0	0.0	100.0	0.0	0.0	0.0
2.	Higher commission	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.	Wholesalers not taking consent while selling	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.	Delay in payment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.	Irrational deductions	0.0	64.0	36.0	0.0	0.0	0.0	0.0
6.	Harassment by middlemen	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.	No problems	100.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Field survey

The contractual arrangement between the processing company and the farmer is another market linkage. We found three companies which are directly dealing with the crop and it is largely the company staff who have introduced the crop in the region. Contractual arrangements are usually in the form of a written contract and provide the farmer sufficient time to understand and interpret the contract. The contract is through agents who frequently visit the farmer and keep a continuous liaison. The company also provides information about the crop, treatment of pests and diseases and the quality parameters that are required to maintain for the purpose of procurement. The contractual arrangement in the case of the company and farmers directly help to propagate the crop and increase the area under the crop significantly. This has happened in the case of patchouli but not so much in the case of sweet flag. Therefore, the problems faced by farmers growing patchouli are not so intensive as those growing sweet flag.

Table 5.5: Contractual arrangement between processing company and farmer

Sl.No.	Particulars	Percentage to total
1.	Total samples (Numbers)	03
2.	Medicinal plant introduced to contract farmer by	
a)	Company staff	100.00
3.	Type of agreement	
a)	Written	100.00
b)	Oral	0.00
4.	Frequency of field visits by officers of the company	
a)	Twice a week	0.00
b)	Once in a week	66.67
c)	Once in fortnight	33.33
5.	Number of installment payments to the farmer (average)	
6.	Period for settlement with contract farmers	
a)	1-15 days	33.33
b)	16-30 days	66.67

Source: Field survey

In addition to the constraints faced by farmers we also investigated into the constraints faced by the firms propagating the cultivation of medicinal and aromatic crops. These questions are asked to contractors and commission agents who procure the crop from farmers. Five important problems cropped up in the context of the selected medicinal and aromatic crops. First it was difficult to decide the price of the crop as farmers sought rates higher than that was prevailing in the market. However, this problem could be resolved through mutual discussions between farmers and the officials of the company. The second problem was about the quality of the product. Farmers prefer to sell the product with a lot of moisture content and that increases the weight of the product. The purchaser wanted produce with least moisture content and that needed longer time before taking the produce to market. Mixing of low-grade material with high-grade was another problem confronted by purchasers, and that was a point of conflict between the two. It was essential to fix the grade of the product and quality parameters before the harvest season. There are a large number of farmers who are ready to provide the crop to the company. However, the company was not interested in selecting all of them due to various problems. That created discontent among farmers, and this discontent at times gets reflected in the way the market operated.

Table 5.6: Constraints faced by firms in cultivation of medicinal and aromatic crops

Sl.No	Particulars	Percentage to total
1.	Problem in fixing price	100.00
2.	Improper drying of produce	100.00
3.	Mixing of low grade with higher grades	66.67
4.	Selection of farmers	66.67
5.	Farmers discontent	33.33

CHAPTER VI

SUMMARY AND CONCLUSIONS

6.1. Introduction

Medicinal and aromatic plants are reaching high in their importance as raw materials for use in drug industries with their far-reaching curative properties. Indian system of medicines strengthened over centuries through practice and oral tradition makes use of many medicinal herbs. These include large number of native preparations established in *Ayurveda*, *Siddha*, *Unani* and have recorded curative properties through the ancient writings. These books of Materia Medica are termed as *Samhitas* and they include *Bhrugu*, *Sharangdhar*, *Charak* and many more scriptures stating the methods of preparations, curative properties and methods of use. Following the sure cure provided by these herb-based medicines many of the modern medicines incorporate basic composition derived from the medicinal herbs. These curative properties are used for Hepatitis-A, Luekoderma, Asthma, Skin ailments and many other common as well as difficult health conditions. Thus, these have become acceptable medicines. There are many reasons for the increasing popularity of Ayurvedic medicines and these include: organic contents, quick availability, least side effects, low prices, environmental friendliness and established long-lasting curative properties. The fact that derivatives of medicinal and aromatic plants are non-narcotic without any side effects and the natural base of the treatment have together caused the demand for these plants to increase in both developing and developed countries (Lambert *et al*, 1997). The transition of using medicinal herbs from traditional low cost sure curative medicines to commercially exploitable raw material for manufactured drugs opened up economic and environmental issues (WHO, 1996). Similar situation also prevails with the aromatic crops and commercial use of these crops has not only become feasible but increasing at a fast rate.

The Ministry of Environment and Forest, Government of India has documented over 10 thousand plant species of medicinal plants having importance in the pharmaceutical industry. Of these, about 2000 species are regularly used in traditional medicines while at least 150 species are used commercially on a large scale (FAO, 2004). Due to this rising international demand, many important medicinal plant species are becoming scarce and

some are facing the prospect of extinction (FRLHT, 1996). Therefore, it is important to conserve the extensively traded medicinal plants in its natural environment or cultivating it in favourable environments. Cultivation of some of the medicinal and aromatic crops is a sure way to overcome this impediment.

