ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF MAJOR MEDICINAL CROPS OF GUJARAT STATE

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ABSTRACT

Looking to the rapid increase in consumption of medicinal plant products, its commercial cultivation and export markets, the present investigation was undertaken with a view to examine the economic viability, resource use efficiency, marketing, export growth and its dynamics and export potentialities of the selected medicinal crops viz., isabgol, senna, coleus and ajowan grown in Saurashtra and Kutch regions of Gujarat state. In all, 200 farm households were selected randomly from 10 villages selected purposively from four talukas of Junagadh, Jamnagar and Kutch districts. The concern marketing agencies involved at different stages of marketing were also selected for studying marketing aspects. The primary data on cultivation and marketing of medicinal crops were collected for the year 2006-07 by personal interview. The secondary data on export quantity, value and prices were also colleted from the various published sources and websites.

Tabular analysis was used to measure the economic viability of medicinal plants. The dynamics of export was studied by exponential growth function, rank correlation and Markov chain analysis. The export competitiveness was estimated by working out nominal protection coefficient.

The average total cost of cultivation of isabgol, senna, coleus and ajowan were Rs.16469, Rs.8224, Rs.46205, and Rs.15204 per hectare, respectively, while the net return realized per hectare was Rs.11101, Rs. 4200, Rs.112216 and Rs.23704 in respective crops. The cost of production per quintal in case of isabgol, senna, coleus and ajowan was found about Rs.1818, Rs.701, Rs.356 and Rs.1696, respectively, while the average farm harvest prices obtained per quintal were Rs. 3043.05, Rs. 1058.26, Rs.1221.66 and Rs.4342.41 in respective crops. The input-output ratios over cost C_2 were 1.67, 1.51,3.43 and 2.56 in case of isabgol, senna, coleus and ajowan, respectively. Thus, cultivation of selected medicinal crops was found remunerative to the growers.

The MVP of human labour was found greater than unity in all the selected crops. Besides this, MVP of Potash in isabgol, nitrogen and working capital in senna and nitrogen and working capital in ajowan were found greater than unity indicating the scope to increase in use of these inputs in respective crops, while the MVP of area, nitrogen and phosphorus in isabgol, area and bullock labour in senna and bullock labour, manure and phosphorus in ajowan were found less than unity indicating need to curtail the use of these inputs in respective crops.

The important marketing agencies of medicinal crops growers were village merchant, wholesaler in regulated market and wholesaler in city. In all the selected crops, transportation

and loading charges were major cost components at producer's level. Majority of the farmers have sold their produce in top two ranges of prices i.e. 92 per cent farmers in isabgol, 60 per cent in senna, 58 per cent in coleus and 78 per cent in ajowan crop. In case of isabgol, more than 50 per cent isabgol was sold through channel III (Producers – wholesalers in city - processors). Transportation, market fee and packing charges were the major marketing costs. Producers received the highest share in channel II (Producers – wholesalers in regulated market - processors). In senna, only one channel (Producers-wholesalers in city-exporters) was found. Producer's share in exporter's price was 89.49 per cent indicating an efficient marketing system of senna. In case of coleus, out of four identified channels, more than 85 per cent quantity was sold through channel II (Producers – wholesalers in regulated market –retailers). Transportation and market fee were the major items of the marketing cost. Producers received higher share in consumers' rupee in channel IV due to direct sale to consumer but most preferred channel was II. In ajowan, more than 85 per cent produce was sold through channel II (Producers - wholesalers in regulated market - retailers) indicating the most preferred channel. Transportation and market fee were the major items of the marketing cost in this crop also. Producers received the highest share (92.17%) in consumers' rupee in channel II.

United States, China and Saudi Arabia were the top buyers of isabgol husk, senna (leaves) and ajowan seeds, respectively from Gujarat. The other important buyers were Spain and Germany for isabgol husk, Malaysia and Germany for Senna (leaves) and United States and United Kingdom for ajowan seeds. The average unit value obtained was found the highest in

case of isabgol husk exported to Japan (Rs. 212.61/kg), for senna (leaves) in United Kingdom (Rs. 52.64/kg) and for ajowan seeds in Uganda and Botswana (Rs. 118.89/kg) during the period 2005-07.

The rank correlation coefficients estimated to measure the inter- year change in export, were found statistically non-significant for all the crops indicating inter-year fluctuation/change in direction of export.

The Markov chain analysis revealed that USA had a lion's share in the export of isabgol husk from Gujarat (74.32%). In case of senna(leaves), China had retention of 100 per cent export share while in ajowan seeds export, Saudi Arabia showed 96.45 per cent retention. Export projection of selected medicinal crops of Gujarat for the period 2008-15 indicated that USA and Spain, China and Germany and Saudi Arabia and UK would be the major buyers of isabgol husk, senna (leaves) and ajowan seeds, respectively.

The export of isabgol husk, senna (leaves) and ajowan seeds from Gujarat were found quite competitive and profitable during the years 2005-07.The most export competitive countries were Japan, Indonesia, Taiwan and United Arab Amirat for isabgol husk, United Kingdom, France, Lebanon and Slovenia for senna(leaves),and Uganda, Botswana and New Zealand were for ajowan.

Price fluctuations and high charges of transportation were major the issues faced by nearly two-thirds of medicinal crops growers. Lack of trading facilities of senna crop through regulated markets was the major bottleneck felt by all the farmers. More than 75 per cent medicinal crops growers faced

the problem of lack of storage facilities. High cost of transportation was a genuine problem of the traders. More than 83 per cent of traders were felt the lower rate of commission in trading. About 70 per cent traders indicated the problem of less availability of standard quality commodity. Exporter's severe problems were low international price, lack of quality packing materials, fluctuation in exchange rates, lack of suitable market survey and unorganized domestic market. More than 65 per cent exporters expressed the problems of strict sanitary and phyto-sanitary standards, lack of pricing information and non availability of standard containers.

On the whole, cultivation of selected medicinal crops was found remunerative to the growers. The highest net return was realized from coleus. The production factors like human labour and working capital were underutilized in majority of the crops. Thus, there is need to divert more fund towards these inputs. In all the crops, transportation and loading charges were the major cost components at producer's level, whereas transportation and market fee were the major marketing costs at traders' level.

The decline in export was observed only in case of isabgol seed whereas the export prices have showed increasing trend in all the crops under study. In case of isabgol, senna and ajowan crops, inter- year fluctuation/change in direction of export was observed. USA and Spain, China and Germany and Saudi Arabia and UK would be the major buyers of isabgol husk, senna (leaves) and ajowan seeds, respectively, during the period 2008-2015.

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CERTIFICATE – III

Date: 21-03-2009

This is to certify that the thesis **"ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF MAJOR MEDICINAL CROPS IN GUJARAT STATE"** submitted by **Mr.THANKI PRABHUDAS MADHAVJI** Junagadh Agricultural University, Junagadh in the partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY (Agriculture)** in the subject of **AGRICULTURAL ECONOMICS** after recommendation by the external examiner was defended by the candidate before the following members of examinations committee. The performance of the candidate in the oral examination was satisfactory; we therefore, recommended that the thesis is approved

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This is to certify that **Mr.THANKI PRABHUDAS MADHAVJI** student of **DOCTOR OF PHILOSOPHY (Agriculture)** in **AGRICULTURAL ECONOMICS** has made all corrections/modifications in the thesis entitled **"ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF MAJOR MEDICINAL CROPS IN GUJARAT STATE"** as suggested by the external examiner and the advisory committee in the oral examination held on **21-03-2009**. The final copies of the thesis duly bound and corrected have been submitted on **14-05-2009**.

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CHAPTER I

INTRODUCTION

World is endowed with opulent wealth of medicinal plants. i. e. more than 3.25 lakhs species of plants. India alone have around 2.50 lakhs plant species, hence it is a live botanical garden on the earth (Shah, 2007). Since *Vedic* era, India is using herbs as the principal form of medicines for preventing and curing the diseases of human being, animals and plant too. Ayurveda being a perfect system of medicine has shown various uses of medicinal herbs. In addition to this, it has also given the uses of medicinal plants for diseases free long life. While herbs lost their importance due to pharmaceutical revolution, they are also becoming popular as people strive to live healthy in the face of chronic stress and pollution. Medicinal plants play crucial role in the lives of rural people, in remote parts of developing countries with limited facilities for health care (Purohit and Prajapati, 2003).

Many plant species are used as herbal medicines either in raw form or semi-processed form, often as mixtures also. Medicinal plants are also used to prepare oil (Tel), ghee (ghrut) chatan (Avleha), alcohol (asav), arishta, raj- rasayan, kwath, bhasma etc. A few species are also the sources of refined compounds used in pharmaceutical industry. The modern medicines on an average contain about 25 per cent of drugs derived form plants.

According to the estimates of World Health Organization (WHO), about 80 per cent of the population of developing countries rely on traditional medicines, mostly plant drugs, for their primary health care needs. In India, about 70 per cent

population uses traditional medicines. According to Export Import (EXIM) bank, the international market of medicinal plants is to the tune of US $ 60 billion per year with a growth rate of 7 per cent per annum which will be of US $ 5 trillion by 2050 (Rawat and Uniyal, 2003).

The collection and processing of medicinal plants and plant product contribute at least 3.5 million man days each year to Indian economy, as a source of both full and part time employment. Micro-studies suggest that a large number of those employed are women. Medicinal plants are one of the most important components of the non-wood products sector which supply over 80 per cent of India's net forest export earning annually. However, the medicinal plants trade in India has been described as extremely complex, secretive, traditional, poorly organized, high under-estimated and unregulated.

The annual exports of medicinal plants are Rs. 4443 crores (Farooqi and Vasundhara, 2004). Over one and half million practitioners of the Indian system of medicine in the oral and codified streams use medicinal plants in preventive, promotive and curative applications. It has been estimated that there are more than 7,800 manufacturing units of medicinal drugs in India. The potential for earning foreign exchange by India from exports of medicinal plants is estimated to be over Rs. 84000 crores.

The significance of medicinal plants has been overlooked in the past, however, at present medicinal plants are looked as a source of affordable health care as well as a source of income.

Though, India possesses one of the richest bio-diversity among top 8 best bio-diversity regions of the world. Her forest area is shrinking. As forest areas have been the traditional

source of medicinal plants and herbs, the position cannot be sustained further without afforestation. On the other hand, requirement of medicinal plants and herbs is increasing steeply. This has resulted in unscientific and over exploitation of medicinal plants in the forests. One indication of the scarcity of some medicinal plants is their steep rise in prices. The Ministry of Environment and Forest have already banned collection of 29 endangered species of medicinal plant from their natural habitat (Ravikumar and Ved, 2000). Growing trees having medicinal values is the only answer for development and sustainability in each sector of the economy.

Medicinal plants in India: past and present

Old Indian scriptures incorporate a broad definition of medicinal plants and consider "all" plant entities to be potential sources of medicinal substances. While all plant entities are potentially medicinal, only those plants are considered 'medicinal' whose medicinal use has already been discovered for human or animal application. Such an application can neither be in the western biomedical system nor in homeopathy or any of the traditional systems of medicine like *Ayurveda, Unani, Siddha* and *Swa-Rigpa,* and folk medical traditions, which are eco-system and ethnic community specific (Shankar and Ved, 2003). Though, Britishers have tried to destroy the traditional medicinal system of *Ayurveda,* it is still a living tradition. There are millions of households, women and elders who have traditional knowledge of herbal home remedies. There is enormous diversity in these local health cultures because they are ecosystem and ethnic community specific. Traditionally medicinal plants have been used for human, animals and plant health. There are also texts on subjects like *Vriksh Ayurveda* and

Krishi Shastra that deal with use of plants for controlling pests, treating plant diseases and as biofertilizers.

India is the richest country with unique diversity in culture and natural vegetation having rich plant diversity. The ecology of India is so unique that all known types of ecosystems ranging for coldest place like the Nupra valley with –57° C, dry cold deserts of Ladakh to hot and dry desert of Rajsthan and Gujarat, temperate and Alpine sub-tropical regions of the North-West and Trans-Himalayas, rain forests with the world's highest rainfall in Cheerapunji in Meghalaya, wet evergreen humid tropics of Western Ghats, arid and semi-arid conditions of Peninsular India, to the coastal mangroves of Sunderban. India is rich in all the three levels of biodiversity – such as species diversity, genetic diversity and habitat diversity.

Rural people who constitute 72.20 per cent of the Indian populations live in 6.39 lakhs villages located in different agro-climate conditions. The village people have their own diverse systems of health management. Most of the common diseases were managed by household remedies, which included ajowan, isabgol, pepper, ginger, turmeric, coriander, cumin, tamarind, fenugreek, tulsi, etc. The traditional village physicians of India are using 4500 to 5000 species of plants for medicinal plants purpose. In India, there is no systematic, record and documentation about the traditional system of health care. A large number of tribal communities of India posses a precious and unique knowledge about the use of wild plants for treating human ailments.

The number of plants listed in Ayurvedic *Materia Medica* range form 260 in Dhanvantri's *Nighuntu* to 560 in Bhav Prakash *Nighuntu* (Ravikumar and Ved, 2000). The *Ayurvedic*

Drug Formulary prepared by Department of Indian System of Medicine, lists, 387 plants (Sarin, 2003). The *Unani* system of medicine describes 440 plants (Said, 1969) of which, 360 are common to other systems of medicine in the country. Sixteen medicinal plants of exotic origin, introduced in India form time to time, are under cultivation and are now considered a part of the Indian medicinal plant resources. Out of 3000 plants listed in the *Glossary of Indian Medicinal Plants,* 2500 plants have been reported to be used in ethno-medicine. The Ministry of Environment and Forests, Government of India, launched an All India Coordinated Project on Ethnobiology in 1982. The interim report so far places the number of plant species used as ethno-medicine at 8000.

Trade in medicinal plants

As the trade of medicinal plants is unorganized and unregulated sector, quality is not offenly maintained. Since medicinal plants sector has a number of stakeholders having divergent interest and without proper co-ordination sustained growth in medicinal plants is difficult to achieve. The emergence of new intellectual property rights is likely to pose serious challenges in future. Medicinal plants should be viewed as a possible link between conservation of biodiversity, sustainable economic development and affordable health care. The potential for earning foreign exchange by India from export of medicinal plants is estimated to be over US $ 2000 million per annum. The scope is enormous and task is difficult but achievable.

Demand and supply of plant raw materials

In the history of world, about 35-70 thousand species have one time or another been used in some culture for medicinal purpose. They are used in the form of crude drugs or

their extracts. There is a few plants from which active constituents are isolated and used as medicines. The species used for isolation of active ingredients may be indigenous species growing wild or cultivated, or hybrids or other cultivated varieties that have been bred for a particular characteristic. The increasing demands of the pharmaceutical industries have created the gap between supply and demand. One of the major problems being experienced by the industry is that of obtaining sufficient quantities of medicinal plants in right quality and time.

India is the major supplier of isabgol (psyllium) seeds and husk to the world market. The infusion and decoction of whole seeds or husk are used as bulk laxative. It also overcomes chronic diarrhea and dysentery by relieving the intestinal irritation. The crop is being cultivated mainly in Gujarat and adjoining areas of Rajasthan with annual turnover of about 82,900 tonnes of isabgol seeds and husk of which about 80 to 85 per cent is exported abroad. As a result of this, the country is earning about Rs. 160 crores as foreign exchange annually (Anonymous, 2001).

Senna (*Cassia angustifolia ammi* L.) is an export-oriented medicinal plant cultivated in India. Dried leaves and pods of senna are frequently used as stimulant laxative. It is grown extensively in south India mainly in Tirunelveli and Ramanathpuram districts of Tamil Nadu and to some extent in Cuddappa district of Andhra Pradesh, Pune in Maharashtra and Kutch in Gujarat. At present, the area under senna in India is more than 20000 ha yielding 3000-5000 tonnes of leaves and pods annually of which major portion is exported to Europe. (Kumar and Singh, 1997).

Coleus (*Coleus forscohlii* (Willd.)Briq.) is known as *Pashan Bhedi* in Sanskrit. Coleus is one of the most potential medicinal plants of the future due to its pharmaceutical properties. The tuberous roots of this plant is resembling carrot in shape and brown in colour are the economic parts and are found to be rich source of forskolin (syn. Coleonol) which is being developed as a drug for hypertension, glaucoma, asthma, congestive heart failures, intestinal disorders, and certain types of cancers (Shinivasappa, 2004).

Ajowan (*Trachyspermum ammi* L.) is also known as "Bishops weed". The most common Indian name is ajowan (also spelled as ajwain, ajowan). It is commercially cultivated for seed and herb, both having medicinal values. Ajowan has long been used in indigenous medicines for the treatment of diarrhea, dysentery, atonic dyspepsia, cholera, flatulence and indigestion. The oil has properties for using as an expectorant in emphysema, bronchial pneumonia and respiration ailment and also possesses antidiuretic effect. Alcolic extract of ajowan exhibited potent antimicrobial effects inhibiting the growth of B. subtills, E. coli and S. cerevisiae. The methanolic extracts of ajowan seeds possess natural antioxidant properties. Thymol is also a powerful antiseptic and has agreeable odour. It is useful in a variety of fungal infections of the skin (Nybe *et al.* 2007).

Medicinal plants sector in India is considered as a forestry sub sector (non-timber forest products).Till Medicinal plants Board was constituted in the year 2000. No nodal agency was there to look in to medicinal plants as an economic "sector" and different organizations were dabbling with different aspects of medicinal plants without any focus and co-ordination leading to paradox of simultaneous existence of under-utilization and

over-exploitation. This lack of co-ordination led to critical research gap relating to socio-economic and policy aspects of medicinal plants. In fact, scientists working in natural sciences themselves conducted socio-economic research in medicinal plants resulting in generally unprofessional analysis leading to over-simplification of complex issues and providing very general suggestions to tackle socio-economic issues.

In our country there are only few herbal drugs which are cultivated on large scale. The committee on cultivation of medicinal plants including conservation of rare and endangered species has identified the 24 species for development (Table1.1). The major cultivated herbs of India are isabgol, senna, opium, poppy, cinchona, ashwagandha and safed musli.

Table1.1 Medicinal plants identified for cultivation and developed by the medicinal plants board.

Common Name	**Botanical name**
A. Annual	
Isabgol	*Plantago ovata*
Long pepper	*Piper longum*
Senna	*Cassia angustifolia*
Ashwagangha	*Withania somnifera*
Kalmegh	*Andrographis paniculata*
Safed Musli	*Chlorophytum arundaenaceum*
Liquorice	*Glycyrrhiza glabra*
Bhumi amla	*Phyllanthus niruri/P. amarus*
B. Perennials	
Amla	*Emblica officinalis*
Ashoka	*Saraca asoca*
Bale	*Aegle marmelos*
Guggal	*Commiphora wightii*
Sandal wood	*Santalum album*
Kokum	*Garcinia indica*
C. Climbers	
Giloe	*Tinospora cordifolia*
Glory Lily	*Gloriosa superba*
Madhunasini	*Gymnema sylvestre*
Satavari	*Asparagus racemosus*
D. Plants for high altitude	
Atis	*Aconitum heterophyllum*
Chirata	*Swertia chirata*

Indian Barberry	*Berberis aristata*
Jatamansi	*Nardostachys jatamansi*
Kutki	*Picrorhiza kurroa*
Kuth	*Saussurea costus*

Source: (Farooqi and Vasundhara, 2004)

The information about the area under these herbs in different states is given in Table1.2. One of the major difficulties of medicinal plants cultivation in large scale is the lack of scientific and appropriate agro-technology for different climatic zones of the country. Although several organizations viz.,

Table-1.2: Area under cultivation of major medicinal plants in India

Sr. No.	**Common name**	**Botanical name**	**Producing states**	**Estimated area (ha)**
1	Isabgol (Psyllium)	*Plantago ovata*	Rajasthan and **Gujarat**	55,000
2	Senna	*Cassia angustifolia*	Tamil Nadu, Rajasthan, Uttar Pradesh and **Gujarat**	20,000
3	Coleus	*Coleus forskohlii*	Tamil Nadu, Karnataka, Andhra Pradesh and **Gujarat**	450
4	Opium poppy	*Papaver somniferum*	Madhya Pradesh, Utter Pradesh and Rajasthan	20,000
5	Cinchona	*Cinchona sp.*	Darjeeling (West Bengal) and Tamil Nadu	8,000
6	Ashwagandha	*Withania somnifera*	Madhya Pradesh, Utter Pradesh and Rajasthan	5,000
7	Safed musli	*Chlorophytum sp.*	Andhra Pradesh, **Gujarat** and Uttar Pradesh	5,000
8	Periwinkle	*Catharanthus roseus*	Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra	4,000
9	Khai katari	*Solanum sp.*	Maharashtra	4,000

10	Sarpagandha	*Rauvolfia serpentina*	Madhya Pradesh	2,500
11	Ipecac	*Cephaelis ipecacuanha*	Darjeeling (West Bengal)	100

Source: (Farooqi and Vasundhara, 2004)

Indian Council of Agricultural Research (ICAR); Council of Scientific and Industrial Research (CSIR) laboratories, various Indian Universities, etc., and Research Councils of Indigenous Systems of Medicine (ISM), Government of India, have taken up the work of development of appropriate agro-technology, and development of high yielding varieties of medicinal plants, yet much efforts are still needed keeping in view the demands and quality requirements of trade and industry. Commercial farming is defined as the type of farming where capital input is high and the production is market and profit oriented (ISA, 2000). Among the medicinal crops grown commercially in Gujarat, Isabgol (*Plantago ovata* Forsk), Senna (*Cassia angustifolia* C), Coleus (*Coleus forscohlii* (Willd.) Briq.), Ajowan (*Trachyapermum ammi* L.) are the major crops selected for this study.

The conventional sources of present supply of herbal crops would not be enough to match rising demand. Hence, there is immense scope of commercial cultivation of these herbal crops. But there is a dearth of literatures and data on economics of production and marketing of herbal crops in our country in general and for Gujarat in particular. Therefore the present study is designed to investigate about the economic and marking aspects which would be the lighthouse for herbal producers, traders and policy makers. The specific objectives of the study are as under:

Objectives

1. To assess the economic viability of cultivation of selected medicinal crops.
2. To estimate the productivity of resources and allocation efficiency of factors used in selected medicinal crops.
3. To identify marketing channels and estimate marketing costs and margins at different stages of marketing.
4. To analyze the growth and export directions of medicinal crops.
5. To elicit the problems faced by the farmers regarding the production and marketing and exporters of selected medicinal crops, and
6. To work out the export competitiveness of selected medicinal crops.

Scope and utility

In spite of the importance of medicinal plants and their safe nature, demand for the cultivation is increasing at slow rate in India. A derivative of medicinal plants is non-narcotic, having no side effects. The demand for these crops is increasing in both developing and developed countries. There are few comprehensive studies on economic analysis of the medicinal crops in our country.

Certain questions like whether the farmer has to grow medicinal plants, does its cultivation is profitable, when and where to sell the produces; are still not very clear. There is a need to address such issues and hence this study aims at answering these questions, considering cultivation and marketing of selected medicinal crops and its export potentials.

