University of Petroleum and Energy Studies

Summer Internship Project Report

On

"Feasibility Study of Horticulture in Pauri Garhwal district of Uttrakhand with IT Implementation"

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Submitted To

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Table of Contents

UNIVERSITY OF PETROLEUM & ENERGY STUDIES
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TO WHOM SO EVER MAY CONCERN

This is to certify that **Mr. Vivek Mamgain**, student of MBA (Information System Management) 2011-13 batch, has undertaken the live project titled "***Feasibility Study of Horticulture in Pauri Garwal district of Uttrakhand with IT Implementation***", for his summer internship and has successfully completed the project under my supervision & guidance. He has made his best effort in the project.

Further, I would like to declare that this project is an original work and has been prepared solely for academic purposes.

Date: 11/August/2012

Dr. Devendra Kumar Punia
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I would like to thank all my project members for all their valuable support which helped in the successful completion of this project.

Finally I would like to thank almighty for his blessings upon me.

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Medicinal And Aromatic Plants

1. INTRODUCTION

Uttrakhand is known as a rich biodiversity area due to it's varied topography and climate. Uttrakhand is located between 28o 43' – 31o 27' N latitudes and 77o 34' – 81o 02' E longitudes. Uttrakhand govt. has projected itself as a herbal state because of it's inherited rich biodiversity and authentic herbal traditions. Uttrakhand became the 27th state of the Republic of India on 9 November 2000.

The population of Uttrakhand primarily depends on agriculture for livelihood. About 70% of the population is engaged in agriculture works. Out of total reported area, only 14.02% area is under cultivation. More than 55.0% of the cultivated land in the State is rain fed with frequent moisture stressed to crops. The cropping intensity of the state is 160.6%. The landholdings are small and scattered. The average land holding is around 0.68 hectare (that too is divided into many patches) in the hills and 1.77 hectare in the plains.

The total of 7.66 lakh hectare cultivated area in the State, 4.21 lakh hectare area is rain fed.
There are 13 districts in Uttarakhand which are grouped into two divisions, Kumaon and Garhwal. Four more districts namely Didihat, Ranikhet, Kotdwar and Yamunotri were declared by the then CM of Uttarakhand, Ramesh Pokhriyal on 15 August 2011. However, these districts have not been created yet.

The Kumaon division includes the following districts.

- Almora
- Bageshwar
- Champawat
- Nainital
- Pithoragarh
- Udham Singh Nagar

The Garhwal division includes the following districts.

- Dehradun
- Haridwar
- Tehri Garhwal
- Uttarkashi
- Chamoli
- Pauri Garhwal (commonly known as Garhwal)
- Rudraprayag

Districts of Uttarakhand

Uttarakhand State was carved out of the state of Uttar Pradesh on November 9, 2000. It is divided into two broad regions--Garhwal and Kumaon. The state is comprised of 13 districts, namely, Chamoli, Pauri, Tehri, Uttarkashi, Dehradun, Haridwar and Rudraprayag in the Garhwal region and Nainital, Almora, Pithoragarh, Udham Singh Nagar, Champawat and Bageshwar in the Kumaon region. Of these 13 districts, four districts (Nainital, Haridwar, Dehradun and Udham Singh Nagar) have large areas in the plains, whereas the other nine districts comprise the hill region of the state. The state is further split into sub-divisions and development blocks. The formation of the new state had to fulfill the high expectations of the local people related to development and better living standards. However, within Uttarakhand there is a geographical inequality between the hills and the plains that divides the state critically. Districts in the plains are far ahead on various development indicators. In 2006-07 the state GDP grew by 10.15 per cent, the manufacturing sector grew by 17 per cent and the share of the primary sector has shrinked by 2.7 per cent. Industries have created about 2.8 lakh jobs but these are in the plains, and most of the growth due to industrialization has been restricted to the plains. The hill region districts are less developed in terms of infrastructure, i.e., electricity, roads and irrigation. The inter-district inequality in infrastructure leads to increasing disparity in terms of income and livelihood between the hills and the plains. Low levels of income not only result in low levels of consumption and material deprivation, but also constrain human potential by restricting access to education and health facilities, thereby creating a vicious cycle of poverty. More than three-fourths of Uttarakhand's total population depends on agriculture for their livelihood and the economy is predominantly dependent on mountain agriculture. However, the land holdings are small and fragmented, and irrigation facilities limited. Soil and water conservation is another issue for inclusive development. For physical, geographical and environmental reasons, the scope for agricultural policies based on modern input-intensive agriculture is severely constrained in the hill regions. As a result, the majority of the rural population in the hills either survives on subsistence agriculture or migrates to other parts of the country for employment.