6.2. Increasing Importance

The importance of medicinal and aromatic crops is increasing in the recent past, due to various changes that have taken place in the field. The first and foremost change that has been observed is the preferred shift from Western medicines towards indigenous medicines. The shift could be attributed mainly to the many severe side effects of the Western medicines, and the focus on symptomatic treatment that does not last longer. The recurrence of the diseases, as well as long duration of the treatments also provoked preference towards indigenous medicines. This was also encouraged by the natural/organic contents of these medicines, and their affordability (Kamboj, 2000). We have noted in second chapter that the manufacturers (we studied) have recorded significant growth in their business during the last five years. All this has resulted into larger demand of the raw material and thereby cultivation of these crops on commercial basis. The increased popularity of Ayurvedic medicines in the Western world has spurred increased demand for trade (WHO, 1991). The trade in medicinal plants has increased, both in the form of raw material, as well as processed medicines. We have looked in to the trade data in chapter two, in order to demonstrate the increasing trends in the trade of medicinal plants, both as raw materials, as well as processed products. The increased demand of the medicinal plants in the industry and for trade created direct incentives to the farmers to undertake cultivation of these crops (Ahmad et al. 1998). Earlier, the medicinal plants, as raw material for the industry as well as trade was largely collected from natural habitats and forests. That led to high level of exploitation of these crops in the natural habitat and loss of biodiversity (Rajasekharan and Gunasekharan, 2002). The pressure of demand exerted by the market, the medicinal and aromatic crops have been taken for cultivation by the farmers. These crops are comparatively easy in the cultivation practices, and do not require so much care as needed by the other commercial crops. These are also high-value and low-cost crops therefore; the acceptance rate is very high. In addition to the income generated by cultivation of these crops, the farming practices also provides sufficient amount of employment to the non-farmers, and that has a good multiplier effect in the development process of the rural economy.

When compared with the traditional crops, cultivation of medicinal crops have a few bold advantages (See Box 6.1):

Given the advantages medicinal crops relative to traditional crops, these have become popular in some of the regions of the country. However, the spread is not large

Box 6.1

- Medicinal crops provide better returns than the traditional crops
- These have very high domestic and export demand,
- They fetch better prices in the market
- These could be stored for a long time, and sold at the time when better prices are prevailing in the market
- These are the largely drought tolerant, and not easily grazed by animals
- These have low incidence of pests and diseases
- They require least resources, therefore the cost of cultivation is lower compared to the traditional crops
- These could be raised as inter-crops, along with the traditional crops, and also on the degraded lands

enough to meet the demand of the industry. Therefore the dependence on the collection from forest and over-exploitation of some of the species has not reduced (Heywood and Synge, 1991). The rate of exploitation of some of the species has threatened extinction. Owing to short supply, the prices of some of the medicinal crops have

increased substantially during the recent past. The increased prices also result in substituting sub-standard material and that may also get into the international consignments. In long run this may affect the prospects of trade.

6.3. Importance of the Medicinal Crops

Indian farmer is presently in a very difficult situation and about 40 % have shown preference for other vocations than farming (NSSO, 59th round). Presently, farmer as a group is confronting shrinking net income flow due to increasing cost of cultivation and uncertainty in the product market prices. Largely the farmers have not diversified out of the traditional crops. These crops now require higher cash inputs and that is aggravated by very poor market system. These two factors together forced the farmers to shift towards other remunerative crops that have potential to get good income flow when compared to the traditional crops (Ahmad et al., 1998). On this backdrop the medicinal crops being less risky in terms of incidence of pests, diseases, price fluctuations, along with high potential returns are gaining importance. This is further strengthened by the fact that these crops can be grown on degraded and marginal soils or raised as inter crops in plantation crops with little difficulty. As mentioned earlier the trade demand for these crops is also increasing with the increased attraction of western consumers towards Indian medicinal systems. Similarly these crops and preparations are also attracting the attention of the patent seekers from the western world (Cullet, 2002) Estimated area under the medicinal

crops in India is in the neighbourhood of about two lakh hectares. But still almost 75 per cent of the plant material used in the indigenous medicines is collected from Forest and wild habitats (GoI, 2000). People who hardly have any knowledge about the plants collect the plant material and pay little attention in selective harvest.

On account of the fact that derivatives of medicinal and aromatic plants have no side effects and deal curatively therefore the demand for these plants is on the increase in both developing and developed countries. As a result, trade of the medicinal plants is increasing fast. From the trade data available, it is clear that the global market for medicinal plants has always been very large and increasing in the recent past. In the report commissioned by the Worldwide Fund for Nature it is pointed out that, the total import in 1980 of "vegetable materials used in pharmacy" by the European Economic Community was 80,738 tons (Lewington 1993). India was the largest supplier of these with 10.05 tons of plants and 14 tons of vegetable alkaloid and their derivatives. India, Brazil and China are the largest exporters of medicinal plants. Medicinal plants trade from India is estimated to be worth Rs. 550 crores. The world demand for the raw material is growing at the rate of 7 percent per annum and India shares a sizeable chunk of that (Singh and Kumar, 2000).