CHAPTER II

REVIEW OF LITERATURE

Studies on economic aspects of medicinal plants cultivation are few and scanty. The review of literature available provides framework for analytical procedure to be followed and new research opportunities may also be identified. Keeping in view the objectives of the present study and the research works done regarding the economics of cultivation of medicinal crops, its marketing and exports have been reviewed and presented under the following heads:

2.1 Economics of medicinal crops

2.2 Resource use efficiency

2.3 Marketing cost and margin of medicinal crops

2.4 Export dynamics and export competitiveness

2.5 Problems in cultivation, marketing and export of medicinal crops

2.1 Economics of medicinal crops

Srivatsava (1996) recognized the significance of commercial cultivation of medicinal plants to protect the natural resource base as well as to improve the supply of raw drugs.

Farooqi and Vasundhara (1997) worked out the cost of cultivation for medicinal plants like ashwagandha, coleus, long pepper (as inter crop in coconut garden) and periwinkle. The results of the study revealed that the cost of cultivation and the net returns per hectare for long pepper was Rs. 90,400 and Rs. 2,13,600 respectively, followed by periwinkle (Rs. 9,500 and

Rs. 40,500), coleus (Rs. 6,500 and Rs. 73,500) and ashwagandha (Rs. 5,600 and Rs. 24,400).

Lambert (1997) identified the medicinal plants as a source of income generating crops especially in rural economies, considering supply contractions and price escalation.

Suneetha (1998) studied the cost of cultivation of medicinal plants in Kerala. The cost of cultivation was estimated for *Plumbago, Kaempferia, Aloe*, *Ocimum* and *Piper longum* as inter crops in coconut garden using partial budget techniques. They provided additional returns of Rs. 30,340 per annum to coconut garden. The additional cost involved in cultivation was Rs. 25,091 per acre for all of the five medicinal plants.

In the study on high value farming-safed musli and senna, Jarial (1999) found that the total expenditure in the cultivation of safed musli was Rs. 2,95,000 and total income was Rs. 6,30,000 per acre. In case of senna the total cost of cultivation per acre was Rs. 3,700 and gross income from the sale of leaves was Rs. 15,000. Net income during the first year was Rs. 11,300 and net income during the subsequent years was Rs. 13,300 in the cultivation of senna crop.

Lokesh (1999) observed in his study on resource economics of sweet flag (*Acrous calamus*) in Tumkur district of Karnataka that the total cost of production per acre of sweet flag was Rs. 28,789 in the case of sewage water farms and Rs. 30,880 in the case of ground water farms. The average yield and gross returns per acre were higher being 23.02 quintal and Rs. 54,374 in the case of sewage water farms than the ground water farms, being 16 quintal and Rs. 45,152, respectively.

Vasudeva (1999) indicated that the total cost of cultivation of periwinkle per hectare was Rs. 15,000 and the

gross returns from leaves, stem and root was Rs. 36,000, Rs. 3,000 and 30,000, respectively. The net profit was Rs. 54,000 after deducing the total cost.

Jadav *et al.* (2001) estimated that the cost of cultivation per hectare of isabgol and patchouli was Rs. 9,866 and Rs. 80,787 and gross returns per hectare was Rs. 12,775 and Rs. 2,50,000 from isabgol and pacholi, respectively. The gross return per hectare of patchouli was higher than the isabgol, because isabgol is long duration crop. The Benefit-cost ratio was 1.26 and 2.00 for isabgol and pacholi, respectively.

Ganapathy (2004) reported that the total cost of cultivation of coleus forskohlii was Rs. 34,660 per acre, out of this, variable cost was Rs.32,046, and fixed cost was Rs. 4,863. Among the variable costs, cost on planting material was the major cost, which was Rs. 20,000. Human labour and irrigation cost were the other important costs in total cost of cultivation of coleus forskohlii. The average yield of dried roots was 978 kg per acre. The average gross return realized per acre was Rs. 44,010. Thus, total cost of cultivation was Rs. 36,349. Net return over variable cost and net return over total cost were Rs. 11,964 and Rs. 9,350, respectively. Cost of production per kg. was Rs. 37.74. Net return over total variable cost per kg. and net return over total cost per kg. were accounted to Rs. 12.23 and Rs. 7.26, respectively. Return per rupee over variable cost and return per rupee over total cost were Rs.1.37 and Rs.1.19, respectively.

A field investigation was conducted by Gawankar *et al.* (2005) with a view to assess the economic viability of cultivating aonla (*Emblica officinalis* Gaerth) under rainfed condition in South Konkan region of Maharashtra state. The study revealed

that cultivation of Aonla as a rainfed crop by providing drip irrigation only during the initial establishment period of three years was found to be remunerative within a period of 6 years after planting as it gave a net return of Rs. 47,684/- per hectare. The higher benefit-cost ratio (2.64) suggested that there exists economic viability in cultivation of aonla crop in the region. The payback period was found to be of six years with 6.01 undiscounted and 3.42 discounted cost benefit ratio. Internal rate of returns (IRR) was 30.76 per cent, which is more than the prevailing rate of interest in the market, indicating that aonla as a fairly profitable crop in the region.

Anonymous (2007) revealed that the average total cost (Cost C_2) of cultivation of isabgol per hectare was Rs. 16974/-. The average yield was 9.40 quintals per hectare. The average gross returns was Rs.27267/-per hectare. The return per hectare over cost C_2 was Rs.10293/-The average total cost of production (Cost C_2) per quintal was Rs. 1795.21. The average farm harvest price of isabgol was estimated to be Rs. 2890.21 per quintal which was higher than the cost of production per quintal. The farm harvest price of isabgol was found higher than the bulk line cost i.e. Rs. 2324.09 per quintal indicating the profitable of this crop. The input output ratio over cost C_2 worked out to be 1:1.61 which shows that one rupee invested on isabgol cultivation yielded Rs.1.61.

2.2 Resource use efficiency

Murthy and Ramanna (1979) employed modified Cobb-Douglas type of production function to the data obtained from 48 mulberry growing farmers selected at random to study the resource productivity and allocative efficiency of important

factors in mulberry cultivation. The results indicated that six variables like land, farm yard manures, fertilizers, number of irrigations, human labours and other variable costs explained 95 per cent of variation in the yields of mulberry crop. They also reported that ratios of their marginal value product to their factor costs were more than one indicating that they were economically used in mulberry cultivation.

Patel *et al.* (1986) made an attempt to assess the resource productivity using Cobb-Douglas production function. The ratio of marginal value productivity to marginal cost of bullock labour, irrigation, seed, manures and fertilizers indicated excessive use of these inputs.

Hossain *et al.* (1987) studied resource allocation efficiency under irrigated farming. They found that coefficients of human labour, animal power and triple super phosphate were positive which indicated a logically consistent relationship between output and these inputs. The negative signs of coefficient of seed, manures, urea and potash revealed the excessive use of these inputs.

Balkrishnan *et al.* (2002) shows that the bullock labour was found to be negatively non-significant in the output of rain fed chillies due to reduction of bullock power and also its non-availability in time. Seeds was found to be negatively significant indicate excessive use of seeds. It was evident that MVP for human labour, manure and fertilizers and PPC were greater than unity. It is indicating the scope to increase the output through use of these variables in Tamil Nadu.

Gaddi *et al.* (2002) showed that profitability ratio of bullock labour on small farms and human labour on large farms in Karnataka were optimally used and use of rest of the inputs

differed from their optimum level. They suggested that the need for reallocation of expenditure among different inputs based on the profitability ratio.

Vagdevi *et al.* (2004) studied resource use efficiency on vegetable farms of Krishna district of Andhra Pradesh. They found that the marginal value products to opportunity cost ratios had indicated the deviation from unity revealing inefficient use of resources of different magnitudes. This offered the scope to adjust the resources so as to derive higher returns in vegetable cultivation.

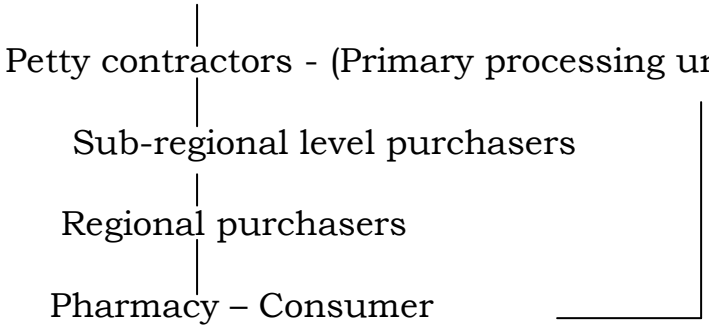
Ardesana (2005) observed that the elasticity of groundnut output with respect to area under crops and human labour has turned out to be positive and significant in all zones. Where as other variables were positive but not significant. This indicates that only human labour has contributed positively and significantly to income from groundnut in Saurashtra region.

2.3 Marketing cost and margin of medicinal plants

The production and marketing pattern of medicinal plants in Madhya Pradesh was studied by Boaz (1997). He observed that about 90% of the requirements of such plants are met from the collection from the wila. Collection is believed to be highly unsustainable as destructive harvesting without emphasis on conservation is practiced along with problems of overexploitation and collection of immature plants. One way to overcome this problem is to take up cultivation of species although such activity is yet to gain acceptance.

He also noted that marketing is highly unorganized and occurs in three forms:

1. Producer/collector– Local healers – village level consumers
2. Collector–Primary processing units–Pharmacies–consumers
3. Collector – Middlemen at weekly markets



The main benefits of the trade seem to go to the middlemen pharmacies. In order to overcome the exploitative practices of middle men, a three tier co-operative structure (at the village-district & state levels) for nationalized Minor Forest Produce viz. Diospyros leaves has been evolved by the state.

An alternate production to consumption model involving JFM committees and the three-tier co-operative system has been suggested to improve better returns to collector and also to ensure sustainable harvesting practices. The emphasis has been given on the need to develop the existing primary processing units involving pharmaceuticals.

Olsen and Heller (1997) studied the trade in medicinal & aromatic plant in Nepal for 2 years in Gorkha district. Analysis showed that a small group of wholesalers has controlled on flow of price information and thereby the prices paid to the road head traders and hence to the collectors such that they led to low net margins. A detailed price margin analysis of three crops – Jatamamsi (*Nordostachys grandiflora*), Kutki (*Picrorhiza scrophulariiflora*) and Chiraita (*Swertia chirayita*) was done for two periods from September, 1994 to August, 1995 and from October, 1994 to March, 1995. The analysis has accounted for

costs viz. storage cost, weight loss, transport costs etc. According to this analysis, the road head traders got net margin ranging from – 8.7 to 2.2 % Nr/Kg: whilst the corresponding wholesaler's margin (after deducting costs) was 33.50 to 12.6% Nr/Kg of produce. The margins of collectors were in the range of 52.2 to 49.98%. The collectors and the road head traders were ill-equipped to get market information form India (Delhi, being the main market) due to 'passive oligopsony' structure of the market, which implies that few (wholesalers) traders control price information informally i.e. with no formal collusion.

Gondalia and Patel (2007) reported that aonla growers sold all the quantity available for sale and did not store them for extended sale in off season due to highly perishable nature of aonla fruit. Grading in aonla is done by the farmers manually on the basis of size of fruits which helped them to get better prices of higher quality fruits in the market. The producer's share in consumer's rupee was 58.26 per cent and the marketing efficiency was 1.40. This implies that aonla marketing system has been working at reasonable efficiency looking to the perishable nature of the crop. The cost of weight loss due to damage and spoilage had the lion's share of about 26 per cent in total marketing cost which can be minimized by using appropriate packing and handling technology and its training should also be imparted to all the marketing personnel. Though marketing of aonla is functioning at reasonable efficiency, there is a scope to enhance the efficiency through intervention of marketing Co-operatives. These will help the growers in orderly marketing of their produce and reduction in unauthorized market charges.

2.4 Export dynamics and export competitiveness

Jeromi and Ramanathan (1993) while analyzing the world pepper market and India's share, reported that there was significant changes in the direction of pepper exports from India during the period 1975 to 1990. It was observed that nearly 44 percent of India's pepper exports were directed to former USSR which constituted about 82 percent of the total pepper import of that country. On the other hand, India not only failed to increase its exports to USA in tandem with increased consumption in that country, but also could not sustain the quantity exported in the past years. Instability of exports was lower in case of former USSR, Italy and Canada and higher for Poland, USA and Czechoslovakia.

Laxminarayana (1993) studied the direction of Indian silk exports by first order Markov process. The major importing countries considered for the analysis were USA, West Germany, United Kingdom, France, Italy and Japan. The exports to USA were stable and would remain highly loyal to Indian silk. The probability of export to the United Kingdom, West Germany and Japan switching over to USA was unity implying that entire quantity of exports to these countries would drift to USA over a period of time.

Jalajakshi (1994) analyzed the changing pattern of shrimp export between two periods – Period I covering 1970 to 1980 and period II covering 1980 to 1990. The study revealed that during the period-I, India could not retain its previous market share in European Economic Community (EEC) countries. Nearly 90 percent of India's share was diverted to Japan and 7 percent to UK. However, in period II, India could

retain its previous market share in EEC countries due to the gradual acceptance of tropical shrimps in these countries.

Veena *et al.* (1994) examined the changing directions of Indian coffee exports in terms of importing country shares over the period 1965 to 1990 using Markov chain analysis. It was observed that India could not retain its previous market share to USA, Netherlands, Yugoslavia and other importers. However, the actual quantity exported to all these countries has increased which was due to increased quantity of Indian coffee exports. India retained its market share to former West Germany, erstwhile USSR and Italy. The increased market share of USSR in the 1970s and 1980s was then threatened by the economic and political upheaval in the region.

Ajjan *et al.* (1998) worked out an economic analysis of export performance of senna and periwinkle in India and found that the export of senna and periwinkle are highly unstable. Also, it is confined to a few countries only. Thus, the future prospects depend upon the demand pattern of these countries only. Germany and France are the major buyers of Indian senna and periwinkle, respectively, while Japan seems to be a growing market for senna.

Ravi and Reddy (1998) used nominal protection coefficient technique to workout the export competitiveness of jowar, maize groundnut, sunflower, cotton and coffee from Karnataka under the importable and exportable hypothesis for a period of ten years form 1984-85 to 1994-95. The results revealed that Karnataka lacked comparative advantage in most of the crops except cotton. The export potential of jowar, maize, groundnut and sunflower were found to be significantly low.

Murthy and Subrahmanyam (1999) measured the dynamics of changes in the exports of onion from India to different countries with the help of a Markov chain model. From one step transitional probabilities, the model is extended to n-step for future forecasting. The results have shown that Malaysia, United Arab Emirates (UAE) and Singapore were having high probability of retention and will continue to be the major importers in future also. As revealed by the low values of probability of retention, Saudi Arabia and others were unstable importers of Indian onion. In the next decade, Sri Lanka and Bangladesh would likely to increase their imports form India, though it may come at the cost of UAE. The exports of onion from India would increase to 5.06 lakh tones by 2004-05 AD.

Tamanna *et al.* (1999) examined the export potentialities of fruits from India by using nominal protection coefficient, which is the ratio of domestic price to the border price. On an average, the nominal protection coefficient value in mango (0.87), grape (0.59) and banana (0.49) were lower than one indicating their competitiveness in international market.

Ashalatha (2000) analyzed the export competitiveness of Indian cashew using nominal protection coefficient technique. Under the exportable hypothesis the nominal protection coefficients were found to be lesser than unity with an average value of 0.91, implying that the Indian cashew kernel is competitive in the international market.

Shivaraya (2000) studied the export competitiveness of Indian fresh vegetables using nominal protection coefficient technique. The results of the study revealed that all the vegetables considered viz; onion, potato and tomato were

competitive for their exports to other countries, since the nominal protection coefficient values were less for all.

Shivaraya (2000) studied the changes in trade directions of export of selected vegetables using Markov chain analysis. The results of the study revealed that UAE and Malaysia were the loyal markets for Indian onion. In case of potato, Sri Lanka and Nepal were found to be the most loyal markets where as, Bangladesh and Nepal were the most stable importers of Indian fresh tomatoes.

Jyothi *et al.* (2003) examined the export performance of onion and potato from India by using exponential function, C.V. and Coppock's instability index. The results of the study revealed that the growth in volume of export, export earnings and unit value realization indicated a positive trend for both onion and potato during the study period. The highest instability was observed for volume of exports in both potato and onion when compared to export earnings and export price/unit value. The average NPC values of onion and potato during 1996-97 to 1999-2000 indicated moderate and high competitiveness respectively.

A study was conducted at Junagadh district of Gujarat on export potential for major horticultural commodities. The results of the study shows that export of fresh mango found most profitable and got highly competitive prices in EU, USA, Canada and South Asian countries as well as some countries of Middle East. Study also emphasized on removal of non trade barriers to increase our exports of horticultural commodities (Anonymous, 2006).

Kumar and Rai (2007) reported that the production and export performance in tomato have revealed that India has ample scope to increase export of tomato and its products. The

export of tomato has registered an impressive growth during the recent years, after the liberalization of trade. Export competitiveness of Indian tomato and its production can be improved through socialization of improved techniques of production and processing and also by providing adequate government support for making production and marketing of these products more economical. Establishment of infrastructure for various sanitary and phytosanitary measures may also help in improving Indian competitiveness in the international market.

Khunt *et al.* (2008) studied export potential and barriers in export of onion form Gujarat. The results revealed that area, production and yield is growing positively at compound rate indicating assurance of onion supply for export as well as for sustaining fast growing onion dehydration industries of the state. The export of fresh onion is highly concentrated to its neighbouring countries and Middle East. Though European Countries as well as USA were found highly competitive for export, the quantity exported to these countries is very small. So there is a need to divert our onion export from less competitive countries to most competitive one. This requires the removal of major non-tariff barriers viz; irregular and inadequate onion supply of required quality, infrastructural bottlenecks like DEPB, lack of quick and cheap transportation facilities, lack of quality testing lab, poor market intelligence etc. as well as tariff barriers like subsidy in transport, removal of protection tariff imposed by EU against export of India.

2.5 Problems in cultivation, marketing and export of medicinal crops

Nagraja *et al.* (1999) identified the most important constraints in production and marketing of potato in Kolar districts of Karnataka by assigning the ranks. In production, high cost of seed material and diseases (rank-I) were the major constraints followed by frequent power failure (rank II), high cost of fertilizers and plant protection chemicals (rank III), Scarcity and high cost of labours (rank-IV) and non-availability of good seed material on time (rank-V), low output prices (rank-VI), and high market charges (rank-VII) were the main constraints in marketing. Under the circumstances, it was suggested to encourage farmers to take up tuber treatment for sufficient time to avoid cost of labour especially during scarcity period and adoption of scientific production technologies and marketing strategies to get maximum returns.

Vasudev and Chowdary (1999) have identified problem of vegetable production and marketing of tomato in three vigour of Andhra Pradesh. The major problems that have been identified are lack of grading facilities, absence of market information, spoilage and mal practices. Providing the proper facilities as above, it can improve the marketing efficiency and will help the farmers in realizing better prices.

Khunt *et al.* (2001) studied the problems faced by the mango growers in Saurashtra region of Gujarat state. The study revealed that the problem of labour shortage was more severe on large size group farms than that of other size group of farms, whereas, financial shortage was found more acute in small size group. Majority of mango growers (59.72 %) felt the problem of higher marketing costs in marketing of this fruit. About 73 per

cent growers experienced the dominant role of traders as a major problem in its marketing. Non-availability of cold storage was also identified a problem by 65.28 per cent mango growers. This problem was felt more by the large sized farmers as they have large quantity of marketable surplus to dispose. More than 50 per cent mango growers felt the transportation problems in terms of non-availability of transportation facility, lack of proper road and higher transportation cost.

Ganpathy (2004) studied the major constraint in selected commercial and endangered medicinal plants of Bangalore rural district and reported that farmers major problems were lack of proper yardstick to measure quality of the produce, poor technical guidance in the cultivation of medicinal plant and high rate of rejection by contract firm if farmers do not maintain quality. Low contract price, irregular payment for produce, influenced the farmers to cultivate next crop or to pay their loan dues.

Reddy and Reddy (2005) studied the production and marketing constraint of sunflower cultivation in Andhra Pradesh and identified that the delay in cash payment after the sale of the produce was a serious problem for about 95 per cent of respondents. Hence, the concerned market committee should pursue the commission agents to pay the cash immediately after the sale for sunflower. About 65 per cent of the sample farmers felt that the commission charges were relatively high and affected their income from sunflower. Hence, the State Government should take necessary steps to fix a reasonable rate of commission without affecting the interest of the producers and commission agents. About 78 per cent of the respondents expressed that they were forced to sell the produce at relatively

lower price due to immediate financial needs and lack of storage facilities. The warehousing corporation should provide necessary storage facilities as well as credit by using their produce as security.

CHAPTER III

METHODOLOGY

This chapter deals with the methodology adopted for achieving the objectives of the study. It provides an insight into the sampling procedures, sources of data, methods of data collection and analytical design adopted for accomplishment of objectives under study. The details of the methodology are discussed under following heads.

3.1 Description of the study area

3.2 Sampling technique and sources of data

3.3 Analytical techniques

3.1 Description of the study area

The study covers Saurashtra and Kutch region of Gujarat state. Junagadh, Kutch and Jamnagar districts were selected purposively for the study as they occupy the large area of medicinal crops under study. Junagadh district for isabgol, Kutch district for senna and Jamnagar district for coleus and ajowan crops were selected, because they were commercially cultivated on larger scale in these districts.

3. 2 Sampling technique and sources of data

3.2.1 Selection of medicinal crops growers

From each selected district, one taluka was selected purposively where the selected crops were cultivated extensively. From each selected taluka, 50 respondents were selected randomly for each crop constituting the total sample size of 200 farmers. Number of villages was selected considering the

availability of respective crop growers and required size of sample. The details of sample farmers are given in Table 3.1. The primary data from sample farmers and traders of medicinal crops for the year 2006-07 were collected through personnel interview by using the pre-tested questionnaire. The secondary data on area, production, productivity, price and export were collected from various published sources. The export data were collected from the port of Mundra (Gujarat) and were analysed for export competitiveness.

Table 3.1 Selection of sample villages and medicinal crops growers

Districts	Talukas	Villages	No. of farmers	Crops
Junagadh	Junagadh	Vadal	20	Isabgol
		Choki	20	
		Kathrota	10	
Kutch	Anjar	Rapar	20	Senna
		Khara pasvariya	20	
		Mitha pasvariya	10	
Jamnagar	Jamkhambhaliya	Jamkhambhaliya	20	Coleus
		Sakhpar	10	
		Dharampur	10	
		Targhadi	10	
	Jamnagar	Jamvanthali	20	Ajowan
		Motilakhani	20	
		Nanilakhani	10	

3.2.2 Selection of intermediaries

The concerned intermediaries between producers and consumers were also contacted. The details of selection of marketing agencies are given in Table 3.2. The data regarding the various items of costs and margins of intermediaries were collected through personal interview during 2006-07.