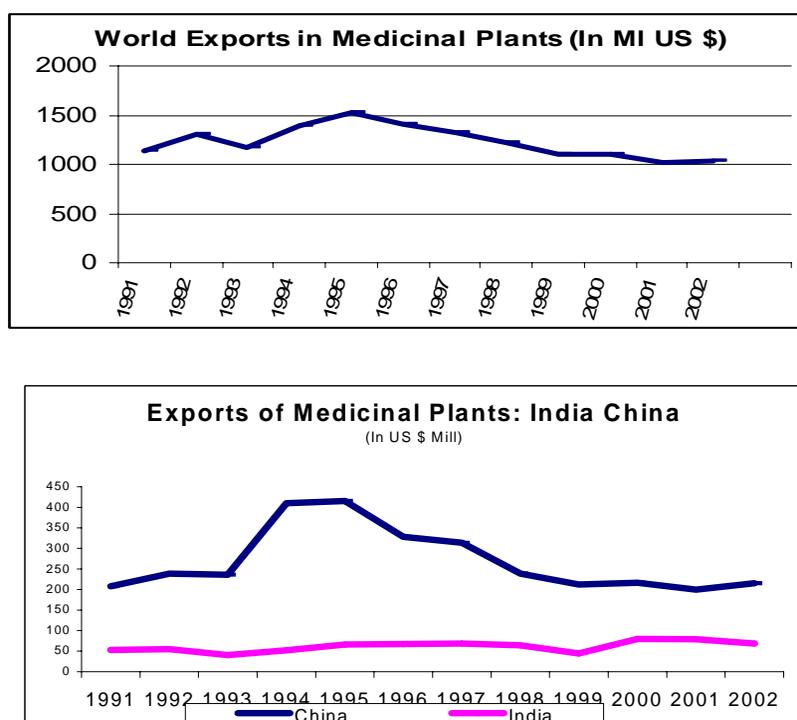
One of the greatest difficulties in assessing the importance of medicinal and aromatic crops as resources, either locally or globally, is the shortage of dependable information about the species being used, their availability and distribution, how these are collected or harvested, where the species are cultivated, the quantities involved, and trade statistics (Anonymous, 1987; GoI, 2000)). Confidentiality still surrounds the industry as well as in the State run systems. Much of the evidence is anecdotal although there has been a concentrated effort in recent years to gather information on these various aspects. National and regional assessments have been published by several countries; also various global reports have been prepared such as Husain (1996) on international trade, marketing and consumption of essential oils, and McAlpine et al. (1997) on future world trends in supply, utilization and marketing. But all these provide only fragmentary information.

6.4. World Trade in Medicinal Crops

World trade in medicinal plants is increasing very fast. One of the interesting features of this trade is that the direction of trade is from developing countries to the developed countries. That has a positive income transfer effect. China and India are the two leading countries in the trade and during the last decade, total trade has increased

from US \$ 52.8 million to US \$ 68.7 million, recording a growth rate of 3.56 percent per annum. As estimated by FAO, the trade in herbal medicine alone is estimated to have exceeded US\$ 1135 million in 1991 but slid down to US\$ 1034 million in 2002, with annual growth rates averaging between 5% and 15%, depending on the time span. The market associated with this sector is expected to have even higher annual average growth rate of 25 percent between 1990 and 1997. Use of herb based medicines in developed countries in Europe and the United States is highly regulated. It is well known that these countries put very stringent restrictions on the quality of the products imported by them. That poses a major constraint for developing countries and LDCs to enter these markets, especially for those whose products have not undergone the stringent tests. Increasing global interest in medicinal plants has created a sustained demand but at the same time hidden trade in plant materials results in indiscriminate harvest of wild varieties and serious damage to biodiversity.

Figure 6.1 and 6.2



In the trade statistics of medicinal crops, a substantial part of the trade is not recorded. Either the collectors of statistics do not identify the plants individually, or do not separate their medicinal use from other usage. The recorded exports of medicinal plants from LDCs peaked at US\$ 37 million in 1998 before falling to a reported US \$27 million in 1999 (FAO). It averages around US\$ 31 million a year from 1995 to 1999. The lesson that comes out very clearly here relates to two issues. First, there is a good potential for trade

of these crops and that is marked by wide variations. Second, this has remained mostly under-exploited and concerted efforts can boost this substantially.

Despite the vast potential for exploiting the medicinal, aromatic, and exotic plants this sector is still in the nascent stage among many promising country. India is not an exception, but still the sector is showing the signs of buoyancy in the recent past. Based on the scenario of growing demand for herb-based medicines, both in the domestic and international markets, it can be inferred that the demand for the raw material, i.e., the medicinal plants will grow correspondingly. The Centre for Monitoring the Indian Economy (CMIE) estimated that India exported plant based drugs and pharmaceutical products worth Rs. 2800 million during 1996-97. That clearly brings out the potential of these crop groups in international trade (Singh and Kumar, 2000).

Table 6.1: India's Exports of Medicinal Plants and Herbal Products
(in crores)

Particulars	Average of 1998-2002	Destinations
Plants and parts of plants (including seeds and fruits), of a kind used primarily in perfumery, in pharmacy or for insecticidal, fungicidal or similar purpose, fresh or dried, whether or not cut, crushed or powdered	237.71	USA, Japan
Vegetable saps and extracts; pectic substances, pectinates and pectates; agar-agar and other mucilages and thickeners, whether or not modified, derived from vegetable products	608.09	USA
Preparations		
Ayurvedic and Unani Medicines	51.96	USA, Russia
Homeopathic Medicines	1.05	Sri Lanka
Ayurvedic and Unani Medicines for retail sales	96.04	USA, Russia,
Homeopathic Medicines for retail sales	3.44	Ivory Coast, USA
Growth per cent per annum	2.0%	

Source: ITC, Asia Healthcare 2004

Unfortunately, the information about the crops, methods of cultivation, and the demand pattern, as well as market share is not well established and easily available. Each of the major traders deal with more than one medicinal crops and the raw material is purchased from various places, having differential quality. The supplier of material is also not regular and therefore the market is not very well established. Prices of the individual medicinal crops also vary substantially, and the quality of supply determines the percentage of active ingredients. There are frequent rejections of consignments of exports, and in addition to that the negative externalities are also quite high. That causes substantial variation in the net income generated to the collectors as well as growers of the medicinal

crops. In the domestic market, major buyers include Zandu, Himalaya Drugs, Baidyanath, Dabur, Natural Remedies, Charak, Kottakal, Kerala Ayurvedic Pharmacy, Dhootpapeswar and a few other local

6.5. Rationale and Method

Medicinal plants are natural resources as they are unique, indispensable and estimation of their availability is complex. We are quite aware that a purely academic approach to the study will involve pluralism of methodological approaches leading to a blend of institutional economics. This also called as transaction cost economics an essential ingredient of natural resource economics. It will bring in the concepts like survival value, safe minimum standard of conservation, scarcity rents, existence value, intrinsic value, externalities, and transaction costs. All these will provide a framework for unravelling the intricate issues in the economics of medicinal plants and hence would be preferred in any study. But here our approach is not to provide an academic treatise, which certainly would have been our preference, but here we intend to give a clear policy outlook for cultivation of medicinal crops replacing the uneconomic traditional crops.

In the quest for earning better returns from the land, farmers have been resorting to cultivation of medicinal and aromatic crops instead of conventional agriculture. However, there is no authentic information about the extent of area covered under medicinal and aromatic plants. The information about the marketing arrangement is also fluid, particularly for medicinal plants. In the circumstance, there is a need to evaluate the economics of cultivating medicinal and aromatic plants. Considering the inherent market imperfections resulting from institutional and market failures in India, this study aims at development of programmes and policies for a total economic preference for medicinal crops. We do not intend to analyse here the threats imposed due to indiscriminate gathering and forest harvesting but focus on the economic opportunities available for their cultivation. This study is a part of an overall study taken up in a few states in India. India has a huge biodiversity and the states in the country have many medicinal plants and crops available. But only a few of these could be considered for the purpose of a systematic analysis.

The objectives of the study are given in box 6.2. This study uses secondary as well as primary data at macro and micro levels. One of the major difficulties however, is to get the data on medicinal crops from secondary sources. Whatever data was available was

Box 6.2 Objectives
<ul style="list-style-type: none">➤ To understand the economics of cultivation/production/gathering of the selected medicinal plants and find their economic and market potential as preferred for cultivation by the farmers.➤ To assess the extent of area being cultivated under selected medicinal and aromatic crops.➤ Estimation of domestic and international demand for the selected medicinal plants in the light of the effect of new IPR regime on pharmaceuticals.➤ To study the relative economic impact of cultivation of medicinal and aromatic plants by the farmers.➤ To identify the bottlenecks in the marketing of medicinal and aromatic plants and suggest possible remedies.

collected but soon we realised that the data availability can be a major constraint for the analysis. The study focuses on Karnataka, but does not claim to have covered all the medicinal crops significantly grown in the State. After listing the major crops/plants available in the region, their normal use, location and processing facilities, two important crops, one medicinal and one aromatic crop are selected for study largely grown in two of the district of Karnataka. We selected

Sweet flag (Acorous calamus) and Patchouli (*Pogostemon cablin*) crops after discussing with many academicians and practitioners / users working in the field. These two crops are cultivated in a few districts of Karnataka but one can get only farm level information for these crops. After consultations, we selected Tumkur and Kolar districts keeping in view the density of the crops grown in view. We selected Tharati village of Koratagere taluka in Tumkur District for *Sweet flag (Acorous calamus)* and Perasandra, Dibbur, Chikkabalapur villages in Chikkabalapur taluk of Kolar District for *Patchouli (Pogostemon cablin)*. These crops are grown substantially in this area and market channels are well established. *Sweet flag (Acorous calamus)* has been identified as a medicinal crop and *Patchouli (Pogostemon cablin)* is taken to represent aromatic crop for the purpose of this study. As mentioned above our intention here is to explore the relative economics of medicinal and aromatic crops as against the seasonal competing crop. For the purpose of comparison, we selected two main competing crops in each of the district to represent medicinal and aromatic crops. We selected Paddy in Tumkur district and Tomato in Kolar district as competing crops. The competing crops are selected keeping in view three important factors. First, we listed the crops grown by the farmers who changed to medicinal and aromatic crops and selected the pre-dominant crop among these. Second, we checked the soil-climatic conditions required for the competing crops and matched that with the selected medicinal and/or aromatic crop. Third, we had also kept in mind the density of the medicinal and aromatic crops as

against the competing crop. Thus, Paddy and Tomato were selected as competing crops for *Sweet flag (Acorous calamus)* and *Patchouli, (Pogostemon cablin)* respectively, in their region.