Table: 3.2 Selected market intermediaries of medicinal crops

crops	**Marketing Agencies**					
	Village merchants	Wholesalers in regulated market	Whole-salers in city	Retailers	Processors	Exporters
Isabgol	3	3	3	--	3	3
Senna	--	--	3	--	--	3
Coleus	--	3	3	3	--	--
Ajowan	3	3	3	3	--	--
Total	**6**	**9**	**12**	**6**	**3**	**6**

3.3 Analytical techniques

Collected data were scrutinized, tabulated and analysed as per objectives of the study by employing tabular analysis and appropriate statistical tools to achieve the stipulated objectives of the study as follows:

3.3.1 Economics of selected medicinal crops

For the calculation of cost, the value of purchased inputs was taken into account as reported by the cultivators with due verification. Some of the inputs used in the production process come from the farmer family sources were valued at prevailing market prices in their localities.

Interest on working capital was charged at the rate of 12 per cent per annum, according to duration of the crops, while interest on owned fixed capital was charged at the rate of 10 per cent per annum. Depreciation of owned farm buildings was calculated at the rate of 5 per cent for kuchcha and 2 per cent for pucca buildings per annum. Rental value of farmers owned land was charged at the rate prevailing in the villages. Management charge was calculated at the rate of 10 per cent of total cost (cost C_1).

The apportionment of total cost of cultivation between the main product and the by-product was done in proportion to their contribution to the total value of output, when the value of by-product is greater than or equal to 10 per cent. But when the value of by-product is less then 10 per cent, it is deducted from the total cost and apportionment of joint costs are calculated. Costs are generated following various cost concepts viz, Cost A, Cost B, Cost C_1 and Cost C_2.

The expenses incurred towards land revenue, transport charges, charges paid for hiring thresher/opener, tractor charges, charges to contract work, etc., were included under the head of miscellaneous cost.

The bulk line cost is the unit cost, which covers the cost of bulk production, that is 85 per cent of the total production of a commodity. A graph of cumulative percentages of area, production and holdings covered is drawn and from this graph, the bulk line cost per quintal was computed alongwith the area and holding covered.

The returns per hectare over different costs, cost of production per quintal over different costs, input-output ratios

and bulk line cost were estimated by arithmetic mean and ratio methods.

3.3.2 Resource use efficiency

The resource use efficiency for the selected crops was estimated by using production function as given below.

$$\mathbf{Y = a\ X_1^{b1}\ X_2^{b2}\ X_3^{b3}\ X_4^{b4}\ X_5^{b5}\ X_6^{b6}\ X_7^{b7}\ X_8^{b8}\ .\ e^{u}}$$

The Cobb-Douglas production function is the most appropriate for studying resource use efficiency. In this functional form, 'Y' is dependent variable, 'Xi' are the independent input variables, 'a' is constant representing intercept of production function, 'bi' are the regression coefficients of the respective input variables and 'u' is the error term. The regression co-efficients obtained from this function directly give the elasticities of production, which remain constant throughout the relevant range of inputs. The sum of coefficients indicates the nature of returns to scale. When the function is expressed in logarithmic term, it becomes a linear function of the following type.

$$\mathbf{\log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + \log u}$$

Where,

Y = Output of crop in qn/ha

X_1= Area under crop in hectares

X_2= Human labour in man days/ha

X_3= Bullock labour in pair days/ha

X_4= Manures in cartloads/ha

X_5= Nitrogen in kg/ha

X_6= Phosphorus in kg/ha

X_7= Potash in kg/ha

X_8= Other working capital in rupees/ha

Specification of variables

Crop output in quintals (Y)

Per hectare output of selected crops (main produce) has been decided as dependent variable.

Area under crop (X_1)

The area under the crops under study has been taken as independent variable as it influences the crop output.

Human labour (X_2)

This input has been expressed in terms of man days of eight hours each. Human labour includes hired labour and family labour utilized for performing crop production activities right from preparation of land to threshing.

Bullock labour (X_3)

Bullock labour used for different farm operations has been considered as a separate variable and it has been measured in pair days. Here one pair day means eight hours of work by one pair of bullocks.

Manures (X_4)

Manure has been considered as a separate explanatory variable. This variable is measured in physical units expressed in cartloads.

Nitrogen (X_5)

Per farm quantity of nitrogen used in kilograms for raising the crop concerned has been taken as an independent variable.

Phosphorus (X_6)

Per farm quantity of phosphatic fertilizer used in kilogram was taken as an independent variable.

Potash (X_7)

Similarly, per farm quantity of potash fertilizer used in kilograms for a crop was considered as an independent variable in present analysis.

Other working capital (X_8)

The expenditure on seed, irrigation, pesticides, fungicides, repairs and maintenance of implements and machinery is also important in the production process. But inclusion of all these inputs as separate variable would greatly reduce the degree of freedom in the analysis. Therefore, other working capital has been included in the set of explanatory variables.

(I) Estimation of marginal value product (MVP)

A neo-classical criterion indicating that marginal value productivity must be equal to or above the unit cost of individual

inputs. This criterion was used to examine the input use efficiency. The marginal value productivity of individual resources was estimated by using the following formula.

$$MVP\ x_i = \frac{b_i \bar{Y}_G . P\bar{Y}}{\bar{X}_{iG}}$$

Where,

$\bar{Y}_G$ = Geometric mean of output

$P\bar{y}$ = Price of output (Rs/qtl)

$\bar{X}_{iG}$ = Geometric mean of i^{th} input

b_i = Production elasticity of i^{th} input

The efficiency of inputs use was studied through the comparison of MVPs of inputs with their marginal costs or acquisition costs.

(II) Marginal costs/acquisition costs

The marginal cost of land has been taken as the average rental value of land under the selected crops. The estimated average wage rate for a man day was taken as the marginal cost of human labour. Similarly, the marginal cost of bullock labour includes the average market rate of a bullock pair for a day. The average market prices of manures and fertilizers prevailed during the study year at the village level has been taken as marginal cost of manures and fertilizers. The marginal cost of other inputs taken as cash expenditure incurred for all other inputs together was considered as one rupee since these inputs have been measured in value terms.

(III) Determination of optimum allocation of fertilizers

From the Cobb-Douglas production function, the optimum allocation of inputs was determined under limited capital situation of each selected crop growing sample farms. It could be obtained by using production elasticities of respective inputs as under.

$$X_i = \frac{b_i \cdot C}{S \cdot P x_i}$$

Where,

X_i = Optimum level of i^{th} input

b_i = Production elasticity of i^{th} inputs

C = Existing total expenditure incurred on all selected inputs

S = Sum of elasticities

Px_i = Price per unit of i^{th} input

3.3.3 Marketing aspects

3.3.3.1 Market price and cost

Gross price was estimated by dividing the total quantity actually sold by the medicinal crops growers to the total sale value of medicinal crops of the sample growers. Net price was estimated by deducting marketing cost incurred by the medicinal crops growers from the gross price obtained by them.

The marketing cost was taken as the sum of all expenses incurred by the medicinal crops growers while transacting the produce from farm to market (e.g. bagging, loading, transporting, unloading and other charges)

3.3.3.2 Marketing channels

Marketing channels consist of various agencies who perform various marketing functions in sequence as the produce moves from the producers to ultimate consumers. The following main channels for medicinal crops have been identified as under:

(i) Producer - village merchant - whole seller - processor

(ii) Producer - whole seller in regulated market - exporter

(iii) Producer - whole seller - retailer - consumer

(iv) Producer - consumer

3.3.3.3 Producer's share in consumer's price

It is the price received by the farmers expressed as a percentage of the retail price. It was worked out by using the following expression

$$Ps = (Pf / Pr)*100$$

Where,

Ps = Producer's share in consumer's price

Pf = Price received by the farmers

Pr = Price paid by the consumer/retail price

Note: In the marketing of isabgol, processor was taken as the consumer whereas in case of the senna (leaves), exporter was taken as the consumer.

3.3.4 Export aspects

3.3.4.1 Analysis of growth

The compound growth rate of export of isabgol seed senna (leaves) and ajowan seed in terms of quantity, value and unit value realization were worked out for the period of 1995-2007 for isabgol seed and ajowan seed and 1983-2000 for senna (leaves) using exponential function. As the timeseries data on export of coleus were not available, this crop is omited for growth analysis. The exponential function used is given below:

$$Y = ab^t$$

Where,

Y = Dependent variable for which growth rate is estimated i.e. quantity/ value/ unit value

a = Intercept

b = Regression co-efficient

t = Time variable in the years

The equation can be rewritten in the logarithmic form as follow:

$$\text{Log } Y_t = \text{Log } a + t \log b$$

We can thus, calculate the compound growth rate (r) = (Anti log of log b-1)*100

Where,

r = Compound growth rate per cent per annum

Along with the growth analysis, the instability index of export was also worked out using following formula.

$$\text{Instability Index} = \sqrt{\frac{\sum_{i=1}^{n} e_i^2}{(n-k)}}$$

Where,

e_i = Value of residual of i^{th} observation

n = Number of observations

k = Number of variables

3.3.4.2 Analysis of Export Dynamics

(a) Export pattern

The change in export quantity to different destinations during the period 2005-07 was estimating by rank correlation coefficient. The ranks were assigned between the years based on the share of export quantity of each crop to total export from India. The formula used for the analysis is as:

$$r_c = 1 - \frac{6 \sum_{i=1}^{n} d^2}{n(n^2 - 1)}$$

Where,

r_c = Rank correlation coefficient

$\sum_{i=1}^{n} d^2$ = Sum of the squares of the rank differences

n = Number of observations

When there are two or more items of equal magnitude and their ranks are the same, then the following formula was used:

$$r_c = 1 - \frac{6[\sum d^2 + 1/12 \sum (P^3 - P)]}{n(n^2 - 1)}$$

Where,

$1/12\ \Sigma(P^3-P)$ is the correction factor

P = Number of items whose ranks are common

For the test of significant, the worked out values of 'r_c' were compared with statistical table values of 'r' at 1 per cent and 5 per cent levels of significance.

(b) Markov analysis

Markov chain analysis is a method of analysis the current behaviour of some variable in an effort to predict the future behaviour of that same variable. This technique was developed by the Russian mathematician Andrei A. Markov early in 1907. As a management tool, markov analysis has been successfully applied to a wide variety of decision situations.

The basic of markov analysis the best demonstrated with a brand-switching problem, structural change in share of export and domestic markets, changes in cropping patterns, etc. The

structural change in the share of export of medicinal crops under study were analysed by using a first order markov model. The probability of next outcome depends on the outcome immediately before. This is called first order markov chain. If the set of possible outcomes is finite it is called a finite markov chain. The model is a stochastic process which described finite number of possible outcomes S_i, of a discrete random variable X_i with the assumption that (i) the probability of an outcome on the i^{th} year depends only on the outcome of the preceding year (t-1), and (ii) this probability is constant for all time period.

In the present study, markov model considered the average export share to a particular country to be a random variable, whereas the exports to the particular country in period 't' depends only on its previous year exports to that country.

The following first order Markov model was used.

$$E_{jt} = \sum_{i=1}^{r} E_{it-1} P_{ij} + e_{jt}$$

Where,

E_{jt} = Exports form India during the year 't' to j^{th} country,

E_{it-1} = Exports to i^{th} country during the year t-1,

P_{ij} = Probabiltiy that exports will shift form i^{th} country in period t-1 to j^{th} country in period t.

E_{jt} = The error term which is statistically independent of E_{it-1}, and

r = The number of importing countries

The transitional probabilities P_{ij} which can be arranged in a (r x r) matrix, have the following properties.

$0 \leq P_{ij} \leq 1$ for all I and j

$$\sum_{i=1}^{r} P_{ij} = 1 \text{ for all j}$$

Lee *et al*[4] and Veena *et al*[5] used the Linear programming framework by a method referred to a Minimisation of mean absolute deviation (MAD) to estimate the transitional probability matrix. This analysis leads to the formulation of the following Linear Programming problem which can be solved to estimate the transition probabilities, (for each i) p_{ij}, j = 1, 2,……r.

Model

For each i, to determine P_{ij} j = 1,2, …… r which minimises

$$Z = \sum_{i=1}^{r} O\, P_{ij} + \sum_{k=1}^{T} O_k + \sum_{k=1}^{T} P_k$$

Subjected to

$$\sum_{i=1}^{r} O\, P_{ij} + O_i + P_i = Y_i$$

$$\sum_{j=1}^{r} P_{ij} = 1$$

$P_{ij} > O$, j = 1,2,.....r

O_k

$$P_{ij} \geq O,\ j = 1,2,.....T$$

$$O_k, P_k \geq O \quad k = 1,2,.....T$$

Where,

X_{ij} = Share of export form i^{th} country to j^{th} country during year t.

Y_i = Export from India to country I during year t

O_k,P_k = Variables denoting absolute errors.

This was repeated for reach country to estimate the entire transition probability matrix P. the expected shares of each country in period t was obtained by multiplying the exports to these countries in previous period (t-1) with transitional probability matrix.

3.3.4.3 Export dynamics and Export competitiveness

The export competitiveness of selected medicinal crops have been assessed by using Nominal Protection Coefficient (NPC).

$$NPC = Pd / Pb$$

Where,

NPC = Nominal Protection Coefficient

Pd = Domestic price of commodity

Pb = Border price of commodity after taking care of transportation and marketing expenses

NPC shows degree of divergence of domestic price from the international price and thus determines the degree of export competitiveness of the commodity in question i.e. if the NPC < 1 the commodity under consideration is export competitive.

In order to identify the most favorable countries for export of selected medicinal crops, NPC values were computed for different importing countries for categories i.e. highly competitive one (NPC > 0.5), moderately competitive (0.5<NPC<1) and non competitive (NPC >1).

CHAPTER IV

RESULTS AND DISCUSSION

In this study, the efforts have been made to find out the economic viability of some important selected medicinal crops grown in Gujarat state. The marketing patterns and scale of international trade in medicinal crops is also taken into consideration to assess the marketing prospect for the cultivators. The findings of the study are discussed in this chapter under the following heads:

4.1 Socio-economic features of sample farmers
4.2 Economics of medicinal crops
4.3 Resource use efficiency in cultivation of medicinal crops
4.4 Marketing channels, marketing costs and margins
4.5 Growth and export dynamics of medicinal crops
4.6 The export competitiveness of medicinal crops
4.7 The problems in production and marketing

4.1 Socio-economic features of sample farmers

The cultivation of medicinal crops require special technical knowledge and special care as compared to traditional crops. The various socio-economic features of the sample farmers like family size, age education level social participation and land use pattern have due role in decision making of farmers.

Distribution of selected households according to family size in each crop is given in Table 4.1. The average size of family ranged from 5.62 persons of isabgol growers to 6.68 persons of senna (leaves) crop cultivators. The majority of the isabgol growers (26 %) had less than six family members, whereas

majority of sample farmers of ajowan (33%) have 6 to 9 family members. Only one family in case of isabgol, senna and coleus growers have more than 9 family members.

Table 4.1 Distribution of selected households according to family size

Crops	Family size (No.)			Total	Average size of family
	Below 6	6 - 9	Above 9		
Isabgol	26	23	1	50	5.62
Senna	17	32	1	50	6.68
Coleus	20	29	1	50	5.82
Ajowan	17	33	--	50	5.74

The information regarding age of the sample farmers of medicinal crops growers is presented in Table 4.2. It can be seen from the table that only 1 to 3 farmers in each crop were below the age of 30 years. The farmers in middle age group (30 to 50 years) ranges from 68 per cent in ajowan growers to 96 per cent in case of coleus cultivators. Only one coleus grower was in the old age group(>50 years), whereas 14 farmers each of isabgol and ajowan cultivators were in this group. Thus, the majority farmers were in the middle age group.

Table 4.2 Distribution of sample medicinal crop growers according to their age

Crops	Age of the head of the family (year)			Total
	Young (up to 30)	Middle (30-50)	Old (Above 50)	
Isabgol	1 (2.00)	35 (70.00)	14 (28.00)	50 (100.00)
Senna	3 (6.00)	35 (70.00)	12 (24.00)	50 (100.00)
Coleus	1 (2.00)	48 (96.00)	1 (2.00)	50 (100.00)
Ajowan	2 (4.00)	34 (68.00)	14 (28.00)	50 (100.00)

Note: Figures in parentheses indicate percentages to the total.

The details of education level of sample medicinal crops growers are given in Table 4.3. The results indicate that only one farmer of the isabgol cultivator obtained the college level education. The maximum number of the heads of the families (66 to 78 %) in each crop had primary education. Only 6 to 26 per cent farmers of medicinal crop growers obtained secondary level education, whereas, 6 to 28 per cent farmers were illiterate. The farmers with primary and secondary education put together accounted for more than 72 per cent in each crop. In all, the data indicate that the majority of medicinal growers were educated.

Table 4.3 Education level of sample medicinal crop growers

Crops	Education levels				Total Number
	Illiterate	Primary	Secondary	College	
Isabgol	3 (6.00)	33 (66.00)	13 (26.00)	1 (2.00)	50 (100.00)
Senna	14 (28.00)	33 (66.00)	3 (6.00)	--	50 (100.00)
Coleus	4 (8.00)	39 (78.00)	7 (14.00)	--	50 (100.00)
Ajowan	8 (16.00)	36 (72.00)	6 (12.00)	--	50 (100.00)

Note: Figures in parentheses indicate percentages to the total.

Farmers' association with village organizations indicates their social participation. Table 4.4 provides an idea of their association with different organizations. It is observed from the table that more than three-forth of the medicinal crops cultivators were members of the farmers' organizations, whereas, more than two-third of the cultivators were members of the co-operative credit society, followed by marketing society (>50 %). The association with milk producers' co-operative society ranged from 20 to 40 per cent of each crop growers, while 22 to 30 per cent had association with yuvak mandal. The

association with village panchayat ranged only 5-7 per cent. Thus, the medicinal crops cultivators were highly associated with village level organizations like cooperative credit society, marketing society and farmers organizations.

Table 4.4 Distribution of sample medicinal crop growers according to Participation in village organizations

Crops	Organizations					
	Co-operative credit society	Producers' co-opera-tive milk society	Market-ing society	Farmers organi-zations	Panch-ayat	Yuvak mandal
Isabgol (50)	35 (70.00)	20 (40.00)	26 (52.00)	41 (82.00)	7 (14.00)	12 (24.00)
Senna (50)	36 (72.00)	10 (20.00)	27 (54.00)	38 (76.00)	5 (10.00)	11 (22.00)
Coleus (50)	34 (68.00)	10 (20.00)	25 (50.00)	40 (80.00)	6 (12.00)	14 (28.00)
Ajowan (50)	33 (66.00)	17 (34.00)	28 (56.00)	39 (78.00)	5 (10.00)	15 (30.00)

Note: Figures in parentheses indicate percentage to total cultivators in each crop.

Land use pattern of sample farmers could be seen in Table 4.5. The senna growers had larger land holding (10.43 ha.), followed by ajowan (6.71 ha.), isabgol (3.63 ha.) and coleus (3.23 ha.).The gross cropped area was also higher in case of senna growers (12.56 ha.), followed by ajowan (12.45 ha.), coleus (6.74 ha.) and isabgol (6.22 ha.). The gross cropped area of isabgol, coleus and ajowan growers were nearly double than average size of holdings. Due to the favourable rainy season and joint efforts of the farmers and government for water harvesting programme during last three – four years, the irrigated land increased significantly, which was resulted in high cropping intensity. The highest cropping intensity (208 %) was found in case of coleus growers, followed by ajowan (185 %), isabgol (171 %) and senna (120 %).

The overall general features of medicinal growers indicate that their family size was nearly average and majority farmers were of middle age group. In case of the education level, it was found that the majority of medicinal growers were educated and they were highly associated with village organization whereas, their land holding was larger to medium.

Table 4.5 Land use pattern of the sample farmer (ha)

Particulars	**Isabgol**	**Senna**	**Coleus**	**Ajowan**
Size of holding	3.63	10.43	3.23	6.71
Gross cropped area	6.22	12.56	6.74	12.45
Cropping intensity (%)	171	120	208	185

4.2 Economics of medicinal crops

4.2.1 Isabgol

Isabgol (*Plantago ovata* Forsk), commonly known as psyllium or Indian Plantago is one of the most important medicinal plant. The seeds and husk of this plant are used in almost all systems of medicine, both ancient and modern. India has been exporting the seeds and husk of isabgol to several countries and holds a monopoly in its production and trade. In Gujarat, the cultivation of this crop is mainly practised in North Gujarat, Saurashtra and Kutch. During 2006-07, Gujarat produced 29.55 thousand tonnes of isabgol from the area of 26.43 thousand hectares.

The details of economics of isabgol cultivation are presented in Table 4.6. The average total cost (cost C_2) incurred by the selected farmers was worked out to be Rs. 16469/- per hectare. The average operating cost (cost A) was estimated to be

49.98 per cent (Rs. 8232/ha) of the total cost. Among the various cost components, the human labour was the major expenditure (Rs. 5235/ha) accounting 34.78 per cent of the total cost followed by rental value of owned land (21.96%), irrigation (12.60%), chemical fertilizers (7.02%), bullock labour (4.18%), etc. The average yield per hectare of isabgol crop was about 9.06 quintals and the gross income obtained was Rs. 27570/- per hectare.

The details of costs and returns from isabgol cultivation are presented in Table 4.7. It is seen from the table that the return per hectare over cost C_2 was Rs. 11101/- whereas, the return over operating cost (cost A) was realized about Rs. 19338/- per hectare. The average total cost of production (cost C2) per quintal was Rs. 1818/-. The average farm harvest price of isabgol obtained by the farmers was Rs. 3043/- per quintal, which was higher than the cost of production per quintal. The farm harvest price of isabgol was also found higher than the bulk line cost (Rs. 2409/qtl) indicating the profitability of this crop. The input output ratio over cost C_2 was worked out to be 1:1.67 which shows that one rupee invested on isabgol cultivation yielded Rs. 1.67 indicating sound economic viability of this crop. Similar results were also obtained by Jadav *et al.* (2001) and Anonymous (2007) in their studies in Gujarat.

Table 4.6 Details of costs and yield of Isabgol crop per hectare in Gujarat, 2006-07

Sr. No.	Item		Physical unit	Value Rs.	% to Cost C_2
1	Human labour:				
	A: Family (man days)		37.5	2905	17.64
	B: Hired (man days)		26.75	2330	14.14
2	Bullock labour (pair days)		2.50	688	4.18
3	Seeds (kgs)		5.00	287	1.74
4	Manures (carts)		7.00	494	3.00
5	Chemical fertilizers (kgs)	N	51.00		
		P	33.00	1156	7.02
		K	3.00		
6	Irrigation			2075	12.60
7	Insecticides/pesticides			197	1.20
8	Miscellaneous costs			494	3.00
9	Depreciation costs			194	1.18
10	Interest on working capital			317	1.92
11	Rental value of owned land			3616	21.96
12	Interest on owned fixed capital			219	1.33
13	Management cost			1497	9.09
14	Cost A			8232	49.98
15	Cost B			12067	73.27
16	Cost C_1			14972	90.91
17	Cost C_2			16469	100
18	Yield (qn/ha)		9.06		
19	FHP* of Main product (Rs/qn)			3043.05	
20	Gross Income (Rs/ha)			27570	

- **FHP = Farm harvest price**

Table 4.7 Details of costs and returns from Isabgol crop in Gujarat, 2006-07

Sr. No.	Item	Amount (Rs.)
1	Gross return (Rs/ha):	27570
2	Return per hectare over:	
	(i) Cost A	19338
	(ii) Cost B	15503
	(iii) Cost C_1	12589
	(iv) Cost C_2	11101
3	Cost of production per quintal:	
	(i) Cost A	908.61
	(ii) Cost B	1331.90
	(iii) Cost C_1	1652.54
	(iv) Cost C_2	1817.77
4	Input-output ratio over:	
	(i) Cost A	1:3.35
	(ii) Cost B	1:2.28
	(iii) Cost C_1	1:1.84
	(iv) Cost C_2	1:1.67
5	Bulk line cost:	
	(i) Bulk line cost (Rs/qn)	2408.64
	(ii) Per cent of area covered	75.88
	(iii) Per cent of farmers covered	68.78

4.2.2 Senna

Senna (*Cassia angustifolia* Vahl), popularly called "Sonamukhi" is a widely used medicinal herb in ayurveda, unani and also in the allopathic system of medicine. It is well known for it purgative activity. Nowadays, there is a growing demand for senna products in the national as well as international markets. In recent years, its cultivation has gained momentum in the arid part of Rajasthan and Gujarat, due to its diversified

adaptability. At present, India is the main producer and exporter of senna leaves and pods. An annual income to the tune of Rs. 100 million was obtained from the export of senna from India (Maiti and Kumar, 2001).

The details of cost of cultivation and yield of senna leaves are presented in Table 4.8. It can be concluded from the table that the average total cost (cost C_2) was worked out to be Rs. 8224/- per hectare. Out of which, 55.76 per cent was operating cost. The item wise cost components indicates that human labour constituted large portion (32.59%), followed by rental value of owned land (18.06%), seeds (13.73%), bullock labour (11.89%), manure (5.69%) etc. The seed cost is considerably large in senna cultivation. The average yield of senna leaves was 11.74 quintals per hectare. The average gross return obtained by sample farmers was Rs. 12424/- per hectare.

The details of cost and returns from senna leaves are presented in Table 4.9. The return per hectare over total cost C_2 was Rs. 4200/-. The average total cost of production per quintal was Rs. 701/-. The average farm harvest price of senna leaves obtained was Rs. 1058/- per quintals which was slightly higher than the cost of production and the bulk line cost. The input out ratio over total cost worked out to be 1:1.51 which shows that one rupee invested on senna leaves cultivation yielded Rs. 1.51 to the farmers indicating fair economic returns. Jarial (1999) found the similar results in his study of senna crop.

Table 4.8 Details of costs and yield of Senna crop per hectare in Gujarat, 2006-07

Sr. No.	Item		Physical unit	Value Rs.	% to Cost C_2
1	Human labour:				
	A: Family (man days)		21.25	1306	15.88
	B: Hired (man days)		23.00	1374	16.71
2	Bullock labour (pair days)		3.75	978	11.89
3	Seeds (kgs)		9.00	1129	13.73
4	Manures (carts)		7.00	468	5.69
5	Chemical fertilizers (kgs)	N	08.00		
		P	18.00	176	2.14
		K	---		
6	Irrigation			--	--
7	Insecticides/pesticides			1	.01
8	Miscellaneous costs			187	2.27
9	Depreciation costs			97	1.18
10	Interest on working capital			176	2.14
11	Rental value of owned land			1485	18.06
12	Interest on owned fixed capital			99	1.21
13	Management cost			748	9.09
14	Cost A			4586	55.76
15	Cost B			6170	75.03
16	Cost C_1			7476	90.91
17	Cost C_2			8224	100.00
18	Yield: (Dry leaves qn/ha)		11.74		
19	FHP* of Main product (Rs/qn)			1058.26	
20	Gross Income (Rs/ha)			12424	

- **FHP = Farm harvest price**

Table 4.9 Details of costs and returns from Senna crop in Gujarat, 2006-07

Sr. No.	Item	Amount (Rs.)
1	Gross return (Rs/ha):	12424
2	Return per hectare over:	
	(i) Cost A	7838
	(ii) Cost B	6254
	(iii) Cost C_1	4948
	(iv) Cost C_2	4200
3	Cost of production per quintal:	
	(i) Cost A	390.63
	(ii) Cost B	525.55
	(iii) Cost C_1	636.80
	(iv) Cost C_2	700.51
4	Input-output ratio over:	
	(i) Cost A	1:2.71
	(ii) Cost B	1:2.01
	(iii) Cost C_1	1:1.66
	(iv) Cost C_2	1:1.51
5	Bulk line cost:	
	(i) Bulk line cost (Rs/qn)	829.54
	(ii) Per cent of area covered	83.40
	(iii) Per cent of farmers covered	79.09

4.2.3 Coleus

Coleus (*Coleus forskohlii* Briq), is one of the most potential medicinal crops of the future as its pharmacopical properties have been discovered only recently. The tuberous roots are found to be a rich source of forskolin (syn. Coleonaol) which is being developed as a drug for the hypertension, glaucoma, asthma, congestive heart failures and certain types of cancers. The plant is well known throughout the country and is

known as *Pashan Bhedi* in Sanskrit, '*Patharchur*' in Hindi, '*Garmalu*' in Gujarati and '*Maimnul*' in Marathi language. In Egypt and Africa, the leaves of *C. barbatus* are used an expectorant, emmenagogue and diuretic while its foliage is employed in treating instestinal disorders, and used as condiment in India since a long time. The tuberous roots of this plant are the economic parts.

The details of cost of cultivation per hectare and yield of coleus are furnished in Table 4.10. The average total cost per hectare of coleus cultivation was to the tune of Rs. 46205/-. The share of operating cost in the total cost of cultivation was as high as 44.91 per cent. The break-up of total cost indicates that among the different items of expenditure, the rental value of owned land ranked first with 30.27 per cent share, followed by human labour (23.15%), stem cuttings (11.38%), irrigation (8.55%), miscellaneous (5.23%), etc. The total yield per hectare of the coleus during the year of study was 110.78 quintals. The average gross return accounted for Rs. 1,58,421/- per hectare.

The details of cost and returns from coleus are given in Table 4.11. The average return per hectare over total cost (cost C_2) worked out was Rs.112216/-. The average total cost of producing one quintal of coleus was Rs.356/-. The price received by the farmers of coleus was Rs.1222/- per quintal, which was higher than the cost of production per quintal and the bulk line cost of production (Rs. 394.52/qn). The input-output ratio over cost C_2 was worked out to be 1:3.43 indicates that the coleus cultivation was highly profitable to its grower during the period under study.

Table 4.10 Details of costs and yield of Coleus crop per hectare in Gujarat, 2006-07

Sr. No.	Item		Physical unit	Value Rs.	% to Cost C_2
1	Human labour:				
	A: Family (man days)		90.00	7090	15.34
	B: Hired (man days)		43.75	3610	7.81
2	Bullock labour (pair days)		7.75	2056	4.45
3	Stem cutting (kgs)		2210.00	5256	11.38
4	Manures (carts)		25.00	1970	4.26
5	Chemical fertilizers (kgs)	N	9.00		
		P	2.00	134	0.29
		K	---		
6	Irrigation			3948	8.55
7	Insecticides/pesticides			---	---
8	Miscellaneous costs			2416	5.23
9	Depreciation costs			184	0.40
10	Interest on working capital			1174	2.54
11	Rental value of owned land			13988	30.27
12	Interest on owned fixed capital			178	0.39
13	Management cost			4200	9.09
14	Cost A			20749	44.91
15	Cost B			34915	75.57
16	Cost C_1			42004	90.91
17	Cost C_2			46205	100.00
18	Yield:				
	A: Main product (qn/ha)		110.78		
	B: By-product (qn/ha)		120.71		
19	A: FHP* of Main product (Rs/qn)			1221.66	
	B: Income from by-product (Rs/ha)			23086	
20	Gross Income: Main product + By-product (Rs/ha)			158421	

- **FHP = Farm harvest price**

Table 4.11 Details of costs and returns from Coleus crop in Gujarat, 2006-07

Sr. No.	Item	Amount (Rs.)
1	Gross return (Rs/ha):	158421
2	Return per hectare over:	
	(i) Cost A	137672
	(ii) Cost B	123506
	(iii) Cost C_1	116417
	(iv) Cost C_2	112216
3	Cost of production per quintal:	
	(i) Cost A	160.01
	(ii) Cost B	269.25
	(iii) Cost C_1	323.91
	(iv) Cost C_2	356.31
4	Input-output ratio over:	
	(i) Cost A	1:7.64
	(ii) Cost B	1:4.54
	(iii) Cost C_1	1:3.77
	(iv) Cost C_2	1:3.43
5	Bulk line cost:	
	(i) Bulk line cost (Rs/qn)	394.92
	(ii) Per cent of area covered	81.24
	(iii) Per cent of farmers covered	79.56

4.2.4 Ajowan

Ajowan is widely used as spice as well as medicinal crop. It is native of India and Egypt. It is known as bishop's weed and carum in English. The most common Indian name is ajowan (also spelled as ajwain,) and the other popular regional names are owa and omum. It is commercially cultivated for seed and herb, both having medicinal values. In Gujarat it is mainly grown in North Gujarat, Saurashtra and Kutch district. During

2006-07, Gujarat produced 7.68 thousand tonnes of ajowan from the area of 3.37 thousand hectares. The details of cost of cultivation and yield of ajowan are presented in Table 4.12. The

Table 4.12 Details of costs and yield of Ajowan crop per hectare in Gujarat, 2006-07

Sr. No.	Item		Physical unit	Value Rs.	% to Cost C_2
1	Human labour:				
	A: Family (man days)		33.50	2214	14.56
	B: Hired (man days)		33.25	2279	14.99
2	Bullock labour (pair days)		6.50	1784	11.73
3	Seeds (kgs)		6.00	336	2.21
4	Manures (carts)		15.00	1081	7.11
5	Chemical fertilizers (kgs)	N	13.00		
		P	8.00	271	1.78
		K	--		
6	Irrigation			647	4.26
7	Insecticides/pesticides			3	0.02
8	Miscellaneous costs			387	2.55
9	Depreciation costs			103	0.68
10	Interest on working capital			276	1.82
11	Rental value of owned land			4338	28.53
12	Interest on owned fixed capital			103	0.68
13	Management cost			1382	9.09
14	Cost A			7167	47.14
15	Cost B			11608	76.34
16	Cost C_1			13822	90.91
17	Cost C_2			15204	100.00
18	Yield (qn/ha)		8.96		
19	FHP* of Main product (Rs/qn)			4342.41	
20	Gross Income (Rs/ha)			38908	

- **FHP = Farm harvest price**

total cost of cultivation (cost C_2) per hectare was Rs. 15204/-. The operating cost (cost A) formed about 47.14 per cent of the total cost. It is also seen that among the different items of total costs, human labour ranked first (29.55%), closely followed by rental value of owned land (28.53%), bullock labour (11.73%), manures (7.11%), irrigation (4.26%), etc. The average yield per hectare of ajowan was 8.96 quintals. The average gross return per hectare was to the tune of Rs. 38908/-.

The details of costs and returns of ajowan are presented in Table 4.13. The average returns per hectare over cost C_2 was

Table 4.13 Details of costs and returns from Ajowan crop in Gujarat, 2006-07

Sr. No.	Item	Amount (Rs.)
1	Gross return (Rs/ha):	38908
2	Return per hectare over:	
	(i) Cost A	31741
	(ii) Cost B	27300
	(iii) Cost C_1	25086
	(iv) Cost C_2	23704
3	Cost of production per quintal:	
	(i) Cost A	799.89
	(ii) Cost B	1295.53
	(iii) Cost C_1	1542.63
	(iv) Cost C_2	1696.68
4	Input-output ratio over:	
	(i) Cost A	1:5.43
	(ii) Cost B	1:3.35
	(iii) Cost C_1	1:2.82
	(iv) Cost C_2	1:2.56
5	Bulk line cost:	
	(i) Bulk line cost (Rs/qn)	2329.07
	(ii) Per cent of area covered	71.43
	(iii) Per cent of farmers covered	77.46

Rs. 23704/-. The average cost of production per quintal was Rs. 1697/- while the average farm harvest price per quintal was Rs. 4342/-, indicating that ajowan was found remunerative to their growers during the period under study. The estimated bulk line cost (Rs. 2329/qn) was also found lower than the farm harvest price. The input- output ratio worked out to be 1:2.56 indicates that on an average, the farmers obtained Rs. 2.56 over one rupee invested in ajowan cultivation. The graphs indicating the bulk line cost of isabgul, senna, coleus and ajowan are presented in appendices I and II.

The cost of cultivation and income data of the medicinal plants under study indicate that the cultivation of coleus, is highly profitable to the farmers, and the ajowan generates good income, whereas, isabgol and senna leaves also provide fair income to the farmers. The investment required for these medicinal crops are not much higher and almost at par with agricultural crops. These all crops can be grown on low fertile soil and also required less number of irrigations. This indicates that these medicinal plants cultivation is economically viable and can generate handsome income to the farmers with less investment and efforts.

4.3 Resource use efficiency in cultivation of medicinal crops

4.3.1 Functional relationship between input and output

The term resource use efficiency in agriculture includes the concept of technical and allocative efficiency. Both technical and allocative efficiency are important to achieve overall economic efficiency in resource use. In order to estimate the resource use efficiency in crop production on the sample farms,

Cobb-Douglas production function was fitted to the farm level data.

The results of the production function for medicinal crops are presented in Table 4.14. All the included variables have

Table 4.14 Estimates and production function for medicinal crops

Particulars	Isabgol	Senna (leaves)	Coleus	Ajowan
Constant	6.0013	-3.2673	2.1855	-5.0773
Area under crop (ha)	0.1243 (0.1017)	0.1174** (0.0364)	0.0096 (0.0619)	-0.0354 (0.1015)
Human labour (man day/ha)	0.3252 (0.3152)	0.7638** (0.1028)	0.3611 (0.2783)	1.5047** (0.2601)
Bullock labour (Pair day/ha)	0.0252 (0.0268)	0.0175 (0.0677)	0.1285 (0.0697)	-0.2913 (0.1324)
Manures (Cartload/ha)	-0.0050 (0.0081)	-0.0029 (0.0051)	-0.2073 (0.1112)	-0.0139 (0.0803)
Nitrogen (Kg./ha)	0.0108 (0.0255)	0.0082 (0.0118)	-0.0002 (0.0057)	0.0162* (0.0083)
Phosphorus (Kg./ha)	0.0045 (0.0158)	-0.0081 (0.0121)	0.0098 (0.0103)	-0.0175 (0.0091)
Potash (Kg./ha)	0.0145 (0.0082)	---	---	---
Working capital(Rs.)	-0.6697** (0.2223)	0.3713** (0.0885)	0.1363 (0.1297)	0.2083** (0.0713)
R^2	0.2762	0.9438	0.2636	.8631
Sum of 'bi'	-0.1702	0.9438	0.4378	1.3711

Figures in parentheses are the standard errors
* Indicates 5 per cent level of significance
** Indicates 1 per cent level of significance

explained about 28, 94, 26 and 86 per cent variation in isabgol, senna, coleus and ajowan, respectively. In case of isabgol, the elasticity of output with respect to working capital only was found statically highly significant and that too was negative. This indicated over utilization of inputs i. e. irrigation, seeds, pesticides etc. which included in working capital. The elasticities of output with respect to area under the crop (0.1174 %), human labour (0.7638 %), and working capital have turned out to be

positive and significant at 1 per cent level in senna crop. In case of the ajowan crop, the elasticities of human labour (1.5047 %) and working capital (0.2083 %) were positive and significant at 1 per cent level whereas for nitrogen also, elasticity was found positive and significant at 5 per cent level. In case of coleus, elasticities of all the included regressors were found statistically non-significant.

4.3.2 Marginal value productivity

A neoclassical theory indicates that marginal value product (MVP) must be equal or above the unit price of respective input for profit maximization. This principle is used to examine the resource use efficiency for the selected crops. The details regarding marginal value product, factor unit cost and the ratio of MVP to factor price for selected crop have been discussed in this section.

The marginal value product for medicinal crops has been given in Table 4.15. The results indicated that MVP of the human labour, bullock labour and potash, were higher than its unit price in case of sample isabgol. Whereas MVP of other factors e.g. area, nitrogen, phosphorous were less than its unit price and it was negative in case of manures and working capital in isabgol. The ratio of MVP to factor price of human labour, bullock labour and potash were greater than unity which calls for its efficient use. Balkrishanan *et al.* (2002) also noted the similar results in their study in Tamil Nadu. In case of potash this ratio found very high (8.10) indicated under utilization of this input. It implies that there is scope for increase theuse of potash in isabgul. The ratios were less than unity incase of area

(0.69), nitrogen (0.66) and phosphorus (0.44). Use of these input therefore calls for its restricted application in isabgol crop.

In case of senna crop, the ratio of MVP to factor price was greater than unity for human labour (3.35), nitrogen (10.96) and working capital (4.01) indicated the under utilization of these inputs. The value of ratios found less than unity for area (0.26), bullock labour (0.24), manures (-1.02) and P (-1945.40) which calls for its restricted application.

In ajowan crop, area under the crop (-0.19), bullock labour (-6.22), manures (-1.99), and P (-17722.6) were found to be over utilized as their ratios of MVP to factor price were less than unity. The ratio of MVP to factor price in case of human labour (12.26), N (6075.20) and working capital (8.49) found quite higher than unity indicating the scope for increase in the use of these inputs.

The MVPs of human labour and bullock labour and potash in case of isabgol, MVPs of human labour, nigtron and working capital in case of senna and that of human labour, nitrogen and woring capital incase of ajowan crop were found greater than unity which calls for its efficient utilization and indicating the scope for increase in the use for these inputs. Use of other inputs having MVPs less than unity call for it's over utilization and need to be curtailed their dozes.

Table 4.15 Marginal value productivity of resource inputs for medicinal crops

Particulars		Isabgol	Senna (leaves)	Ajowan
Area under crop (ha)	MVP	2508.41	385.96	-827.91
	Price/Unit	3616	1485	4338
	MVP/Price	0.69	0.26	-0.19
Human labour (man day/ha)	MVP	119.74	202.88	825.43
	Price/Unit	81.48	60.56	67.31
	MVP/Price	1.47	3.35	12.26
Bullock labour (Pair day/ha	MVP	314.87	62.48	-1706.18
	Price/Unit	272.20	260.80	274.46
	MVP/Price	1.16	0.24	-6.22
Manures (Cartload/ha)	MVP	-26321.4	-68.47	-143.24
	Price/Unit	70.57	66.86	72.07
	MVP/Price	-372.98	-1.02	-1.99
Nitrogen (Kg/ha)	MVP	7.19	25858.00	66584.14
	Price/Unit	10.96	10.96	10.96
	MVP/Price	0.66	2359.30	6075.20
Phosphorus (Kg/ha)	MVP	7.23	-35016.00	-319008.2
	Price/Unit	18.00	18.00	18.00
	MVP/Price	0.40	-1945.40	-17722.68
Potash (Kg/ha)	MVP	267595.80	---	---
	Price/Unit	8.10	---	---
	MVP/Price	33036.52	---	---
Working capital (Rs.)	MVP	-6.17	4.01	8.49
	Price/Unit	1.00	1.00	1.00
	MVP/Price	-6.17	4.01	8.49

4.3.3 Optimum use of resources under limited capital

Comparison of marginal value products and unit price of resource inputs under different crops lead to infer that whether a particular input was used efficiently or otherwise. However, such comparison can not give an exact idea about the optimal level of each resource inputs. In recognition of disequilibrium in the resource use efficiency, an attempt was made to estimate economic optimal use level to give clear picture as the limitation of availability of capital does not permit drastic changes. In that sense, these estimates indicate the potentialities of situation in short run period. The land is a fixed resource with limited

capital. Therefore, suggestion for land resource had not been given.

The estimated existing and optimal use level of resources for selected medicinal crops are presented in Table 4.16. There was under utilization of working capital (Rs.19376/ha.), but human labour (195.43 man day/ha), bullock labour (5.58 pair day/ha), manure (4.65 cart load/ha), N (83.34 kg/ha), P (41.21 kg/ha) and K (61.99 kg/ha) were found over utilized in isabgol. The results indicated diverting more fund in favour of working capital in isabgol crop.

In senna crop, it was found that human labour (9.91 man day/ha), bullock labour (3.57 pair day/ha), manures (7.12 cart load/ha), N (5.97 kg/ha), P (19.22 kg/ha) and working capital (125.26) were found over-utilized. Hence there is need to reduce the excessive use of these inputs as senna is low inputs consuming crops.

Existing and optimal level of input use for ajowan crop showed that there was over utilization of bullock labour (11.24 pair day/ha), manure (15.86 cart load/ha) N (6.39 kg/ha), and P (3.66 kg/ha) but human labour (-32.54 man day/ha) and working capital (-105.72) was found under utilized in ajowan crop. The results showed that diverting more fund in favour of human labour and working capital in ajowan crop is highly needed.

In nutshell, it can be concluded that there is need for diverting more fund towards working capital in isabgol, towards bullock labour, phosphorus and working capital in coleus and towards human labour and working capital in ajowan crop.

Table 4.16 Existing and optimum level of input use for medicinal crops

Particulars		Isabgol	Senna	Ajowan
Human labour (man day/ha)	Existing	64.25	44.25	66.75
	Optimal	-131.18	34.34	99.29
	Difference	195.43	9.91	-32.54
Bullock labour (Pair day/ha)	Existing	2.50	3.75	6.50
	Optimal	-3.08	0.18	-4.74
	Difference	5.58	3.57	11.24
Manures (Cartload/ha)	Existing	7.00	7.00	15.00
	Optimal	2.35	-0.12	-0.86
	Difference	4.65	7.12	15.86
Nitrogen (Kg/ha)	Existing	51.00	8.00	13.00
	Optimal	-32.34	2.03	6.61
	Difference	83.34	5.97	6.39
Phosphorus (Kg/ha)	Existing	33.00	18.00	8.00
	Optimal	-8.21	-1.22	4.34
	Difference	41.21	19.22	3.66
Potash (Kg/ha)	Existing	3.00	---	---
	Optimal	-58.99	---	---
	Difference	61.99	---	---
Working capital(Rs.)	Existing	2637	1136	1037
	Optimal	22013	1010.74	931.28
	Difference	-19376	125.26	-105.72

4.4 Marketing channels, marketing costs and margins

4.4.1 Marketing agencies

The details about the various marketing agencies involved in marketing of different medicinal crops are given in Table 4.17. There were four marketing agencies involved in the marketing of medicinal crops namely; village merchant, wholesaler in regulated market, wholesaler in city and consumers. The results of the study indicated the relative importance of the different agencies in overall marketing system. Out of 50 isabgol growers, 10 (20%) growers sold to the village merchants, 15 (30%) isabgol growers sold to the wholesalers in regulated market and 25 (50%) isabgol growers sold to the wholesalers in city.

Table 4.17 Distribution of sample farmer according to marketing agencies

Medicinal crops	No.of growers	Marketing agencies (No.)			
		Village merchant	Whole-saler in regulated market	Whole-saler in city	Consumers
Isabgol	50 (100.00)	10 (20.00)	15 (30.00)	25 (50.00)	--
Senna	50 (100.00)	--	--	50 (100.00)	--
Coleus	50 (100.00)	--	40 (80.00)	9 (18.00)	1 (2.00)
Ajowan	50 (100.00)	12 (24.00)	32 (64.00)	6 (12.00)	--

Note: Figures in parentheses indicate percentages to the total.