We have chosen the sample as follows:

- **TUMKUR**
 - *Sweet flag (Acorous calamus)*
 - Sample of farmers growing *Sweet flag (Acorous calamus)* in Tharati village of Koratagere in Tumkur District are **50**
 - Control farmers (Paddy) 20

- **KOLAR**
 - *Patchouli (Pogostemon cablin)* Sample of farmers growing *Patchouli* in villages of Chikkabalapur Taluk in Kolar District are
 - Perasandra - (31), Dibbur – (12),
 - Chikkbalapur – (7). (**Total – 50**)
 - Control farmers (Tomato) 20

6.6. Understanding the Selected Crops

We have selected two crops from different perspective. While *Sweet flag* is used only by the pharmaceuticals directly as an ingredient and therefore has to go through a full circle of market chain, *Patchouli* can be processed at the field level by the grower in a simple decanter to extract the base oil.

i. *Sweet flag (Acorous calamus)*

Sweet flag (Acorous calamus) is highly valued as a rejuvenator for the brain and nervous system and as a remedy for digestive disorders. A powder made from the rhizomes is smoked or chewed to destroy the taste for tobacco. Some of the uses of (*Acorous calamus*) discussed with the users are:

Uses of *Sweet flag (Acorous calamus)*

- Over coming stomach related disorders in both human and animals
- Treatment for the nerve related disorders
- Dried *Sweet flag* rhizomes are used in medicinal preparation and as a flavor.
- Powdered rhizomes and the essential oil used as a safe against flies, mosquitoes, bed bugs, moths and lice.
- As a combination with other ingredients to cure the burn injuries.
- As a remedy for asthma, and nausea.
- Used to treat bronchial catarrh, hysteria, and neuralgia

ii. *Patchouli* (*Pogostemon cablin*)

Patchouli (*Pogostemon cablin*) oil is extracted from the young dried leaves of the plant, which are fermented and then dried before steam distillation. *Patchouli* (*Pogostemon cablin*) oil is considered an excellent base in perfumery industry. As a fixative, it slows the evaporation of other, more volatile oils so that their aroma may be released over a longer period of time. *Patchouli* (*Pogostemon cablin*) has a strong, earthy, musty and spicy smell, and is used in many perfumes with an oriental or exotic aroma. The smell is reported to improve with age of the oil. It has many practical uses some are given below:

- It is used as a base in Ayurvedic medicines, perfumery, rituals, and cosmetics.
- It is used for digestive disorders and as a remedy for dry skin, wrinkles, dandruff, oily skin and scalp, fungal infections, and insect bites.
- In aromatic treatment it is used for controlling diarrhoea, vomiting, and nausea
- It is also used as an insect repellent.
- *Patchouli* (*Pogostemon cablin*) oil is blended with other ingredients as massage oil for treating dermatitis, overweight, anxiety and dandruff.
- In a lotion or cream, *Patchouli* (*Pogostemon cablin*) oil is used as base for ointments treating foot cracking, eczema, acne and sores.

6.7. Layout of the Study

The first chapter has set the tone for the study and includes discussion about the importance of medicinal crops. In the second chapter we have included the importance of medicinal and aromatic crops in the State. The data on these crops are not usually collected and disseminated like other crops and that is the major limitation. The third chapter incorporates a brief analysis of the processing units operating in the State and the relative economics of medicinal and aromatic crops. Here, trends in area, production, and yield of medicinal and aromatic crops and potential of diversification towards medicinal and aromatic plants are analysed. Following this is the core chapter of the report. Here we have presented and analysed the data collected on 'Relative Economics'. The Chapter contains a detailed analysis of relative economics of two selected crops with the competing crops. Costs and returns of the selected crops have been worked out in relation to the competing crops. The motivational factors and decision-making have been analysed in the fourth Chapter based on the field data. In the penultimate chapter, marketing and cultivating problems have been analysed on the basis of the data collected as well as using information available in the literature in the State.

6.8. Findings of the Study

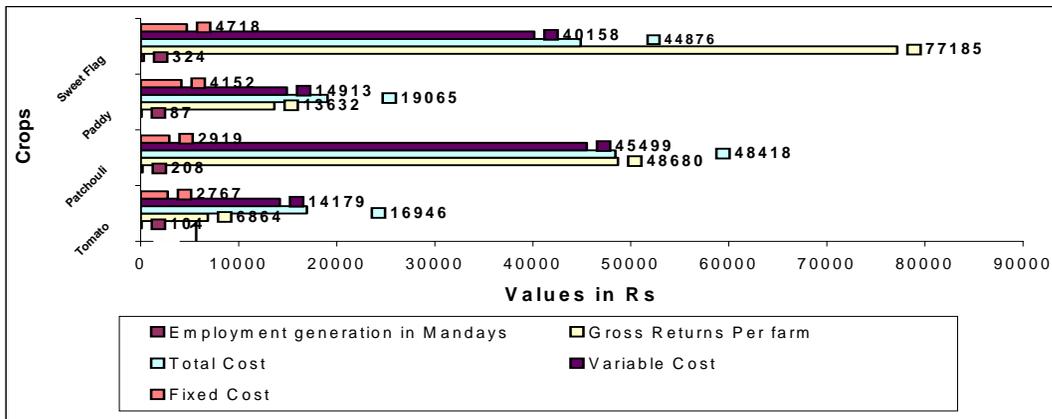
Relative economics of the crops can be studied from five different perspectives. First, it is essential to compare the suitability of the crop in the agro-climatic conditions of the region and its relative advantages as far as natural sources are concerned. In order to do this, one has to choose the crop, along with the competing crop, which requires almost similar agro-climatic conditions and resource base. In this study, we have chosen *Sweet flag (Acorous calamus)*, and *Patchouli (Pogostemon cablin)* as the medicinal and aromatic crops as these two have been cultivated as pure crops in the state of Karnataka. In order to work out the relative economics of the crops we have taken paddy and tomato as the competing crops, which are grown in similar soil and agro-climatic conditions. It is in the recent past, that *Sweet flag (Acorous calamus)* and *Patchouli (Pogostemon cablin)* are replacing paddy and tomato aggressively. Second, the relative economics has to be checked on the count of natural suitability and negative externalities of the selected commercial crop. It was noted that *Sweet flag (Acorous calamus)* and *Patchouli (Pogostemon cablin)* are the crops most suited in the natural conditions of the selected districts. Additionally these crops also have medicinal values, and therefore are using local conditions by the local practitioners. Third, generation of employment in rural areas is one of the major policy initiative for the development. In the context of the labour absorption, these two crops play an important role and that is the count on which relative economics has to be worked out. Fourth, in any process of production, one looks at the total cost as well as and the working capital together to study its economics. If the need for working capital is high it is difficult to get the crops accepted among the farmers who have fragile liquidity. But in addition to that the last count of relative economics works more effectively in the process of decision calculus of the farmer. This is the operand on which relative economics actually operates. One must look into income generated per unit of working capital, as well as per unit of the total cost incurred in the process of production. Here we try to look into all these aspects to understand the relative economics of the crop.

Patchouli (Pogostemon cablin) and *Sweet flag (Acorous calamus)* are the crops agro-climatically suitable for Tumkur and Kolar districts of Karnataka. The farmers are cultivating these crops after a careful decision and the market for these crops is aggressively increasing. The crops are suitable to the agro climatic conditions of the districts and do not exert any externalities in terms of environment or ecology. In the recent past, it has been noted that the prices of the traditional crops (ragi, paddy, jolla etc)

in the two districts have been suppressed due to market forces. That has significantly reduced income flow to the farmers and the distress has been quite visible. *Patchouli (Pogostemon cablin)* and *Sweet flag (Acorous calamus)* are the crops, which are directly tied with the market through the commission agents who purchases the entire production at the farm gate.

Therefore, prices are assured, and as the prices are reasonably high and the demand for the products is increasing, the development of the crops is quite conducive in the present conditions. We have presented in figure 6.3 the number of Labour days required per acre for *Sweet flag (Acorous calamus)* and *Patchouli (Pogostemon cablin)* as against paddy and tomato.

Figure 6.3: Relative Economics of Selected Medicinal and Aromatic Crops



It can be noted that *Sweet flag (Acorous calamus)* uses 324 mandates, as against 87 mandates required for paddy. That generates 237 mandates of additional employment and an income of Rs 15,405 to the agricultural labourers in the region. In the case of *Patchouli (Pogostemon cablin)*, the additional employment generated is 104 mandates, and that provides an additional income to the agriculturalist is to the tune of Rs 6,760. This multiplier effect of income generation for the agricultural labourer has created attraction for the agricultural is towards working on these crops and the skills serving well developed.

Output and returns per acre of the crop are indicators that provide the final test in the study of crop economics. We have shown in figure 6.3 the variable cost and fixed cost incurred in the cultivation of *Patchouli (Pogostemon cablin)* and *Sweet flag (Acorous calamus)*. In order to make comparison very clear, and also given the total variable cost and fixed cost of the competing crops. As far as *Sweet flag (Acorous calamus)* is

concerned, the variable cost is Rs 40,158, as compared to Rs 14,914 for Paddy. That means an increment of Rs 25,245, is the requirement for meeting variable cost in order to shift towards *Sweet flag (Acorous calamus)*. In the case of *Patchouli (Pogostemon cablin)* this requirement is much higher, and one acre of *Patchouli (Pogostemon cablin)* needs an investment in terms of labour cost of Rs 45,499 as against Rs 14,178 for tomato. Which means an additional requirement of Rs 31,321 per acre in order to shift towards *Patchouli (Pogostemon cablin)* from the traditional tomato cultivation. In both cases, the requirement of variable cost is quite high, and the farmer through the advance payment received from the contractor or commission agent meets that. Some of the farmers even borrow from the institutional sources in order to meet the variable cost as far as fixed cost is concerned the difference between *Sweet flag (Acorous calamus)* and Paddy; or *Patchouli (Pogostemon cablin)* and tomato is not very large. Therefore, on the cost side, both *Sweet flag (Acorous calamus)* and *Patchouli (Pogostemon cablin)* need initial investment, and that has to be met by the contractor. When we look at the gross returns from the crops we find that *Sweet flag (Acorous calamus)* generates gross return to the tune of Rs 59,432 as against Rs 13,632 for Paddy. That leaves net surplus of Rs 45,800 when 1 acre of Paddy land is converted to cultivation of *Sweet flag (Acorous calamus)*. In other words, *Sweet flag (Acorous calamus)* generates Rs 1.47 per rupee of investment as against Rs 1.09 generated in the cultivation of Paddy. When we consider *Patchouli (Pogostemon cablin)* cultivation, the total variable cost is Rs 45,499 as against the gross returns of Rs 48,680.

In fact, it is due to the low-prices received by the tomato growers, that the gross income generated from *Patchouli (Pogostemon cablin)* seem to be substantially high. *Patchouli (Pogostemon cablin)* has a sure market and the commission agent or the contractor purchases the entire crop. The purchasers also provide advance payment towards the crop, and the crop is harvested two to three times in the season, which provides continuous income flow to the farmer.