In case of the senna growers, all the 50 (100%) selected growers sold to the wholesalers in city. In coleus, 40 (80%) coleus growers sold to the wholesalers in regulated market, nine farmers (18%) sold to the wholesalers in city and only one farmer (2%) sold to the direct consumers. In the case of the ajowan growers, 12 (24%) sold to the village merchants, 32 (64%) sold to the wholesalers in regulated market and six (12%) ajowan growers sold to the wholesalers in city.

The details about marketed surplus sold to different agencies are given in Table 4.18. This table also shows the relative importance of the different agencies in the overall marketing system. Out of 637.95 quintals of isabgol, 67.89 quintals (10.64 %) of isabgol was sold to the village merchants, 234.97 quintals (36.83%) was sold to the wholesalers in regulated market and 335.09 quintals (52.53 %) was sold to the wholesalers in city. In the case of the senna, total quantity (2702 qn.) of senna was sold to the wholesalers in city. In coleus,

Table 4.18 Marketed surplus sold to different agencies

(quintal)

Medicinal crops	Total quantity sold	Purchasing agencies			
		Village merchant	Whole-saler in regulated market	Whole-saler in city	Consumers
Isabgol	637.95 (100.00)	67.89 (10.64)	234.97 (36.83)	335.09 (52.53)	--
Senna	2702.00 (100.00)	--	--	2702 (100.00)	--
Coleus	1396.34 (100.00)	--	1195.22 (85.60)	182.25 (13.05)	18.87 (1.35)
Ajowan	862.01 (100.00)	126.81 (14.71)	619.19 (71.83)	116.01 (13.46)	--

Note: Figures in parentheses indicate percentages to the total.

out of total quantity, 1195.22 quintals (85.60 %) was sold to the wholesalers in regulated market, 182.25 quintals (13.05 %) was sold to the wholesalers in city and 18.87 quintals (1.35 %) was sold to the direct consumers. In the case of the ajowan, out of total quantity, 126.81 quintals (14.71 %) sold to the village merchants, 619.19 quintals (71.83 %) was sold to the wholesalers in regulated market and 116.01 quintals (13.46 %) was sold to the wholesalers in city.

Thus, the village merchants, wholesalers in regulated markets and the wholesalers of city played a key role from the point of view of the number of farmers utilizing their services and the quantity of isabgol, senna, coleus and ajowan sold through them. The reasons for this type of behaviour of isabgol, senna, coleus and ajowan growers are village merchants, wholesalers in regulated market and the wholesalers of city offered quick and quality services to their clients.

4.4.2 Marketing cost and prices

4.4.2.1 Marketing cost

The frequency distribution of sample farmers according to marketing cost incurred per quintal of medicinal crops is given in Table 4.19. It can be seen from the data that in case of the isbgol crop, the highest percentage of sample farmers (40 %) was in the cost range of Rs. 11 to 15, 26 per cent in cost range above Rs. 20 per quintal, 18 per cent in the cost range of Rs. 6 to 10 and only 16 per cent were in the cost range of Rs. 16 to 20 per quintal.

In senna crop, the highest percentage of sample farmers (44 %) was in the cost range above Rs. 24 per quintal, 42 per cent in the cost range of Rs. 22 to 24, 12 per cent in the cost range of Rs. 19 to 21 and only 2 per cent were in the cost range of Rs. 16 to 18 per quintal.

Table 4.19 Distribution of sample farmers according to marketing cost (Rs/qn)

Isabgol		**Senna**		**Coleus**		**Ajowan**	
Cost range	No.of sample farmers	Cost range	No.of sample farmers	Cost range	No.of sample farmers	Cost range	No.of sample Farmers
6-10	9 (18.00)	16-18	1 (2.00)	27-29	22 (44.00)	6-10	15 (30.00)
11-15	20 (40.00)	19-21	6 (12.00)	30-32	10 (20.00)	11-15	3 (6.00)
16-20	8 (16.00)	22-24	21 (42.00)	33-35	12 (24.00)	16-20	26 (52.00)
Above 20	13 (26.00)	Above 24	22 (44.00)	Above 35	6 (12.00)	Above 20	6 (12.00)
Total	50 (100.00)	Total	50 (100.00)	Total	50 (100.00)	Total	50 (100.00)

Note: Figures in parentheses indicate percentages to the total.

In case of the coleus crop, the highest percentage of sample farmers (44%) was in the cost range of Rs. 27 to 29, 24

per cent in the cost range of Rs. 33 to 35, 20 per cent in the cost range of Rs. 30 to 32 and only 12 per cent were in the cost range above Rs. 35 per quintal.

In ajowan crop, the highest proportion of sample farmers (52 %) was in the cost range of Rs. 16 to 20, 30 per cent in the cost range of Rs. 6 to 10, 12 per cent in the cost range above Rs. 20 and only 6 per cent were in the cost range of Rs. 11 to 15. These observed variation in marketing cost were due to influence of different factors viz, distance from farmers' godown to purchasers' godown, amount of marketed surplus, means of transportation etc.

On the whole, the results revealed that majority of isabgol (58 %) and coleus growers (64 %) were fallen in lower two cost ranges, whereas in senna (86 %) and ajowan crops (64 %) majority of farmers were in upper two cost ranges. This has indicated that isabgol and coleus growers are efficients in handling their products, as compared to senna and ajowan growers.

4.4.2.2 Price received by the sample farmers

The sample farmers have been classified in to 4 groups according to the prices they have received. It can be observed from the data given in Table 4.20 that in isabgol crop, the highest percentage of farmers (58 %) was in the price range above Rs. 2800 per quintal, 34 per cent in the price range of Rs. 2601 to 2800 and 4 per cent each in the price range of Rs. 2200 to 2400 and Rs. 2401 to 2600.

Table 4.20 Distribution of sample farmers according to price received (Rs/qn)

Isabgol		Senna		Coleus		Ajowan	
Price per quintal	No. of sample farmers	Price per quintal	No. of sample farmers	Price per quintal	No. of sample farmers	Price per quintal	No. of sample farmers
2200-2400	2 (4.00)	875-950	11 (22.00)	975-1050	7 (14.00)	2800-3000	5 (10.00)
2401-2600	2 (4.00)	951-1025	9 (18.00)	1051-1125	14 (28.00)	3001-3200	6 (12.00)
2601-2800	17 (34.00)	1026-1100	17 (34.00)	1126-1200	19 (38.00)	3201-3400	12 (24.00)
Above 2800	29 (58.00)	Above 1100	13 (26.00)	Above 1200	10 (20.00)	Above 3400	27 (54.00)
Total	50 (100.00)	Total	50 (100.00)	Total	50 (100.00)	Total	50 (100.00)

Note: Figures in parentheses indicate percentages to the total.

In case of senna crop, the highest percentage of farmers (34 %) was in the price range of Rs. 1026 to 1100 per quintal and 26 per cent in the price range above Rs. 1100, 22 per cent in the price range of Rs. 875 to 950 and 18 per cent were in the price range of Rs. 951 to 1025. In coleus crop, the highest percentage of farmers (38 %) was in the price range of Rs. 1126 to 1200 per quintal, 28 per cent in the price range of Rs. 1051 to 1125, 20 per cent in the price range above Rs. 1200 and 14 per cent were in the price range of Rs. 950 to 1050. In ajowan crop, the highest proportion of farmers (54 %) was in the price range above Rs. 3400 per quintal, 24 per cent in the price range above Rs. 3201 to 3400, 12 per cent in the price range of Rs. 3001 to 3200 and only 10 per cent were in the price range of Rs. 2800 to 3000.

Thus, in all the crops, majority of the farmers sold their produce in top two ranges of prices, i.e. 92 per cent farmers in

isabgol, 60 per cent in senna, 58 per cent in Coleus and 78 per cent in ajowan crop.

The details of channel-wise marketing costs are given in Table 4.21. Item-wise per quintal marketing cost incurred by

Table 4.21 Channel-wise per quintal marketing cost incurred at different marketing stage of isablgol (Rs/qn)

Sr.No.	Particulars	Channel I	Channel II	Channel III
(A)	Producer			
	1) Transportation	5.49	18.41	7.84
	2) Loading & unloading	4.05	3.84	4.84
	3) Other charges	--	1.53	1.22
	Total	**9.54**	**23.78**	**13.90**
(B)	Village merchant			
	1) Loading & unloading	3.75	--	--
	2) Weighing charges	1.5	--	--
	3) Storage charges	2.00	--	--
	4) Transportation	13.80	--	--
	5) Other charges	1.40	--	--
	Total	**22.45**	--	--
(C)	Wholesaler in regulated market			
	1) Loading & unloading	--	2.53	
	2) Weighing charges	--	1.25	
	3) Transportation	--	5.55	
	4) Market fee	--	30.48	
	5) Other charges	--	2.90	
	Total		**42.71**	
(D)	Wholesaler of city			
	1) Loading & unloading			4.00
	2) Weighing charges			1.50
	3) Packing charges			10.00
	4) Storage charges			5.00
	5) Transportation	--	--	12.36
	6) Other charges			2.50
	Total			**35.36**
	Grand total	**31.99**	**120.71**	**49.26**

growers ranged between Rs. 9.54 in channel I to Rs. 23.78, in channel II. At wholesale level, the marketing cost incurred by village merchant was Rs. 22.45 per quintal, for wholesalers in regulated market Rs. 42.71 and for wholesalers in city it was Rs. 35.36. Total marketing cost was found the highest in

channel II (Rs. 120.71/qn) followed by channel III (Rs. 49.26/qn) and channel I (Rs. 31.99/qn). Among the various costs, transportation, market fee and packing charges were the major costs. Per quintal cost incurred by wholesalers in regulated market was found the highest followed by wholesalers in city and village merchants.

Producer's share in consumers' (processor's) rupee was estimated to be 95.52, 95.64 and 95.61 per cent (Table 4.22) in channel I, II and III respectively. The margin of the village merchants was relatively more (3.68 %) as compared to rest of the intermediares.

The results revealed that out of the three identified channels, more than 50 per cent isabgol was sold through channel III. Transportation, market fee and packing charges were the major items of the marketing cost. Producers received the highest share in channel II but the difference is at par with the other channels. Among the different intermediares, the village merchant's margin was found higher in the marketing of isabgol.

In the marketing of senna crop in the Kuchchh district, only one marketing channel (Producers – Wholesalers in city) was identified. Hundred per cent quantity of senna was sold to the wholesalers in nearby city. Per quintal marketing cost incurred by senna grower was Rs.23.77 (Table 4.23), in which transportation, godown charges were the major item of cost. Per quintal marketing cost incurred by wholesalers in city was Rs. 49.46. Commission charges, packing, storage and transportation were the major costs incurred by wholesalers in city. Total cost of marketing estimated to be Rs. 73.23 per

Table 4.22 Channel-wise price spread in marketing of Isabgol

(Rs/qn)

Sr. No.	Particulars	Channel I	Channel II	Channel III
I	a) Gross price received by producer	2667.62 (95.52)	3048.10 (95.64)	2957.13 (95.61)
	b) Marketing cost incurred by producer	9.54 (0.34)	23.78 (0.75)	13.90 (0.45)
	c) Net price received by producer	2657.88 (95.17)	3024.32 (94.90)	2943.23 (95.16)
II	a) Price paid by village merchant	2667.62 (95.52)	--	--
	b) Marketing cost incurred by village merchant	22.45 (0.80)	--	--
	c) Net margin of village merchant	102.70 (3.68)	--	--
III	a) Price paid by wholesaler of regulated market	--	3048.10 (95.64)	--
	b) Marketing cost incurred by wholesaler of regulated market	--	42.71 (1.34)	--
	c) Net margin of wholesaler of regulated market	--	96.02 (3.01)	--
IV	a) Price paid by wholesaler of city	--	--	2957.13 (95.61)
	b) Marketing cost incurred by wholesaler of city	--	--	35.36 (1.14)
	c) Net margin of wholesaler of city	--	--	100.54 (3.25)
V	Price paid by processor (consumer)	2792.77 (100.00)	3186.83 (100.00)	3093.03 (100.00)
VI	Marketing cost	31.99 (1.15)	66.49 (2.09)	49.26 (1.59)
VII	Net marketing margin	102.70 (3.68)	96.02 (3.01)	100.54 (3.25)
VIII	Total cost	134.69 (4.82)	162.51 (5.10)	149.80 (4.84)

Note: Figures in parentheses indicate percentages to consumer's price.

quintal. The net margins was found the highest in channel I (Rs. 102.70/qn), followed by channel III (Rs. 100.54/qn) and channel II (Rs. 96.02).

Table 4.23 Per quintal marketing cost incurred at different marketing stages of senna (Rs/qn)

Particulars	**Channel III**
Producer	
1) Transportation	13.85
2) Loading & unloading	3.82
3) Godown charges	5.96
4) Other charges	0.14
Total	**23.77**
Wholesaler of city	
1) Loading & unloading	5.00
2) Weighing charges	3.80
3) Commission	10.41
4) Packing charges	10.00
5) Storage charges	9.00
6) Transportation	8.50
7) Other charges	2.75
Total	**49.46**
Grand total	**73.23**

Producer's share in exporter's price was 89.49 per cent (Table 4.24) whereas the share of wholesaler in city in exporter's price was found 10.51 per cent only in marketing of senna indicating an efficient marketing systems as compared to food grains, fruits and vegetable marketing system in which the share of producers varied form 62 to 75 per cent (Rao *et al.* 2008), 44 to 61 per cent (Malaisamy *et al.* 2007) and 37 to 52 per cent only (Chahal *et al.* 2004), respectively.

In the marketing of coleus, there were three marketing channels identified which are as under:

Channel II : Producer- Wholesaler in regulated market- Retailer – Consumer

Channel III : Producer- Wholesaler in city- Retailer –

Consumer

Channel IV : Producer- Consumer

Table 4.24 Channel-wise price spread and market margin in marketing of Senna (Rs/qn)

Sr.No.	Particulars	Channel III
I	a) Gross price received by producer	1043.15 (89.49)
	b) Marketing cost incurred by producer	23.77 (2.04)
	c) Net price received by producer	1019.38 (87.45)
	d) Net margin of wholesaler of regulated market	--
II	a) Price paid by wholesaler of city	1043.15 (89.49)
	b) Marketing cost incurred by wholesaler of city	49.46 (4.25)
	c) Net margin of wholesaler of city	73.02 (6.26)
	d) Gross margin (b+c)	122.48 (10.51)
III	Price paid by exporter	1156.65 (100.00)
IV	Marketing cost	73.25 (6.29)
V	Net marketing margin	73.02 (6.26)
VI	Total cost	146.27 (12.55)

Note: Figures in parentheses indicate percentages to consumer price

The maximum quantity (85.60%) was marketed through channel II (wholesalers in regulated market) indicating the most preferred marketing channel. But per quintal price received was the highest in channel IV (Rs. 1400/qn) followed by channel II (Rs. 1195.22) and channel III (Rs. 1056.01). Total marketing cost per quintal incurred by growers varied between Rs. 27.57 (Channel IV) to Rs. 32.16 (Channel II). Marketing cost incurred

by wholesalers in regulated market was Rs. 25.80 and wholesalers in city were Rs. 16.05. Marketing cost incurred by retailers was Rs. 15.10 (Table 4.25). Among different items of cost, transportation and market fee were found the highest. Per quintal cost incurred was the highest by wholesaler in regulated market, followed by wholesalers in city and retailer. The total marketing cost incurred was found to be varied from the lowest Rs. 27.57/qn in channel IV to the highest Rs. 73.06/qn in channel II. Producer's share in consumer's rupee was estimated to be 82.84, 75.43 and 100 per cent in channel II, III and IV respectively (Table 4.26). It is observed that margin of the retailer was more (8.71 %) as compared to rest of the agencies.

Table 4.25 Item-wise per quintal marketing cost incurred by Coleus's intermediaries (Rs/qn)

Sr. No.	Particulars	Channel II	Channel III	Channel IV
(A)	Producer			
	1) Transportation	19.21	16.73	17.50
	2) Pecking	6.52	7.42	6.09
	3) Loading & unloading	5.67	3.6	3.98
	4) Other charges	0.76	0.74	--
	Total	**32.16**	**28.49**	**27.57**
(B)	Wholesaler in regulated market			
	1) Loading & unloading	2.60	--	--
	2) Weighing charges	1.30	--	--
	3) Market fee	11.60	--	--
	4) Transportation	8.30	--	--
	5) Other charges	2.00	--	--
	Total	**25.80**		
(C)	Wholesaler of city			
	1) Loading & unloading	--	5.00	--
	2) Weighing charges	--	3.80	--
	3) Packing charges	--	--	--
	4) Storage charges	--	--	--
	5) Transportation	--	5.25	
	6) Other charges	--	2.00	--
	Total		**16.05**	
(D)	Retailer			
	1) Packing charges	4.25	4.25	--

	2) Loading & unloading	3.50	3.50	--
	3) Transportation	5.10	5.10	--
	4) Storage charges	1.25	1.25	--
	5) Other charges	1.00	1.00	--
	Total	**15.10**	**15.10**	--
	Grand total	**73.06**	**59.64**	**27.57**

Table 4.26 Price spread and market margin in marketing of Coleus **(Rs/qn)**

Sr. No.	Particular	Channel II	Channel III	Channel IV
I	a) Gross price received by producer	1159.80 (82.84)	1056.01 (75.43)	1400.00 (100.00)
	b) Marketing cost incurred by producer	32.16 (2.30)	28.49 (2.04)	27.57 (1.97)
	c) Net price received by producer	1134.58 (81.04)	1032.78 (73.77)	1372.44 (98.03)
II	a) Price paid by wholesaler of regulated market	1159.80 (82.84)		
	b) Marketing cost incurred by wholesaler of regulated market	28.80 (2.06)		
	c) Net margin of wholesaler of regulated market	75.39 (5.39)		
III	a) Price paid by wholesaler of city	--	1056.01 (75.43)	--
	b) Marketing cost incurred by wholesaler of city	--	16.05 (1.15)	--
	c) Net margin of wholesaler of city	--	89.76 (6.41)	--
IV	a) Price paid by retailer	1263.99 (90.29)	1263.99 (90.29)	
	b) Marketing cost incurred by retailer	15.10 (1.08)	15.10 (1.08)	
	c) Net margin of retailer	121.91 (8.71)	121.91 (8.71)	
V	Price paid by consumers	1400 (100.00)	1400 (100.00)	
VI	Marketing cost	69.12 (4.94)	69.12 (4.94)	
VII	Net marketing margin	197.30 (14.09)	197.30 (14.09)	
VIII	Total cost	266.42 (19.03)	266.42 (19.03)	

Note: Figures in parentheses indicate percentages to consumer's price.

The results indicated that out of the three identified channels, more than 85 per cent coleus was sold through channel II. Transportation and market fee were the major items of the marketing cost. Producers received higher share in consumers' rupee in channel IV due to direct sale to consumer but efficient channel was II because the quantity sold was more. Among the different intermediares, the retailer's margin was found higher in the marketing of coleus.

In the marketing of ajowan, three marketing channels were identified as shown in Table 4.27. Quantity of ajowan sold was the highest in channel-II (619.19 qn). It is also observed that per quintal price received was the highest in channel-II (Rs. 3635.83), followed by channel-II (Rs. 3299.70) and channel- I (Rs.3092.15) (Table 4.28).

Item-wise per quintal marketing cost incurred by growers ranged between Rs.9.19 (Channel-I) and Rs. 19.39 (Channel-II). The cost incurred by village merchants was Rs. 26.95, for wholesalers in regulated market it was Rs. 48.42, for wholesalers in city Rs. 37.70 and in case of retailers, it was Rs. 17.40 per quintal. Among the various items of costs, transportation and market fee were found the major costs. Per quintal cost was incurred the highest by wholesalers in regulated market followed by wholesalers in city, village merchants and retailers. The total marketing cost per quintal found the highest in channel II (Rs. 85.21/qn) and the lowest in channel I (Rs. 36.14/qn) indicating the high variation in marketing cost across the marketing channels.

Producer's share in consumer's rupee was estimated to be 78.81, 92.67 and 84.10 per cent in channel I, II and III,

respectively (Table 28). The margin of the retailers was observed higher (2.87 %) as compared to rest of the intermediaries.

Table 4.27 Item-wise per quintal marketing cost incurred by Ajowan's intermediaries

Sr. No.	Particulars	Channel I	Channel II	Channel III
(A)	Producer			
	1) Transportation	5.87	15.01	6.71
	2) Loading & unloading	3.32	3.35	3.00
	3) Other charges	--	1.03	1.29
	Total	**9.19**	**19.39**	**11.00**
(B)	Village merchant			
	1) Loading & unloading	3.40	--	--
	2) Weighing charges	3.80	--	--
	3) Storage charges	3.50	--	--
	4) Transportation	15.00	--	--
	5) Other charges	1.25	--	--
	Total	**26.95**	--	--
(C)	Wholesaler in regulated market			
	1) Loading & unloading		3.4	--
	2) Weighing charges	--	0.830	--
	3) Market fee	--	36.44	--
	4) Transportation	--	5.00	--
	5) Other charges	--	2.75	--
	Total	--	**48.42**	--
(D)	Wholesaler of city			
	1) Loading & unloading	--	--	3.40
	2) Weighing charges	--	--	3.80
	3) Packing charges	--	--	6.60
	4) Storage charges	--	--	5.00
	5) Transportation	--	--	16.00
	6) Other charges	--	--	2.90
	Total	--	--	**37.70**
(E)	Retailer			
	1) Packing charges	--	4.10	--
	2) Loading & unloading	--	3.30	--

	3) Transportation	--	5.00	--
	4) Storage charges	--	3.00	--
	5) Other charges	--	2.00	--
	Total	--	**17.40**	--
	Grand total	**36.14**	**85.21**	**48.70**

Table 4.28 Channel-wise price spread and market margin in marketing of Ajowan **(Rs/qn)**

Sr. No.	Particulars	Channel I	Channel II	Channel III
I	a) Gross price received by ajowan producer	3092.15 (78.81)	3635.83 (92.67)	3299.70 (84.10)
	b) Marketing cost incurred by producer	9.19 (0.23)	19.39 (0.49)	11.00 (0.28)
	c) Net price received by producer	3082.96 (78.57)	3616.44 (92.17)	3288.70 (83.82)
II	a) Price paid by village merchant	3092.15 (78.81)	---	---
	b) Marketing cost incurred by Village merchant	26.95 (0.69)	---	---
	c) Net margin of village merchant	108.23 (2.76)	---	---
III	a) Price paid by wholesaler in regulated market	---	3635.83 (92.67)	---
	b) Marketing cost incurred by wholesaler of regulated market	---	48.42 (1.23)	---
	c) Net margin of wholesaler of regulated market	---	109.07 (2.78)	---
IV	a) Price paid by wholesaler of city	---	---	3299.70 (84.10)
	b) Marketing cost incurred by wholesaler of city	---	---	37.70 (0.96)
	c) Net margin of wholesaler of city	---	---	102.29 (2.61)
V	a) Price paid by retailer	3793.54 (96.69)	3793.54 (96.69)	3793.54 (96.69)
	b) Marketing cost incurred by retailer	17.40 (0.44)	17.40 (0.44)	17.40 (0.44)
	c) Net margin of retailer	112.67 (2.87)	112.67 (2.87)	112.67 (2.87)
VI	Price paid by consumer	3923.61 (100.00)	3923.61 (100.00)	3923.61 (100.00)
VII	Marketing cost	85.41 (2.18)	85.41 (2.18)	85.41 (2.18)
VIII	Net marketing margin	221.74	221.74	221.74

		(5.65)	(5.65)	(5.65)
IX	Total cost	307.17 (7.83)	307.17 (7.83)	307.17 (7.83)

Note: Figures in parentheses indicate percentages to consumer's price

It can be concluded that out of the three identified channels, more than 85 per cent ajowan production was sold through channel II indicating the most preferred channel. Transportation and market fee were the major items of the marketing cost. Producers received the highest share in consumers' rupee in channel II. Among the different intermediares, the retailer's margin was found the highest in the marketing of ajowan.

The major marketing cost components in different medicinal crops are given in Table 4.29. The data in the table showed that in isabgol crop the major costs were transportation charges (67.22 %) and loading-unloading charges (26.94 %). In case of senna crop, transportation (58.27%) and godown charges (25.07%) were the major costs. In coleus, the major costs were transportation (60.56 %), packing materials (22.71) and loading – unloading charges (15.03 %). In case of ajowan crop, the transportation cost was found the highest (69.75 %), followed by laoding – unloading charges (24.49) and other charges (5.76).

Table 4.29 Major marketing cost components in different medicinal crops

Cost components	Isabgol	Senna	Coleus	Ajowan
Loading-unloading	4.24 (26.94)	3.82 (16.07)	4.42 (15.03)	3.23 (24.49)
Packing& materials	--	--	6.68 (22.71)	--
Transportation	10.58 (67.22)	13.85 (58.27)	17.81 (60.56)	9.20 (69.75)
Godown charges	--	5.96 (25.07)	--	--
Other charges	0.92	0.14	0.50	0.76

	(5.84)	(0.59)	(1.70)	(5.76)
Total	15.74 (100.00)	23.77 (100.00)	29.41 (100.00)	13.19 (100.00)

Note: Figures in parentheses indicate percentages to the total.

Thus, it can be concluded that in all the crops under study, the major marketing costs were transportation and loading- unloading charges.

4.5 Growth and export dynamics of medicinal crops

4.5.1 Growth and instability

The performance of isabgol seed, senna (leaves) and ajowan seed exports from India with respect to quantity, value and unit value of exports was evaluated using an exponential growth model. The results are presented in Table 4.30.

Table 4.30 Compound growth rate of export quantity, value and price of medicinal crops in India

(% per annum)

Crops	Export (Tonnes)		Value (Rs. lakhs)		Price (Rs/kg)	
	CGR	Instabi-lity	CGR	Instabi-lity	CGR	Instabi-lity
Isabgol (1995-07)	-43.91**	0.19	-4.01	0.26	5.81**	0.05
Ajowan (1995-07)	6.85**	0.06	8.94**	0.04	1.96	0.02
Senna (1983-01)	3.97**	0.06	13.65**	0.05	9.31**	0.05

CGR= Compound Growth Rate

** Indicates 1 per cent level of significance.

The quantity of ajowan seeds and senna (leaves) exports from India registered a positive and significant growth rate of 6.85 per cent and 3.97 per cent per annum, whereas it was negative and significant in case of isabgol seed (-43.91%). Export earning growth rates was found positive and significant in ajowan seeds (8.94 %) and senna (leaves) (13.65 %) whereas it was found negative and non significant in isabgol seeds (-4.01%). The growth rate of unit value was found positive and significant

in isabgol seed (5.81 %) and senna (leaves) (9.31 %) whereas it was positive but statistically non-significant in case of ajowan seed (1.96 %).

It is also evident that the instability indices for quantity of isabgol seed, ajowan seed and senna (leaves) exports were 0.19, 0.06 and 0.06, respectively, whereas instability indices for export earnings and unit value were 0.26, 0.04, 0.05 and 0.05, 0.02, 0.05 in respective crops. The results indicated that export prices of isabgol seed, ajowan seed and senna, the unit value of exports were found relatively stable when compared to the quantity and export earning. The results also indicated that instability in export quantity, value and prices were found the highest in isabgol.

4.5.2 The Export dynamics of medicinal crops

4.5.2.1 The Export direction

The direction of export of isabgol husk from Gujarat during the years 2005-07 is described in Table 4.31. It is observed that United States is on the top as our buyer which has imported 60.84 per cent of total quantity of isabgol husk from Gujarat. Other important buyer countries are spain, Germany, United Kingdom, Australia and Mexico in their order. The unit value was the highest in case of Japan (Rs. 212.61/ kg) and it was the lowest in case of Mexico (Rs. 97.76/kg). The average total export of isabgol husk from Gujarat during the years 2005-07 was 36049.43 tonnes and the average unit value was Rs. 119.18/kg.

The data in Table 4.32 revealed the direction of export of senna (leaves) from Gujarat during the years 2005-07. It is clear from the table that China is the topper as our buyer which has imported 32.56 per cent of total quantity of senna (leaves) from

Gujarat. The other important buyer countries are Malaysia, Germany, Russia, Poland, Latvia and Vietnam in their order. The

Table 4.31 Export of isabgol husk from Gujarat-direction of trade (2005-07)

Country	Quantity		Value		Unit Value
	(MT)	%	Rs. Lakhs	%	Rs/Kg
United States	21932.01	60.84	24240.50	56.42	110.53
Spain	2682.61	7.44	3423.22	7.97	127.61
Germany	2347.47	6.51	3286.73	7.65	140.01
United Kingdom	2104.05	5.84	2508.27	5.84	119.21
Australia	1974.90	5.48	2420.59	5.63	122.57
Mexico	1017.00	2.82	994.25	2.31	97.76
Denmark	646.85	1.79	773.32	1.80	119.55
Sweden	394.20	1.09	516.52	1.20	131.03
Indonesia	378.00	1.05	748.09	1.74	197.91
Belgium	350.00	0.97	524.46	1.22	149.85
Japan	339.20	0.94	721.19	1.68	212.61
Hong Kong	322.00	0.89	373.87	0.87	116.11
France	314.00	0.87	389.01	0.91	123.89
Italy	246.13	0.68	401.53	0.93	163.14
Malaysia	243.60	0.68	386.16	0.90	158.52
Canada	125.52	0.35	236.36	0.55	188.31
Taiwan	109.40	0.30	211.04	0.49	192.90
China	85.00	0.24	144.30	0.34	169.76
Colombia	81.50	0.23	109.78	0.26	134.70
Pakistan	76.28	0.21	126.68	0.29	166.07
Argentina	71.00	0.20	76.98	0.18	108.43
Saudi Arabia	53.02	0.15	99.46	0.23	187.60
Korea Rep.	45.00	0.12	71.97	0.17	159.93
United Arab Amirat	27.96	0.8	54.52	0.13	194.98
New Zealand	27.63	0.08	47.64	0.11	172.44
El Salvador	18.00	0.05	23.04	0.05	128.03
Russia	10.00	0.03	10.69	0.02	106.94
Guatemala	10.00	0.03	15.36	0.04	153.64
Singapore	8.10	0.02	14.18	0.03	175.02
Chile	4.50	0.01	6.44	0.01	143.11
Brazil	4.00	0.01	6.34	0.01	158.40
Reunion	0.29	0.00*	0.35	0.00*	122.09
Kenya	0.21	0.00	0.32	0.00	150.06
Total	**36049.43**	**100.00**	**42963.16**	**100.00**	**119.18**

* Negligible quantity

Table 4.32 Export of senna (leaves) from Gujarat-direction of trade (2005-07)

Country	Quantity		Value		Unit Value
	(MT)	%	Rs. Lakhs	%	Rs/Kg
China	5868.39	32.56	800.02	23.51	13.63
Malaysia	2750.15	15.26	405.90	11.93	14.76
Germany	2704.23	15.00	685.71	20.15	25.36
Poland	832.76	4.62	179.71	5.28	21.58
Latvia	726.81	4.03	130.10	3.82	17.90
Vietnam	698.68	3.88	165.06	4.85	23.63
Russia	987.70	5.48	188.83	5.55	27.46
Thailand	499.39	2.77	122.97	3.61	24.62
Brazil	470.36	2.61	111.48	3.28	23.70
Ukraine	466.70	2.59	117.63	3.46	25.21
United States	361.81	2.01	92.72	2.72	25.63
Japan	201.95	1.12	49.28	1.45	24.40
Turkey	183.32	1.02	39.96	1.17	21.80
Hong Kong	181.91	1.01	36.00	1.06	19.79
Mexico	180.97	1.00	37.13	1.09	20.52
Italy	133.44	0.74	31.38	0.92	23.51
Chile	92.10	0.51	24.57	0.72	26.68
Argentina	78.80	0.44	19.64	0.58	24.93
Syria	65.90	0.37	15.96	0.47	24.22
Morocco	58.14	0.32	12.37	0.36	21.27
Iran	56.75	0.31	14.57	0.43	25.68
Spain	47.39	0.26	11.68	0.34	24.65
Israel	47.29	0.26	7.12	0.21	15.05
Taiwan	45.80	0.25	11.79	0.35	25.74
United Kingdom	36.55	0.20	19.24	0.57	52.64
Slovenia	36.00	0.20	11.37	0.33	31.58
Egypt	26.00	0.14	5.39	0.16	20.73
Guatemala	23.18	0.13	6.16	0.18	26.57
Bulgaria	22.25	0.12	5.10	0.15	22.94
Lebanon	19.33	0.11	6.25	0.18	32.35
South Africa	14.00	0.08	4.27	0.13	30.50
Domican Rep.	13.30	0.07	3.73	0.11	28.01
Portugal	13.00	0.07	6.78	0.20	52.15
Venezuela	13.00	0.07	3.98	0.12	30.62
Bahrin	12.19	0.07	3.65	0.11	29.93
Korea Rep.	12.00	0.07	2.90	0.09	24.16
Romania	11.50	0.06	3.58	0.11	31.12
Greece	11.00	0.06	2.17	0.06	19.71
Singapore	10.00	0.06	2.73	0.08	27.33
Canada	6.00	0.03	2.67	0.08	44.45
France	6.00	0.03	1.96	0.06	32.64

Total	**18026.04**	**100.00**	**3403.51**	**100.00**	**18.88**

unit value was the highest in case of United Kingdom (Rs. 52.64/kg) and was the lowest in case of China (Rs. 13.63/kg). The total export of senna (leaves) from Gujarat during the years 2005-07 was 18026.04 tonnes and the average unit value was Rs. 18.88/kg.

The direction of export of ajowan seed from Gujarat during the years 2005-07 is given in Table 4.33. It can be seen from the table that Saudi Arabia is on the top as our buyer which has imported 82.62 per cent to total quantity of ajowan seed export from Gujarat. Other important buyer countries are United States, United Kingdom, Kenya, Yeman Democratic

Table 4.33 Export of ajowan seed from Gujarat-direction of trade (2005-07)

Country	**Quantity**		**Value**		**Unit Value**
	(MT)	%	Rs. Lakhs	%	Rs/Kg
Saudi Arabia	900.22	82.62	439.82	75.86	48.04
United State	117.59	10.79	95.13	16.41	81.46
United Kingdom	41.34	3.79	25.67	4.43	48.86
Kenya	8.86	0.82	4.26	0.73	55.49
Yemen Demo	5.00	0.45	3.28	0.56	48.78
Canada	4.05	0.37	2.27	0.39	62.10
Uganda	4.00	0.37	3.40	0.59	118.89
Tanzania	3.00	0.28	1.91	0.33	65.5
Australia	2.75	0.25	2.23	0.39	71.51
United Arab Amirat	1.64	0.15	1.17	0.20	63.53
Sudan	0.54	0.05	0.26	0.04	48.78
Germany	0.46	0.04	0.30	0.05	80.90
New Zealand	0.05	0.01	0.03	0.01	85.09
Botswana	0.03	0.01	0.04	0.01	118.89

Total	**1089.53**	**100.00**	**579.77**	**100.00**	**53.21**

and Canada in their order. The unit value was the highest in case of Uganda and Botswana (Rs. 118.89 /kg) whereas the lowest was noticed in case of Saudi Arabia (Rs. 48.04/kg). The total export of ajowan seed from Gujarat during the year 2005-07 was 1089.53 tonnes and the average unit value was Rs. 53.21/kg.

4.5.2.2 Change in export pattern

In order to examine shift in export pattern of selected medicinal crops of Gujarat for the years 2005 to 2007, the rank correlation coefficient was used. The rank correlation coefficients were worked out for each pair of years and the results are presented in Table 4.34.

Table 4.34 The rank correlation coefficient for measuring shift in export pattern of medicinal crops

Commodity	Years	Value of "r_c"
Isabgol husk	Between 2005 and 2006	-0.01438
	Between 2006 and 2007	-0.23806
	Between 2005 and 2007	-0.20467
Senna (leaves)	Between 2005 and 2006	-0.16029
	Between 2006 and 2007	0.14196
	Between 2005 and 2007	-0.26083
Ajowan seed	Between 2005 and 2006	-0.30053
	Between 2006 and 2007	-0.01125
	Between 2005 and 2007	-0.39297

It is evident that in isabgol husk, calculated rank correlation coefficients for different years were negative and non-significant. Hence, it can be concluded that there has been shift in the export pattern between the years. In case of senna (leaves)

the rank correlation coefficients for the years 2005 and 2006, and 2005 and 2007 were negative and non significant but for the year 2006 and 2007, it was positive and non significant indicating that there has been shift in the export pattern between the years. In ajowan seed, calculated rank correlation coefficients for the different years were also negative and non significant. Hence, it can be concluded that there has been no consistency in the export pattern between the years for all the crops under study.

4.5.2.3 Markov chain analysis

(I) Isabgol

The major isabgol husk importing countries from Gujarat taken for the analysis were USA, Australia, Germany, Spain, Denmark and Mexico along with the remaining importing countries grouped under 'others'.

It is clearly evident that export of isabgol husk from Gujarat to USA was retained to the tune of 74.32 per cent (Table 4.35). The remaining 25.68 per cent was diverted to other countries i. e. 2.85 per cent to Denmark, 3.49 per cent to Mexico and 19.34 per cent to other countries. At the same time, USA gained 80.22 per cent share of Australia, 83.02 per cent share of Germany, 5.46 per cent share of Spain and 64.95 per cent share of 'others'.

Table 4.35 Transitional probability matrix of isabgol husk exports from Gujarat (2005 to 2007)

	USA	Australia	Germany	Spain	Denmark	Mexico	Others
USA	0.7432	0	0	0	0.0285	0.0349	0.1934
Australia	0.8022	0	0.1978	0	0	0	0
Germany	0.8302	0	0	0	0.0239	0.1459	0
Spain	0.0546	0.2934	0.3698	0.2822	0	0	0
Denmark	0	0	0	0.3348	0	0	0.6652

Mexico	0	0	0	0	0	0	1.0000
Others	0.6495	0.1053	0	0.2452	0	0	0

Gujarat could not retain its export share of Australia, Germany, Denmark, Mexico and others. Our almost entire share of isabgol husk market was directed to USA. In case of Spain, Gujarat could retain its previous export share to the tune of 28.22 per cent. Spain lost a considerable share to Germany (36.98%) and Australia (29.34%).

(II) Senna (leaves)

The major senna (laves) importing countries from Gujarat were Germany, Ukraine, China, Russia, Thailand and USA. They have been taken for the analysis of trade directions. It is evident that senna (leaves) export from Gujarat to China retained 100 per cent during the current period (Table 4.36). In addition, China also gained 41.48 per cent share of other countries.

Gujarat could not retain its previous export shares to Germany, Ukraine, Russia, and Thailand, but it could retain its previous export shares to USA up to 34.29 per cent. In case of other countries, Gujarat retained its previous export share to the tune of 32.10 per cent. Other countries lost a sizeable share of 41.18 per cent to China.

Table 4.36 Transitional probability matrix of senna (leaves) exports from Gujarat (2005 to 2007)

	Germany	Ukraine	China	Russia	Thailand	USA	Others
Germany	0	0	0	0	0	0	1.0000
Ukraine	0.7701	0	0	0	0	0.1272	0.1027
China	0	0	1.0000	0	0	0	0
Russia	0	0.3403	0	0	0	0	0.6597
Thailand	0	0	0	0	0	0	1.0000
USA	0	0	0	0	0	0.3429	0.6571

Others	0.1423	0	0.4148	0.0670	0.0549	0	0.3210

(III) Ajowan seeds

The major ajowan importing countries taken for the analysis of trade in Gujarat were USA, UK, Kenya, Canada and Saudi Arabia along with the remaining importing countries grouped under 'others'. It can be seen that Gujarat's ajowan seeds export to Saudi Arabia was retained to the tune of 96.45 per cent (Table 4.37). Of the remaining 3.55 per cent was diverted to the UK. At the same time, Saudi Arabia gained 100 per cent share of USA and Kenya, 53.67 per cent share of Canada and 13.92 per cent share of Kenya.

Gujarat's previous ajowan exports to UK was retained to the tune of 22.87 per cent. Out of the remaining 77.13 per cent, 62.30 per cent was lost to UK, 0.91 per cent lost to Kenya and 13.92 per cent lost to Saudi Arabia. Gujarat could not retain its previous export shares to USA, Keniya and Canada. Our entire share of USA and Kenian ajowan markets was directed to Saudi Arabia, while Canadian market was diverted to UAS, Saudi Arabia and other countries. In case of other countries, Gujarat retained 10.27 per cent of its export to those importing countries.

Table 4.37 Transitional probability matrix of ajowan seeds exports from Gujarat (2005-07)

	USA	UK	Kenya	Canada	Saudi Arebia	Others
USA	0	0	0	0	1.0000	0
UK	0.6230	0.2287	0.0091	0	0.1392	0
Kenya	0	0	0	0	1.0000	0
Canada	0.2806	0	0	0	0.5367	0.1827
Saudi	0	0.0355	0	0	0.9645	0

Arabia						
Others	0.6684	0	0.0806	0.1483	0	0.1027

Export projection of major medicinal crops of Gujarat

Using the transitional probability matrix, market share projections of Gujarat isabgol husk, senna (leaves) and ajowan seeds exports to major importing countries were worked out for the period 2008-2015. The projected isabgol husk exports to different countries are given in Table 4.38. It can be observed that USA will be the major importer of isabgol husk. Its share in total export would be around 65 per cent. Thus, USA is considered to be a growing market importing about 22000 tonnes (65.24%) in 2015 A. D. The major buyers are others countries and Spain.

Table 4.38 Projected isabgol husk exports to different countries (tonnes)

Year	USA	Aus-tralia	Ger-many	Spain	Den-mark	Mexico	Others	Total
2008	22073.13 (65.48)	1212.88 (3.60)	1254.78 (3.72)	2056.48 (6.10)	649.02 (1.93)	1052.47 (3.12)	5411.93 (16.05)	33710.69 (100.00)
2009	22046.77 (65.40)	1173.25 (3.48)	1000.4 (2.97)	2124.64 (6.30)	659.07 (1.96)	953.42 (2.83)	5753.14 (17.07)	33710.69 (100.00)
2010	22009.54 (65.29)	1229.18 (3.65)	1017.76 (3.02)	2230.9 (6.62)	652.24 (1.93)	915.39 (2.72)	5655.68 (16.78)	33710.69 (100.00)
2011	21983.65 (65.21)	1250.09 (3.71)	1068.12 (3.17)	2234.7 (6.63)	651.59 (1.93)	916.62 (2.72)	5605.91 (16.63)	33710.69 (100.00)
2012	21990.87 (65.23)	1245.96 (3.70)	1073.66 (3.18)	2223.35 (6.60)	652.06 (1.93)	923.07 (2.74)	5601.7 (16.62)	33710.69 (100.00)
2013	21994.16 (65.24)	1242.19 (3.68)	1068.64 (3.17)	2219.28 (6.58)	652.4 (1.94)	924.13 (2.74)	5609.85 (16.64)	33710.69 (100.00)
2014	21994.49 (65.24)	1241.86 (3.68)	1066.4 (3.16)	2220.24 (6.59)	652.37 (1.94)	923.51 (2.74)	5611.78 (16.65)	33710.69 (100.00)
2015	21993.93 (65.24)	1242.34 (3.69)	1066.68 (3.16)	2220.97 (6.59)	652.33 (1.94)	923.2 (2.74)	5611.2 (16.65)	33710.69 (100.00)

Note: Figures in parentheses indicate the percentage to total.

The data about the expected quantity of exports of senna (leaves) to major importing countries during the period 2008-15 are given in the Table 4.39. It can be seen that China would be the major importer of senna. Its share would increase from 54.23 per cent in 2008 to 95.46 per cent in 2015. Thus, China is considered to be a growing market for senna (leaves) export. The other major buyers would be Germany and other countries. There would be a very wide fluctuation in senna exports. The reason attributed to this wide fluctuation was purely based on the demand of the importers (Ajjan, 1998).

Table 4.39 Projected senna (leaves) exports to different countries (tonnes)

Year	Ger-many	Ukrai-ne	China	Russia	Thai-land	USA	Others	Total
2008	1101.81 (7.44)	167.13 (1.13)	8026.75 (54.23)	457.35 (3.09)	374.76 (2.53)	97.83 (0.66)	4576.75 (30.92)	14802.38 (100.00)
2009	779.98 (5.27)	155.64 (1.05)	9925.19 (67.05)	306.64 (2.07)	251.26 (1.70)	54.81 (0.37)	3328.86 (22.49)	14802.38 (100.00)
2010	593.56 (4.01)	104.35 (0.70)	11306 (76.38)	223.03 (1.51)	182.75 (1.23)	38.59 (0.26)	2354.09 (15.90)	14802.38 (100.00)
2011	415.35 (2.81)	75.9 (0.51)	12282.48 (82.98)	157.72 (1.07)	129.24 (0.87)	26.5 (0.18)	1715.18 (11.59)	14802.38 (100.00)
2012	302.52 (2.04)	53.67 (0.36)	12993.94 (87.78)	114.92 (0.78)	94.16 (0.64)	18.74 (0.12)	1224.41 (8.27)	14802.38 (100.00)
2013	215.56 (1.46)	39.11 (0.26)	13501.83 (91.21)	82.04 (0.55)	67.22 (0.45)	13.26 (0.09)	883.35 (5.97)	14802.38 (100.00)
2014	155.82 (1.05)	27.92 (0.19)	13868.24 (93.69)	59.18 (0.40)	48.5 (0.33)	9.52 (0.06)	633.19 (4.28)	14802.38 (100.00)
2015	111.6 (0.76)	20.14 (0.13)	14130.89 (95.46)	42.42 (0.29)	34.76 (0.23)	6.81 (0.05)	455.74 (3.08)	14802.38 (100.00)

Note: Figures in parentheses indicate the percentage to total.