The related economics of *Patchouli (Pogostemon cablin)* and *Sweet flag (Acorous calamus)*, very clearly, brings out a few important points. First, it is very clear that some of these commercial crops, specifically in the medicinal and aromatic crop groups have been making headway in the traditional crop pattern. The emergence and increase of area under these crops is mainly due to the demand side push rather than supply induced acceptance. *Patchouli (Pogostemon cablin)* and *Sweet flag (Acorous calamus)* have high demand in Ayurvedic preparations. The contractors and commission agents provide

incentive by purchasing the material in advance and giving loans during cultivation and that keeps the product market locked. At times, they also provide some of the latest know-how and inputs without much hassle. Second, the crops are well suited in the agro climatological conditions of the region, and that makes them easily acceptable by the farmers. The demand of these species on natural resources is also limited, and therefore these crops have become popular in the study region. However, the consistency in demand always limits their spread, as well as the participation of the farmers in cultivation of these crops. Third, *Sweet flag (Acorous calamus)* as well as *Patchouli (Pogostemon cablin)* have significant employment generation effect and the cultivation of these crops, helps to transfer significant amount of income to the agricultural labourer. Therefore, the labourers, are happy to work on the fields cultivating these crops. Fourth, even though the crops required high variable cost that is largely met by the commission agents or the contractors. At times even the farmers have approached commercial banks, to borrow crop loans. The per acre gross income generated out of the two crops is quite substantial to attract any farmer towards these crops and even the returns to investment are also quite lucrative. Therefore, it will not be erroneous, if we say that the area under these crops in these two districts will increase substantially in the coming years albeit constrained by the demand.

Demand for the crop material of *Patchouli (Pogostemon cablin)* and *Sweet flag (Acorous calamus)* is a derived demand and that is based on the Ayurvedic medicines. This has increased substantially during the recent years due to increased dependence on Ayurvedic medicines. The dramatic increase in exports of medicinal plants in the past decade vindicates the worldwide demand for these products as well as in traditional health systems. Experience of the last decade shows that Indian exports of medicinal plants has increased. But, as these plants are predominantly of forest origin, most of these are harvested unsystematically without proper attention to the environmental implications. Hundreds of species are now threatened with extinction because of over-harvesting, unscientific collection techniques, and conversion of traditional plant habitats to crop-based agriculture. Open access to medicinal plants in the wild is perhaps one of the main reasons for the current unsustainable levels of harvesting. India's traditional medical system is a significant component of a time-honoured and time-tested culture that is getting popular today due to its holistic approach.

In economic theory the motivational factors and the decision-making are analysed with the help of the concept of expectations. Any production process begins with *a priori*

expectations about the outcome and that forms the basis of the incentive to undertake such process. The expectations about an outcome are formed by the past experience and/or the structural conditions in the market. Nerlovian supply response theory is built around this theoretical platform where price expectations (P^*) are taken as the main variable determining the supply.

$$Y_t - Y_{t-1} = \alpha (Y_t^* - Y_{t-1}) \quad \text{OR} \quad Y_t^* = \alpha + \beta_1 P_t^*$$

Where Y_t, Y_{t-1} are output in year t and $t-1$; $Y_t^* =$ Expected out put

$P_t^* =$ Expected price and α and β are regression correlation

Many authors further elaborated these basic formulations in modified Nerlovian framework. However, not much has been done about the supply response at micro level (Deshpande, 1995). The difficulties are two fold, first, the theory of Nerlovian equation is not easily modifiable at micro level and second the micro level variables are numerous as well as interdependence that makes it difficult to model the behaviour. We are concerned here about the factors that enter the decision-making calculus of the farmer who cultivates medicinal crops in preference to the traditional seasonal crops.

Economic incentives can be easily grouped into the factors that cause 'push effect' or 'pull effect'. A few studies have brought out these effects in different contexts (Singh, Kamala et al., 2000; Sharma et al., 1996; Srivastava et al., 1996). The 'push effects' originate due to the traditional economic activities that yield low returns, in the present context, cultivation of paddy or tomato. These enterprises have significant disadvantages and essentially cause distress to the farmer. Under the 'push effects', the current production activity is either economically nonviable or difficult to undertake with the available resources. In such a situation, the cultivator is 'pushed out' of the present production environment and tries to accept whatever is available as the immediate best alternative. In such a situation, it is not necessary that the cultivator chooses the high pay off production activity, but even satisfies with the marginal gains in the new production activity. 'Pull effects' on the other hand, provoke the farmer to adopt a new cropping activity based on the high incremental income and/or ease in the production process. The hidden uncertainties are usually not considered seriously, and at times the cultivator has to trace back the path. 'Pull effects' are usually guided by higher income opportunities, availability of new material and know-how, as well as the demonstration effect.

While understanding the motivating factors that govern the decision making for area under *Patchouli (Pogostemon cablin)* and *Sweet flag (Acorous calamus)* we have kept in mind the 'push and pull' effects, with respect to the competent crops. In the case of *Sweet flag (Acorous calamus)*, area is being shifted from Paddy to *Sweet flag (Acorous calamus)*, whereas *Patchouli (Pogostemon cablin)* gains area from under tomato. It is in the recent past, that this shift has taken place not necessarily due to any development scheme specifically focusing on the cultivation of *Sweet flag (Acorous calamus)* and *Patchouli (Pogostemon cablin)* but rather provoked by the assured market, relative price differential and ease of cultivation. In short the market forces have played a decisive. Now the market channels for *Patchouli (Pogostemon cablin)* and *Sweet flag (Acorous calamus)* are well established. Largely, the contractors and commission agents purchase the entire crop well in advance and this particular factor has been quite attractive to the farmers. Therefore, slowly and steadily contract farming has been increasing in the spread of these two crops with quite a few encouraging factors. Contract farming helps the farmer initially however, as the contractors get hold on the market, the process of exploitation of the farmer begins. Yet this has not started in the study area, as the production is quite low and the contractors find it difficult to collect the required quantity of the crops. Once large number of farmers start growing *Sweet flag (Acorous calamus)* and *Patchouli (Pogostemon cablin)* the contractors will get an upper hand, and possibly at that time begins the exploitation of the farmers through lowering of the price and rejecting the produce on the quality pretext. Therefore, a few things are quite essential as far as these two crops are concerned, namely, the facility to process the crops and well drafted legal contracts, so that the farmers can benefit in the process. In the field, it was difficult to ask the farmer information about the contractors and the contract arrangements, as the entire operation is quite personal between the farmer and the contractor. The farmers are quite wary about divulging the information to a stranger with the fear that the contractor may get offended. Therefore, most of the farmers reported that they sell directly to the commission agents or the contractors. One of the prime policy initiatives is to legalise the system of contractors and provide a safety-net to the farmer in the case of the contract arrangements.