The projected export share of ajowan seeds to major importing countries are given in Table 4.40. It could be observed that Saudi Arabia would be the major importer of ajowan. Its share in total exports may vary widely between 46.69 per cent in 2008 to 93.01 per cent 2015. Thus, Saudi Arabia is considered to be a growing market importing about 1940 tonnes in 2015 A. D. The other major buyers would be UK and USA.

On the whole, it can be concluded that the export of isabgul would be highly stable as compare to senna and ajowan. Also, it will be confined to a few countries only. Thus, the future prospects depends upon the demand pattern of those countries. Only USA and Spain; China and Germany; and Saudi Arabia and UK would be the major buyers of isabgul husk, senna (leaves) and ajowan seeds, respectively.

Table 4.40 Projected ajowan seeds exports to different countries (tonnes)

Year	USA	UK	Keniya	Canada	Saudi Arebia	Others	Total
2008	723.78 (34.70)	39.52 (1.89)	84.9 (4.07)	155.63 (7.46)	973.77 (46.69)	108.15 (5.19)	2085.75 (100.00)
2009	140.58 (6.74)	43.61 (2.09)	9.08 (0.44)	16.04 (0.77)	1836.91 (88.07)	39.54 (1.90)	2085.75 (100.00)
2010	58.1 (2.79)	75.18 (3.60)	3.59 (0.17)	5.86 (0.28)	1936.04 (92.82)	6.99 (0.34)	2085.75 (100.00)
2011	53.15 (2.55)	85.92 (4.12)	1.24 (0.06)	1.04 (0.05)	1942.62 (93.14)	1.79 (0.09)	2085.75 (100.00)
2012	55.02 (2.64)	88.61 (4.25)	0.92 (0.04)	0.27 (0.01)	1940.57 (93.04)	0.37 (0.02)	2085.75 (100.00)
2013	55.53 (2.66)	89.16 (4.27)	0.84 (0.04)	0.05 (0.01)	1940.09 (93.01)	0.09 (0.01)	2085.75 (100.00)
2014	55.62 (2.68)	89.26 (4.28)	0.82 (0.04)	0.01 (0.00)	1940.03 (93.01)	0.02 (0.00)	2085.75 (100.00)
2015	55.62 (2.67)	89.28 (4.28)	0.81 (0.04)	0 (0.00)	1940.03 (93.01)	0 (0.00)	2085.75 (100.00)

Note: Figures in parentheses indicate the percentage to total.

4.6 Export competitiveness

The export competitiveness of the isabgol husk was analyzed using Nominal Protection Coefficients. The data in Table 4.41 show the country wise NPC values for isabgol husk exported from Gujarat. It can be seen from the table that export of isabgol husk was most profitable to Japan as the value of NPC found the lowest (0.446), followed by Indonesia, United Arab Amirat, Taiwan etc. Countries including Saudi Arabia, Canada,

Singapore. New Zealand, China etc. were found to be moderately competitive. In case of Maxico only, the value of NPC was found greater than unity indicating non-competitiveness of export of isabgol husk to this country.

Table 4.41 Export competitiveness of isabgol husk from Gujarat

Country	Quantity (MT)	Value Rs. Lakhs	Unit Value Rs/Kg	Reference price (pb) (Rs/kg)	NPC (Pd/Pb)
Japan	339.20	721.19	212.61	202.01	0.446
Indonesia	378.00	748.09	197.91	187.31	0.480
United Arab Amirat	27.96	54.52	194.98	184.38	0.488
Taiwan	109.40	211.04	192.90	182.3	0.494
Canada	125.52	236.36	188.31	177.71	0.506
Saudi Arabia	53.02	99.46	187.60	177	0.508
Singapore	8.10	14.18	175.02	164.42	0.547
New Zealand	27.63	47.64	172.44	161.84	0.556
China	85.00	144.30	169.76	159.16	0.565
Pakistan	76.28	126.68	166.07	155.47	0.579
Italy	246.13	401.53	163.14	152.54	0.590
Korea Rep.	45.00	71.97	159.93	149.33	0.603
Malaysia	243.60	386.16	158.52	147.92	0.608
Brazil	4.00	6.34	158.40	147.8	0.609
Guatemala	10.00	15.36	153.64	143.04	0.629
Kenya	0.21	0.32	150.06	139.46	0.645
Belgium	350.00	524.46	149.85	139.25	0.646
Chile	4.50	6.44	143.11	132.51	0.679
Germany	2347.47	3286.73	140.01	129.41	0.695
Colombia	81.50	109.78	134.70	124.1	0.725
Sweden	394.20	516.52	131.03	120.43	0.747
El Salvador	18.00	23.04	128.03	117.43	0.766
Spain	2682.61	3423.22	127.61	117.01	0.769
France	314.00	389.01	123.89	113.29	0.794
Australia	1974.90	2420.59	122.57	111.97	0.804
Reunion	0.29	0.35	122.09	111.49	0.807
Denmark	646.85	773.32	119.55	108.95	0.826
United Kingdom	2104.05	2508.27	119.21	108.61	0.829
Hong Kong	322.00	373.87	116.11	105.51	0.853
United States	21932.01	24240.50	110.53	99.93	0.901
Argentina	71.00	76.98	108.43	97.83	0.920
Russia	10.00	10.69	106.94	96.34	0.934
Mexico	1017.00	994.25	97.76	87.16	1.033

Total	**36049.43**	**42963.16**	**119.18**	**108.58**	**0.829**

Packing and transportation cost Rs.10.60/kg.
Wholesale price Rs. 90/kg
Source: Exporters

On an average, the analysis shows that for majority of the countries, export of isabgol husk from Gujarat's port is competitive during the years 2005-07. In general, out of 33 importing countries, four were found the most profitable, 28 countries were found moderately profitable and one was found non-competitive. Thus, it can be concluded that export of isabgol husk from Gujarat is quite competitive and profitable.

The values in Table 4.42 depict the country wise NPC values for senna (leaves) exported from Gujarat. It is seen from the table that export of Gujarat senna (leaves) was most profitable to United Kingdom with NPC as low as 0.245 followed by Portugal, Canada, Lebanon, Slovenia etc. The countries including Bahrin, Chile, Germany, South Africa, Venezuela etc. were found to be moderately competitive. Overall analysis shows that for most of the countries, export of senna (leaves) from Gujarat is competitive during the years 2005-07. In general, out of 41 senna (leaves) importing countries, seven were found most profitable (NPC < 0.5), 27 were found moderately profitable (0.5 < NPC < 1) and seven were found non-competitive (NPC > 1). Thus, it can be concluded that exports of senna (leaves) from Gujarat is profitable business.

The data in Table 4.43 show the country wise NPC values for ajowan seed exported from Gujarat. It is clearly seen that export of ajowan was found to be the most profitable to Uganda and Bostwana with NPC as low as 0.334, followed by New Zealand (0.485) while rest of the countries were found to be moderately competitive. Thus, for most of the countries, export

of ajowan seed from Gujarat is competitive and profitable during the years 2005-07.

Table 4.42 Export competitiveness of senna (leaves) of Gujarat

Country	Quantity (MT)	Value Rs. Lakhs	Unit Value Rs/Kg	Reference price (pb) (Rs/kg)	NPC (Pd/Pb)
United Kingdom	36.55	19.24	52.64	42.54	0.245
Portugal	13.00	6.78	52.15	42.05	0.248
Canada	6.00	2.67	44.45	34.35	0.304
France	6.00	1.96	32.64	22.54	0.463
Lebanon	19.33	6.25	32.35	22.25	0.469
Slovenia	36.00	11.37	31.58	21.48	0.486
Romania	11.50	3.58	31.12	21.02	0.496
Venezuela	13.00	3.98	30.62	20.52	0.508
South Africa	14.00	4.27	30.50	20.4	0.511
Bahrin	12.19	3.65	29.93	19.83	0.526
Domican	13.30	3.73	28.01	17.91	0.582
Russia	987.70	188.83	27.46	17.36	0.601
Singapore	10.00	2.73	27.33	17.23	0.605
Chile	92.10	24.57	26.68	16.58	0.629
Guatemala	23.18	6.16	26.57	16.47	0.633
Taiwan	45.80	11.79	25.74	15.64	0.667
Iran	56.75	14.57	25.68	15.58	0.669
United States	361.81	92.72	25.63	15.53	0.672
Germany	2704.23	685.71	25.36	15.26	0.683
Ukraine	466.70	117.63	25.21	15.11	0.690
Argentina	78.80	19.64	24.93	14.83	0.703
Spain	47.39	11.68	24.65	14.55	0.717
Thailand	499.39	122.97	24.62	14.52	0.718
Japan	201.95	49.28	24.40	14.3	0.729
Syria	65.90	15.96	24.22	14.12	0.739
Korea Rep.	12.00	2.90	24.16	14.06	0.742
Brazil	470.36	111.48	23.70	13.6	0.767
Vietnam	698.68	165.06	23.63	13.53	0.771
Italy	133.44	31.38	23.51	13.41	0.778
Bulgaria	22.25	5.10	22.94	12.84	0.812
Turkey	183.32	39.96	21.80	11.7	0.891
Poland	832.76	179.71	21.58	11.48	0.909
Morocco	58.14	12.37	21.27	11.17	0.934
Egypt	26.00	5.39	20.73	10.63	0.981
Mexico	180.97	37.13	20.52	10.42	1.001
Hong Kong	181.91	36.00	19.79	9.69	1.076

Greece	11.00	2.17	19.71	9.61	1.085
Latvia	726.81	130.10	17.90	7.8	1.337
Israel	47.29	7.12	15.05	4.95	2.107
Malaysia	2750.15	405.90	14.76	4.66	2.238
China	5868.39	800.02	13.63	3.53	2.955

Packing and transportation cost Rs.10.10/kg
Wholesale price Rs.10.43/kg
Source: Exporters

Table 4.43 Export competitiveness of ajowan seed of Gujarat

Country	Quantity (MT)	Value Rs. Lakhs	Unit Value Rs/Kg	Reference price (pb) (Rs/kg)	NPC (Pd/Pb)
Botswana	0.03	0.04	118.89	108.79	0.334
Uganda	4.00	3.40	118.89	108.79	0.334
New Zealand	0.05	0.03	85.09	74.99	0.485
United States	117.59	95.13	81.46	71.36	0.509
Germany	0.46	0.30	80.90	70.80	0.513
Australia	2.75	2.23	71.51	61.41	0.592
Tanzania	3.00	1.91	65.5	55.40	0.656
United Arab Amirat	1.64	1.17	63.53	53.43	0.680
Canada	4.05	2.27	62.10	52.00	0.699
Kenya	8.86	4.26	55.49	45.39	0.801
United Kingdom	41.34	25.67	48.86	38.76	0.938
Sudan	0.54	0.26	48.78	38.68	0.940
Yemen Demo	5.00	3.28	48.78	38.38	0.940
Saudi Arabia	900.22	439.82	48.04	37.94	0.958

Packing and transportation cost Rs.10.10/kg
Wholesale price Rs.36.35/kg
Source: Exporters

4.7 The problems in production and marketing

An opinion survey was carried out for the sample of 50 farmers of each crop and respective intermediaries regarding the problems faced by them in the production, marketing and export of medicinal crops. The important problems and difficulties perceived by the farmers, traders and exporters are discussed in this section.

The major constraints faced by medicinal crops growers in production and marketing are given in Table 4.44. The

shortage of electricity and high wage rate were found the most acute problems faced by isabgol, ajowan and coleus producers. Majority of isabgol and ajowan growers felt the problem of lack of irrigation facilities, and senna and coleus cultivators faced the problem of high cost of seeds. Non-availability of good quality seeds was also a limiting factor expressed by more than 50 per cent cultivators of isabgol, senna and ajowan.

Table 4.44 Constraints faced by the sample farmers in production and marketing of medicinal crops (N = 50)

Sr. No.	Constraints	Percentage of sample farmers expressed the problem			
		Isabgol	Senna	Coleus	Ajowan
	Production				
1	Non availability of good quality of seed	56	70	44	64
2	High price of seed	36	80	76	20
3	Shortage of labour	52	48	40	44
4	High wage rate of labour	90	70	76	84
5	Lack of credit facilities	68	72	70	76
6	Shortage of electricity	100	46	88	100
7	Lack of irrigation facilities	72	22	36	84
8	Lack of technical knowledge	64	70	50	56
	Marketing				
1	Lack of transportation	24	44	42	28
2	High charges of transportation	84	80	70	80
3	Lack of link road	76	72	50	68
4	Lack of market yard	68	100	30	20
5	Malpractices by traders	44	90	20	34
6	No correct weighing	16	24	12	26
7	Late payment	28	28	18	20
8	Price fluctuation	92	86	88	96
9	Lack of price information	64	80	44	40
10	Non-availability of storage facilities	72	96	92	74

Looking to the marketing constraints, price fluctuations and high charges of transportation were the major issues faced by nearly two-thirds of medicinal crops growers. There was a lack of trading in regulated markets for senna. More than 70 per

cent medicinal crops growers faced the problem of lack of storage facilities. Lack of price information and malpractices adopted by the traders were also big hurdles in marketing of medicinal crops.

The problems faced by the traders of medicinal crops are presented in Table 4.45. With regard to the problem of marketing, all traders indicated that high cost of transportation is a genuine problem faced by them. The lower rate of commission in their trading business was the problem for 88.89, 100.00, 88.89 and 83.33 per cent of isabgol, senna, coleus and ajowan intermediaries, respectively. The problem of inadequate

Table 4.45 Constraints faced by the traders in marketing of medicinal crops (N=33)

Sr. No.	Constraints relating	Percentages of sample traders expressed the problem			
		Isabgol	Senna	Coleus	Ajowan
1	High cost of transportation	88.89	100.00	83.33	100.00
2	Lower rate of commission	77.78	100.00	88.89	83.33
3	Lack of storage facilities	77.78	66.67	44.44	58.33
4	Less availability of standard quality	88.89	66.67	66.67	75.00
5	Interference of government	44.44	33.33	22.22	41.67
6	Lack of credit facilities	77.78	66.67	66.67	83.33

storage facilities were expressed by 77.78 per cent of isabgol, 66.67 per cent of senna, 44.44 per cent of coleus and 58.33 per cent of ajowan traders. About 70 per cent traders have indicated the problem of less availability of standard quality products. More than 65 per cent traders complained about lack of credit facility.

The major constraints faced by the exporters are given in the Table 4.46. With regard to problems of exports, all the exporters indicated that low international price, lack of quality packing materials, fluctuation in exchange rate, lack of suitable market survey and unorganized domestic markets were the major bottlenecks.

Table 4.46 Constraints faced by the exporters in marketing of medicinal crops (N=6)

Sr. No.	Constraints relating	Percentages sample traders expressed the problem		
		Isabgol	Senna	Ajowan
1	Less availability of standard commodity	33.33	66.67	66.67
2	Low price in international market	100.00	100.00	100.00
3	Lack of storage facilities at terminal place	33.33	66.67	33.33
4	Non-availability of standard containers	66.67	66.67	66.67
5	Lack of quality packing materials availability	100.00	100.00	100.00
6	High cost of freight	66.67	100.00	66.67
7	Interference of government	33.33	33.33	33.33
8	Fluctuation in exchange rate	100.00	100.00	100.00
9	Problem of sanitary and phyto-sanitary	66.67	66.67	33.33
10	Lack of suitable market survey	100.00	100.00	100.00
11	Lack of pricing information	66.67	66.67	66.67
12	Unorganized domestic markets	100.00	100.00	100.00

More than 65 per cent exporters expressed the problems of sanitary and phyto-sanitary, lack of pricing information, non-availability of standard containers and high cost of freight. Less

availability of standard commodities and lacks of storage facilities at terminal place were other important hurdles faced by the exporters.

CHAPTER V

SUMMARY AND CONCLUSIONS

Medicinal plants are the local heritage with global importance, World is endowed with treasure of medicinal plants. Herbs have always been the principal form of medicine in ancient India and now a days they are becoming most popular throughout the developed world, as they have zero or negligible side effects. India is a live botanical garden on the earth as she is endowed with about 2.50 lakhs plant species. Medicinal plants play an important role in rural life, particularly in remote parts of developing countries with few health facilities. Many plant species are used as herbal medicines either in raw form or as semi-processed form, often as mere mixtures. In India, about 70 percent population uses traditional medicines and generates the employment of about 3.5 million mandays per year during the collection and processing operations. According to EXIM bank, the International market of medicinal plants is to the tune of US $ 60 billion per year with a growth rate of 7 per cent per annum which will be of US $ 5 trillion by 2050.

India has potentials of foreign exchange earning from export of medicinal plants over US $ 2000 million per annum. The scope is enormous but the task is difficult as the commercial cultivation of medicinal is in infant stage and marketing system is highly unorganized and scattered.

Among the medicinal crops grown commercially in Gujarat, Isabgol (*Plantago ovata* Forsk), Senna (*Cassia angustifolia* C), Coleus (*Coleus forscohlii* (Willd.) Briq.), Ajowan (*Trachyapermum ammi* L.) are the major crops selected for this study. Gujarat occupied prime passion in production and export

of these medicinal crops. Presently, in Gujarat isabgol and ajowan crops are cultivated on 26430 and 3370 hectares of land produces 29550 and 7680 tonnes annually, respectively. Total export of medicinal crops during the year 2006 was 1566, 3094 and 41 tonnes of isabgol husk, senna (leaves) and ajowan crops, respectively.

This shows an immense scope of commercial cultivation and export market of the medicinal crops from Gujarat. But there is lack of literatures and data on economics of production, domestic and export markets, and its problems etc. in our country in general and for Gujarat in particular. Therefore the present study is conducted to investigate about the economics and marking aspects which could be helpful for herbal producers, traders and policy makers. The specific objectives of the study are as under:

7. To assess the economic viability of cultivation of selected medicinal crops.
8. To assess the productivity of resources and allocation efficiency of factors used in selected medicinal crops.
9. To identify marketing channels and estimate marketing costs and margins at different stages of marketing.
10. To analyze the growth and export directions of medicinal crops.
11. To elicit the problems faced by the farmers regarding the production and marketing, and exporters of selected medicinal crops.
6. To work out the export competitiveness of selected medicinal crops.

The study area

This study is confined to the Saurashtra and Kutchh region of Gujarat state. Junagadh district for isabgol, Kutchh district for senna and Jamnagar district for coleus and ajowan crops were selected purposively for the study, as they were commercially cultivated in larger scale in these districts. One taluka from each selected district was selected purposively where in the selected crop occupied large area. From each selected taluka, 50 respondents were selected randomly for each crop constituting the total sample size of 200 farmers. Number of villages was selected considering the availability of respective crop growers and required size of sample.

The concerned intermediaries between producers and consumers were also contacted. The data regarding the various items of costs and margins of intermediaries were collected through personal interview. The data were analysed using tabular analysis and appropriate statistical tools like exponential growth function, rank correlation, markov chain analysis and nominal protection coefficient to evaluate the objectives of the study.

The overall general features of medicinal growers indicate that their family size was around 6 members and majority farmers were of middle age group. In case of the education level, it was found that the majority of medicinal growers were educated and they were highly associated with village organization. Average size of their land holding was larger to medium.

Economics of medicinal crops

In isabgol crop, the average total cost (C_2) was worked out to be Rs. 16469/- per hectare. The return per hectare over cost C_2 was Rs. 11101/-. The average total cost of production (cost C_2) and bulk line cost per quintal was Rs. 1818/- and Rs. 2409/-, respectively. The average farm harvest price of isabgol was estimated to be Rs. 3043/- per quintal which was higher than the cost of production per quintal. The input output ratio over cost C_2 was worked out to be 1:1.67 indicated sound economic viability of this crop.

In the cultivation of senna crop, the average total cost (cost C_2) was worked out to be Rs. 8224/- per hectare. The return per hectare over total cost C_2 was Rs. 4200/-. The average total cost of production and bulk line cost per quintal was Rs. 701/- and Rs. 830/-, respectively. The average farm harvest price of senna leaves obtained was Rs. 1058/- per quintal indicating fair economic returns. The input out ratio over total cost worked out to be 1:1.51.

In coleus crop, the average total cost per hectare of coleus cultivation was amounted to Rs. 46205/-. The average return per hectare over total cost (cost C_2) worked out to be Rs. 112216/-. The cost of production and bulk line cost per quintal was Rs. 356/- and Rs. 394.52/-, respectively. The price received by the farmers of coleus was Rs. 1222/- per quintal which was quite higher than the cost of production indicating strong economic viability of this crop. The input-output ratio over cost C_2 (1:3.43) also indicated high profitability.

In ajowan crop, the total cost of cultivation (cost C_2) per hectare was Rs. 15204/-. The net returns per hectare over cost C_2 was Rs. 23704/-. The average cost of production and bulk line cost per quintal was Rs. 1697/-and Rs. 2329/-, respectively. The average farm harvest price per quintal was Rs. 4342/-, indicated that cultivation of ajowan was highly remunerative. The input- output ratio was greater than unity (1:2.56) also indicates the profitability of this crop.

Resource use efficiency in cultivation of medicinal crops

The negative and significant impact of working capital was observed in isabgol. The elasticities of output with respect to area under the crop (0.1174 %), human labour (0.7638 %), and working capital (0.3713%) in senna crop, while in ajowan crop, the elasticities of human labour (1.5047 %), working capital (0.2083 %) and for nitrogen were found positive and statistically significant. In case of isabgol and coleus elasticities of all the included regressors were found statistically non-significant.

In case of isabgol, MVPs of the human labour, bullock labour and potash only were found higher than its unit price which calls for its efficient use. The ratios were less than unity in case of area (0.69), nitrogen (0.66) and phosphorus (0.44). suggested their restricted application in isabgol crop.

In case of senna crop, the ratios of MVP to factor price were greater than unity for human labour (3.35), nitrogen (10.96) and working capital (4.01) indicated the under utilization of these inputs. The values of ratios found less than unity for

area (0.26), bullock labour (0.24), manures (-1.02) and P (-1945.40) which calls for its restricted application.

In coleus, the ratios of MVP to factor price are less than unity in case of area under the crop (0.40), manures (-14.08) and N (-3772.44) indicated their inefficient use.

The analysis of resource use efficiency revealed that there is need for diverting more funds from working capital in isabgol and allocate more funds towards human labour and working capital in ajowan crop.

Marketing channels, marketing costs and margins

There were four marketing agencies involved in the marketing of medicinal crops namely; village merchants, wholesalers in regulated market, wholesalers in city and consumers. The village merchants, wholesalers in regulated market and the wholesalers of city played a key role from the point of view of the number of farmers utilizing their services and the quantity of isabgol, senna, coleus and ajowan sold through them.

The results revealed that majority of isabgol (58 %) and coleus growers (64 %) were fallen in lower two cost ranges, whereas in senna (86 %) and ajowan crops (64 %) majority of farmers were in upper two cost ranges. This has indicated that isabgol and coleus growers are efficients in handling their products as compared to senna and ajowan growers. In all the medicinal crops, majority of the farmers were sold their produce in top two ranges of prices, i.e. 92 per cent farmers in isabgol, 60 per cent in senna, 58 per cent in Coleus and 78 per cent in ajowan crop.

Out of the three identified channels, more than 50 per cent isabgol was sold through channel III (Producers – wholesalers in city - processors). Transportation, market fee and packing charges were the major items of the marketing cost. Producer received the highest share in channel II (Producers – wholesalers in regulated market - processors) but the difference is at par with the other channels. In senna , only one channel (Producers-wholesalers in city-exporters) was identified. Producer's share in exporter's price of senna was 89.49 per cent, indicating an efficient marketing system.

In coleus, out of the three identified channel, more than 85 per cent coleus was sold through channel II (Producers – wholesalers in regulated market –retailers). Transportation and market fee were the major items of the marketing cost. Producers received higher share in consumers' rupee in channel IV due to direct sale to consumer but efficient channel was II because it provide the facilities of open auction, true weight and cash payments to their clients.

Out of three identified channels, more than 85 per cent ajowan was sold through channel II (Producers - wholesalers in regulated market - retailers) indicating the most preferred channel. Transportation and market fee were the major items of the marketing cost. Producers received the highest share in consumers' rupee in channel II.

Growth and export dynamics of medicinal crops

The growth in export quantity and export earning of isabgol was found negative while in ajowan and senna it was found positive over the study period. In case of unit value the growth were found positive in isabgol seeds and senna leaves

whereas it was positive but non-significant in case of ajowan seeds.

The result of instability index shows that export prices and export earning of isabgol seeds, ajowan seeds and senna, were found relatively stable when compared to the volume of export. The results also indicated that instability in export quantity, value and prices found the highest in isabgol.

The Export direction

United States is on the top as our buyer which has imported 60.84 per cent of total quality of isabgol husk from Gujarat. Other important buyer countries are Spain, Germany, United Kingdom and Australia in their order. The unit value was the highest in case of Japan (Rs. 212.61/ kg) and it was the lowest in case of Mexico (Rs. 97.76/kg).

In case of senna, China was the major buyer which has imported 32.56 per cent of total quantity of senna (leaves) from Gujarat. The other important buyer countries are Malaysia, Germany, Russia and Poland in their order. The unit value was the highest in case of United Kingdom (Rs. 52.64/kg) and was the lowest in case of China (Rs. 13.63/kg).

In ajowan seed export, Saudi Arabia has imported the highest share of 82.62 per cent of total quantity of ajowan seed exported from Gujarat, followed by United States (10.79%), United Kingdom (3.79%), Kenya (0.82%) and Yeman (0.45%). The unit value was the highest in case of Uganda and Botswana (Rs. 118.89 /kg) whereas the lowest in case of Saudi Arabia (Rs. 48.04/kg).

Change in export pattern

The change in export pattern was measure by using rank correlation coefficient. The results revealed that there has been no consistency in the export pattern between the years for all the crops under study indicating high inter year variation in export of isabgol,senna and ajowan.

Markov chain analysis

It is clearly evident that major share of export of isabgol husk from Gujarat has retained by USA (74.32 %). The remaining 25.68 per cent will be diverted to other countries viz; Denmark (2.85%), Mexico (3.49 %) and other countries (19.34 %). At the same time USA gained major share of Australia (82.22 %), Germany (83.02 %), and 'others' (64.95 %). Thus, Gujarat could not retain its export share to Australia, Germany, Denmark, Mexico and others. Our entire share of isabgol husk market had directed to USA.

Gujarat senna (leaves) exported to China retained 100 per cent during the current period. In addition, China also gained 41.48 per cent share of other countries. Gujarat could not retain its previous export shares to Germany, Ukraine, Russia, and Thailand, but it could retain its previous export shares to USA up to 34.29 per cent.

Ajowan seeds exported to Saudi Arabia has retained to the tune of 96.45 per cent. Of the remaining 3.55 per cent had diverted to the UK. At the same time, Saudi Arabia gained 100 per cent share of USA and Kenya, 53.67 per cent share of Canada and 13.92 per cent share of Kenya.. Gujarat could not retain its previous export shares to USA, Keniya and Canada. Our entire share of USA and Kenian ajowan market was directed

to Saudi Arabia, while Canadian market was diverted to UAS, Saudi Arabia and other countries.

Export projection of major medicinal crops from Gujarat

The export of isabgol would relatively stable as compared to senna and ajowan. Also, it will be confined to a few countries only. Only USA and Spain; China and Germany; and Saudi Arabia and UK would be the major buyers of isabgol husk, senna (leaves) and ajowan seeds, respectively.

Export competitiveness

Out of 33 isabgol importing countries, four were found the most competitive, 28 countries were found moderately competitive and one was found non competitive.

Out of 41 senna (leaves) importing countries seven were found most profitable (NPC < 0.5), 27 were found moderately profitable (0.5 < NPC < 1) and seven were found non competitive (NPC > 1).

Export of ajowan was found to be the most profitable to Uganda and Bostwana with NPC as low as 0.334, followed by New Zealand (0.485), while rest of the countries were found to be moderately competitive.

The problems in production and marketing

Shortage of electricity was found the most acute problem faced by isabgol, ajowan and coleus growers, followed by high wage rate of labour. Majority of isabgol and ajowan growers felt the problem of lack of irrigation facilities, and senna and coleus cultivators faced the problem of high cost of seeds. Non-availability of good quality seeds was also a constraint expressed

by more than 50 per cent cultivators of isabgol, senna and ajowan.

Looking to the marketing constraints price fluctuations and high charges of transportation are major issues faced by nearly two-third of medicinal crops growers. Lack of trading facilities of senna crop through regulated markets was the major bottleneck felt by all the farmers. More than 75 per cent medicinal crops growers faced the problem of lack of storage facilities. Lack of price information and malpractices adopted by the traders were also the big hurdles in marketing of medicinal crops.

All the traders indicated that the high cost of transportation was a genuine problem. More than 83 per cent of traders were felt the lower rate of commission in trading. The problem of inadequate storage facilities were expressed by 77.78 per cent of isabgol, 66.67 per cent of senna, 44.44 per cent of coleus and 58.33 per cent of ajowan traders. About 70 per cent traders indicated the problem of less availability of standard quality commodity. More than 65 per cent traders complained about lack of credit facility.

All the exporters indicated that low international price, lack of quality packing materials, fluctuation in exchange rate, lack of suitable market survey and unorganized domestic market were the severe problems. More than 65 per cent exporters expressed the problems of sanitary and phyto-sanitary, lack of pricing information, non availability of standard containers, lack of storage facilities at terminal place were other important problems faced by the exporters.

On the whole, cultivation of selected medicinal crops was found remunerative to the growers. The highest net return was

realized from coleus. The production factors like human labour and working capital were underutilized in majority of the crops. Thus, there is need to diverting more funds towards these inputs. In all the crops, transportation and loading charges were the major cost components at producer's level, whereas transportation and market fee were the major marketing costs at traders level.

The decline in export was observed only in case of isabgol seed whereas the export prices have showed increasing trend in all the crops under study. In case of isabgol, senna and ajowan crops, inter- year fluctuation/change in direction of export was observed. USA and Spain, China and Germany and Saudi Arabia and UK would be the major buyers of isabgol husk, senna (leaves) and ajowan seeds, respectively, during the period 2008-2015. The export of medicinal crops from Gujarat was found quite competitive. The most export competitive countries were Japan, Indonesia, Taiwan and United Arab Amirat for isabgol husk; United Kingdom, France, Lebanon and Slovenia for senna (leaves), and Uganda, Botswana and New Zealand were for ajowan.

Price uncertainly, high charges of transportation and lack of storage facilities were the major issues of producers. High transportation cost, lower rate of commission and less availability of standard quality commodity were also the noteworthy constraints of the traders. Exporter's major problems were: low international price, lack of quality packing materials, fluctuation in exchange rate, lack of suitable market survey, etc.

Policy implications

Based on the findings of the study, the following policy implications are drawn:

(1) Extension efforts are needed to popularize the cultivation of highly remunerative medicinal crops like coleus, ajowan and isabgol.

(2) The problems of underutilization of fertilizers and capital in cultivation of medicinal crops can be minimised by increasing availability of credit and fertilizers.

(3) Marketing channel II for isabgol, coleus and ajowan needs to be popularized through effective marketing extension efforts.

(4) Though Gujarat is enjoying monopolistic position in export of isabgol, its export is declining. This needs critical analysis and policy support to sustain the isabgol export.

(5) Contract farming system should be popularized for regular supply of quality products and also for increasing the exports.

(6) Export incentives viz, subsidising transportation cost and DEPB scheme should be given to exporters of medicinal plant products.

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Appendix I Bulk line cost of isabgol crop of Gujarat state for the year 2006-07

Sr. No.	Cost Range Rs./q	No. of farm covered	Area covered (Hect).	Production covered (Qtls).	Percentage to total farms covered.	Percentage to total area covered.	Percentage to total production covered.	Cumulative percentage of		
								Farms Covered	Area Covered	Production Covered
1	Less than 1300	4	10.5221	129.50	8.00	14.76	20.04	8.00	14.76	20.04
2	1301-1600	8	14.0026	154.00	16.00	19.64	23.82	24.00	34.40	43.86
3	1601-1900	15	19.4256	182.70	30.00	27.24	28.27	54.00	61.64	72.13
4	1901-2200	6	8.5790	73.30	12.00	12.03	11.34	66.00	73.67	83.47
5	2201-2500	6	2.2664	14.20	4.00	3.18	2.20	70.00	76.85	85.67
6	2501-2800	3	2.9138	18.40	6.00	4.09	2.85	76.00	80.94	88.52
7	2801-3100	4	3.4804	21.25	8.00	8.88	3.20	84.00	85.82	91.80
8	3101-3400	4	5.3420	29.70	8.00	7.48	4.60	92.00	93.30	96.40
9	More than 3400	4	4.7755	23.30	8.00	6.70	3.60	**100.00**	**100.00**	**100.00**
	Total	**50**	**71.3074**	**646.35**	**100.00**	**100.00**	**100.00**			

Appendix II Bulk line cost of senna (leaves) crop of Gujarat state for the year 2006-07

Sr. No.	Cost Range Rs./q	No. of farm covered	Area covered (Hect).	Production covered (Qtls).	Percentage to total farms covered.	Percentage to total area covered.	Percentage to total production covered.	Cumulative percentage of		
								Farm Covered	Area Covered	Production Covered
1	< 600	5	36.8322	470.25	10.00	15.68	17.06	10.00	15.68	17.06
2	601-700	9	53.8251	682.00	18.00	22.91	24.73	28.00	38.59	41.79
3	701-800	22	90.4595	1033.25	44.00	38.50	37.47	72.00	77.00	79.26
4	801-900	12	50.1828	535.75	24.00	21.36	19.43	96.00	98.45	98.69
5	> 900	2	3.6423	36.00	4.00	1.55	1.31	**100.00**	**100.00**	**100.00**
	Total	**50**	**234.9419**	**2757.25**	**100.00**	**100.00**	**100.00**			

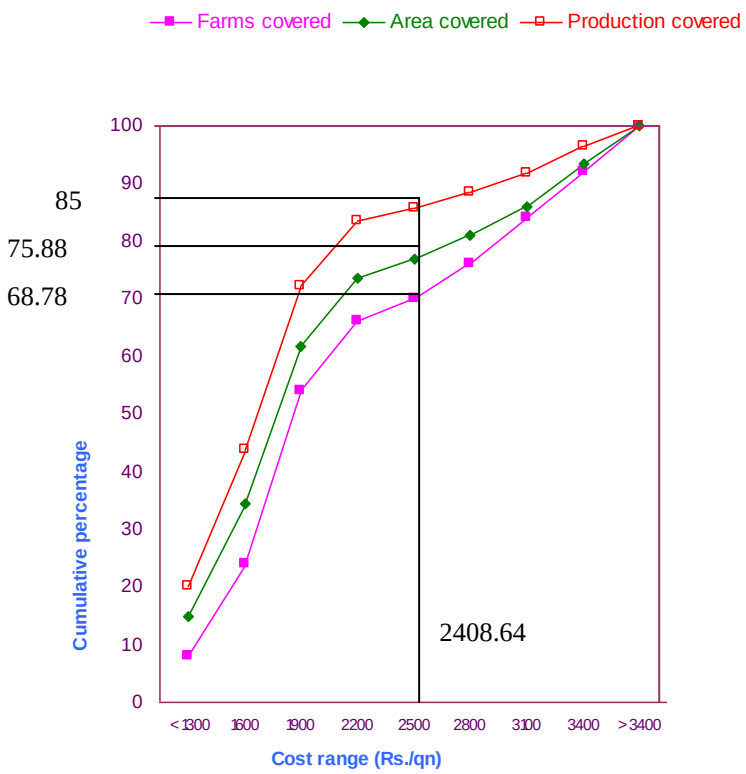

Fig. 1 Bulkline cost of Isabgol production (Sample farms)

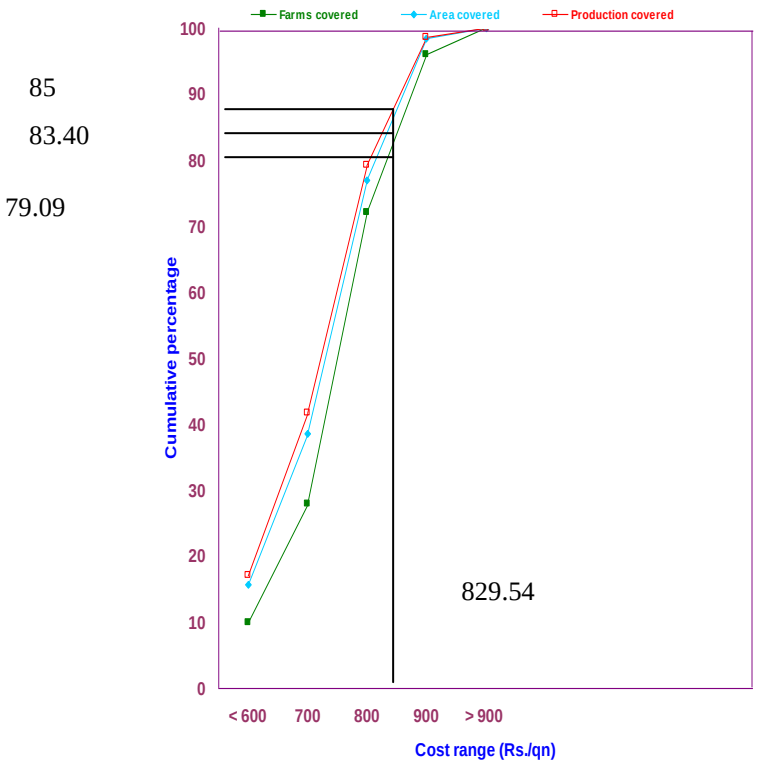

Fig. 2 Bulkline cost of Senna production (Sample farms)

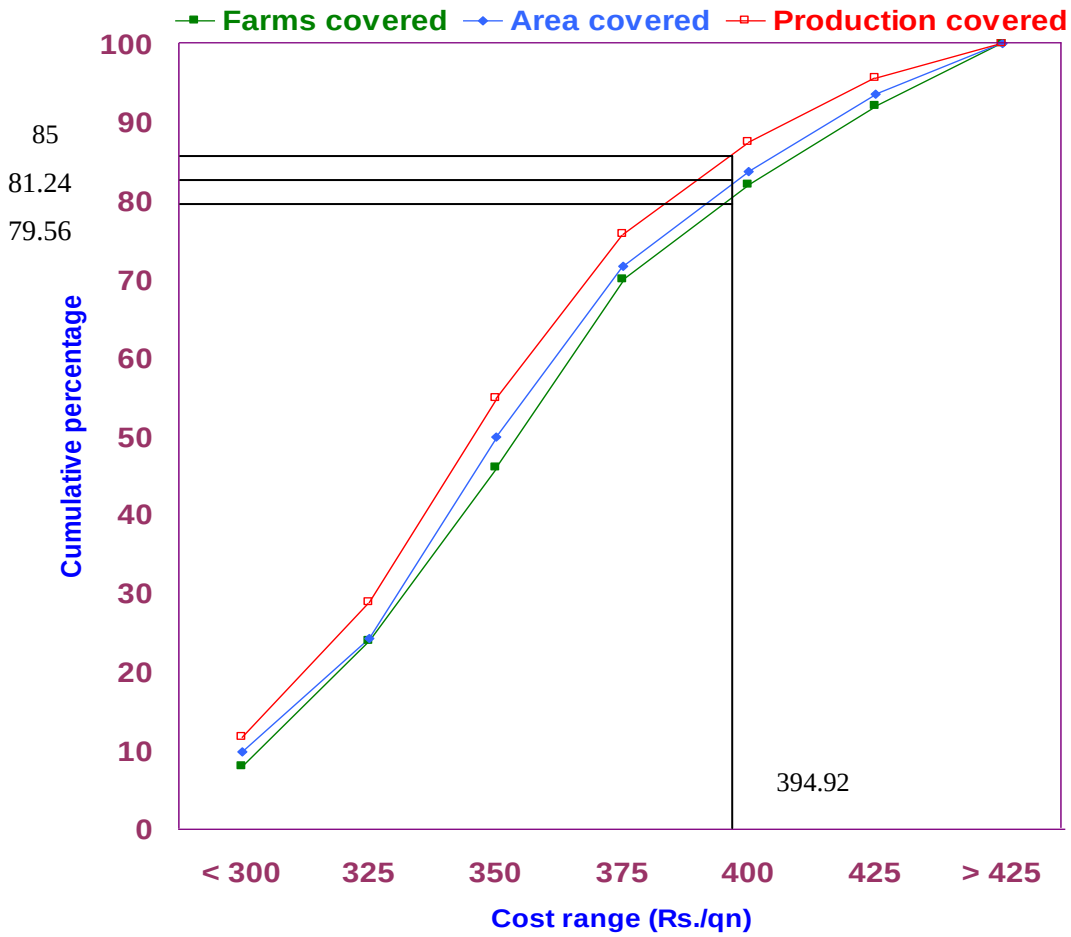

Fig. 3 Bulkline cost of Coleus production (Sample farms)

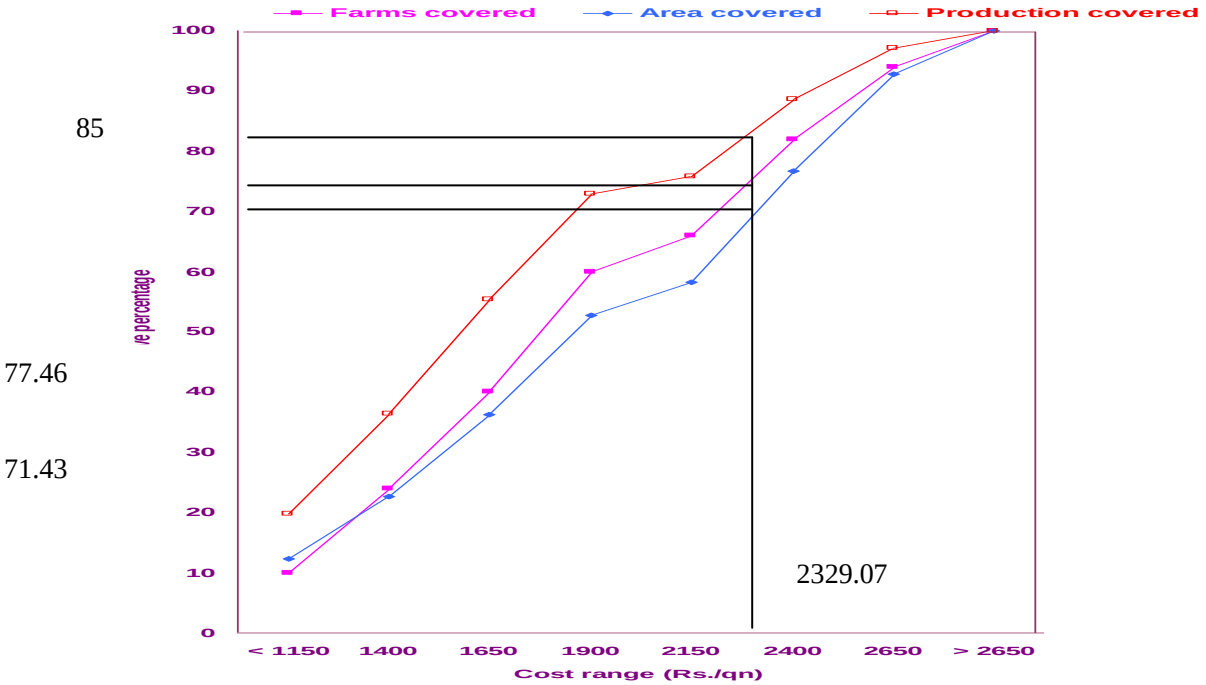

Fig. 4 Bulkline cost of Ajowan production (Sample farms)

Appendix IV Bulk line cost of coleus crop of Gujarat state for the year 2006-07

Sr. No.	Cost Range Rs./q	No. of farm covered	Area covered (Hect).	Production covered (Qtls).	Percentage to total farms covered.	Percentage to total area covered.	Percentage to total production covered.	Cumulative percentage of		
								Farm Covered	Area Covered	Production Covered
1	Less than 300	4	1.2547	164.50	8.00	9.90	11.72	8.00	9.90	11.72
2	301-325	8	1.8211	239.60	16.00	14.38	17.07	24.00	24.28	28.79
3	326-350	11	3.2378	365.00	22.00	25.56	26.01	46.00	49.84	54.80
4	351-375	12	2.7522	293.90	24.00	21.73	20.94	70.00	71.57	75.74
5	376-400	6	1.5378	163.00	12.00	12.14	11.62	82.00	83.71	87.36
6	401-425	5	1.2546	115.30	10.00	9.90	8.22	92.00	93.61	95.58
7	More than 425	4	0.8094	62.00	8.00	6.39	4.42	**100.00**	**100.00**	**100.00**
	Total	**50**	**12.6676**	**1403.30**	**100.00**	**100.00**	**100.00**			

Appendix V Bulk line cost of ajowan crop of Gujarat state for the year 2006-07

Sr. No.	Cost Range Rs./q	No. of farm covered	Area covered (Hect).	Production covered (Qtls).	Percentage to tota farms covered.	Percentage to tota farms covered.	Percentage to total farms covered.	Cumulative percentage of		
								Farm Covered	Area Covered	Production Covered
1	Less than 1150	5	11.8982	172.40	10.00	12.24	19.79	10.00	12.24	19.79
2	1151-1400	7	10.1175	144.20	14.00	10.40	16.56	24.00	22.64	36.35
3	1401-1650	8	13.2741	166.00	16.00	13.66	19.06	40.00	36.30	55.41
4	1651-1900	10	16.0240	152.60	20.00	16.49	17.52	60.00	52.79	72.93
5	1901-2150	3	5.2520	25.10	6.00	5.40	2.88	66.00	58.19	75.81
6	2151-2400	8	17.9688	111.80	16.00	18.49	12.83	82.00	76.68	88.64
7	2401-2650	6	15.7024	73.00	12.00	16.16	8.38	94.00	92.84	97.07
8	More than 2650	3	6.9608	26.00	6.00	7.16	2.98	**100.00**	**100.00**	**100.00**
	Total	**50**	**97.1978**	**871.10**	**100.00**	**100.00**	**100.00**			