6.9. Policy Implications

Cultivation of Medicine and aromatic crops are emerging as new commercial enterprises. The World export demand of medicinal plants has gone above 1000 million US dollars. Out of this India provides only 6.8%, and has a potential of capturing more than

15% of the world market share in medicinal and aromatic crops. There are many pharmaceutical companies in India, that use medicinal and aromatic crops as raw materials, and this domestic demand is also increasing at a very fast rate. Our analyses of a few manufacturers have shown that during the last five years, these companies have made increasing strides in their growth. Their export share has also increased substantially. The domestic demand for raw material in the industry is increasing at a very fast pace. At the same time, the traditional habitats of medicinal and aromatic crops are being exhausted, speedily. That has generated significant demand pressure on these crops as raw material. Our analyses of the domestic demand, as well as the international trade indicate clearly that the crops need to be significantly widespread and the demand will increase substantially in near future. As a natural response from the farming community, many farmers in some of the states in the country have taken up the medicinal crops as commercial crops. We have located many such promising crops that could be grown in the country on a commercial basis. All these point towards the emergence of medicinal and aromatic crops as one of the important alternative commercial crop group. Our focus in the study was to look at the economic feasibility of medicinal and aromatic crops as potential commercial crops are replacing the traditional crops. In order to understand this, we undertook a study of two important medicinal crops in Karnataka. *Sweet flag (Acorous calamus)* and *Patchouli (Pogostemon cablin)* the selected crops are widely grown in the districts of Karnataka. *Sweet flag (Acorous calamus)* is known for its medicinal properties and has been raw material for the many ayurvedic-manufacturing companies. The ayurvedic practitioners also use it as raw medicine. *Patchouli (Pogostemon cablin)* on the other hand, is an aromatic crop, yielding oil out of its vegetative growth. The market channels for the two crops are well established, and it is more in the form of contract farming that the crops are grown. Usually the potential buyer provides planting material and know-how to grow the crops and purchases the product at a predefined price. However, these contracts are largely overall in nature and therefore exploitative for the farmers. In addition to that there is there, significant interlocking between the product and the credit market as the contractor provides initial credit to the farmer in order to make the contract obligatory.

It is necessary to popularise medicinal and aromatic crops in order to replace some of the traditional and economic crops. There are a few attempts towards arriving at the policy for harvesting and conservation of medicinal plants but not much is said about their commercial cultivation on private lands (GoI, 2000; FRLHT, 1996 & 1997). Our study

indicates below a few steps for incentivising the cultivation of medicinal and aromatic crops.

- It is necessary to provide information about cultivation practices and uses of major medicinal crops. Location really suitable in the respective regions. The package are practices for such crops, be prepared by the Universities of Agriculture Sciences in the respective regions so as to popularise the crops. This information should be disseminated through extension agencies, and other farmers' organisations.
- Medicinal and aromatic crops are largely grown under contract arrangements with the contractors, and therefore it is necessary to have a good legal framework, so that neither of the contracting parties are affected and one does not take advantage of the loopholes in order to exploit the other.
- Market and trade avenues for the medicinal and aromatic crops have properly organised in order to provide proper incentive to the cultivators and basic information about the trade should be provided to them.
- Seeds and saplings of the medicinal and aromatic plants are not easily available therefore, especially programme need to be undertaken for the purpose of providing seed material to the farmers.
- We must identify location specific medicinal and aromatic crops with a good value-added and linkages to the post harvest technology. Such information should be readily available at the district headquarters in the Departments of agriculture and horticulture.
- Diversification towards medicinal and aromatic crops should be quite cautious in order not to impact the food security of the farmers, and therefore, the database should be well maintained.
- Presently, we do not have the data about the area, production and productivity of the medicinal and aromatic crops. Nor we have sufficient data on the trade and marketing of these crops. At the industry level, confidentiality surrounds the process and therefore industries are not forthcoming to provide the processing data. That creates a major outlet in analysing the trade prospects and processing of the medicinal and aromatic crops.
- Technologically the processing of the medicinal and aromatic crops has not progressed sufficiently. Largely the processing is done with indigenous methods, and little is done to modernise the industry. Some of the efforts taken by Natural

Remedies, Himalaya Drugs and other a few industries are worth mentioning however, these are very sporadic in nature.

A special scheme maybe taken up in order to popularise some of the mid-signal and aromatic crops, which are in high demand from the industry as well as trade. Such scheme will go a long way in incentivising the farmers to undertake cultivation of medicinal and aromatic crops.

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