The state faces the challenge of promoting livelihoods to retain people through local employment and income generation and to enhance their quality of life.

At the same time, the hill districts of Uttarakhand have tremendous potential. The vast natural resources add to the state's attractiveness as an investment destination, especially for tourism and agriculture- and forest-based industries. Uttarakhand is the first state in the country to have created a Tourism Development Board by legislation. Also, it is the first one to be called an organic state.

1.1 Economic Profile of Uttarakhand

The state of Uttarakhand encompasses a geographical area of 53,483 sq. km which accounts for only 1.63 per cent of India's area. The state contains about 4.53 per cent of India's forest area and about 3.1 per cent of India's agricultural area (Table 1). 43.6 per cent of the agricultural area is under irrigation as against the national average of 40.3 per cent and average rainfall is also above the national average. The ratio of irrigated area in the hills and plains is 10.2: 88.8 in Uttarakhand.the region hold good profile and promises for developing herbal pharmaceutical industry owing to the abundant medicinal plants.

1.2 Geographic conditions of Uttarakhand

Uttarakhand lies on the southern slope of the Himalaya range, and the climate and vegetation vary greatly with elevation, from glaciers at the highest elevations to subtropical forests at the lower elevations. The highest elevations are covered by ice and bare rock. Below them, between 3,000 and 5,000 meters (9,800 and 16,000 ft) are mountain grasslands and shrub lands: the western Himalayan alpine shrub and meadows. Temperate coniferous forests, the western Himalayan subalpine conifer forests, grow just below the tree line. At 3,000 to 2,600 meters (9,800 to 8,500 ft) elevation they transit to the temperate western Himalayan broadleaf forests, which lie in a belt from 2,600 to 1,500 meters (8,500 to 4,900 ft) elevation. Below 1,500 meters (4,900 ft) elevation lie the Himalayan subtropical pine forests. The Upper Gangetic Plains moist deciduous forests and the drier Terai-Duar savanna and grasslands cover the lowlands along the Uttar Pradesh border. This belt is locally known as Bhabhar. These lowland forests have mostly been cleared for agriculture, but a few pockets remain.

1.3 Demographics

According to 2011 India census, Uttarakhand had a population of 10,116,752. The native people of Uttarakhand are generally called either Kumaoni or Garhwali depending on their place of origin in either the Garhwal or Kumaon region.

Kumaoni and Garhwali dialects of Central Pahari are spoken in Kumaon and Garhwal region respectively. Jaunsari and Bhotiya dialects are also spoken by tribal communities in the west and north respectively. The urban population however converses mostly in Hindi. Sanskrit has also official status in the state.

Hindus form the majority of the population at 85.0%, Muslims form 9.2%, Sikhs 2.5% and Christians, Buddhists, Jains and others about 0.5%. It has male-female ratio of .963 and has a literacy rate of 79.63%. The largest cities in the state include Dehradun (530,263), Haridwar (220,767), Roorkee (158,896), Haldwani (145,278) and Rudrapur (88,720). The state government recognizes 15,620 villages and 81 cities and urban areas.

1.4 Variety of medicinal and aromatic plants (MAP's)

There are 701 total Medicinal and aromatic plants in Uttarakhand which consists of 498 genera and 149 families.
Uttarakhand constituents are 138 trees, 135 shrubs, 421 herbs and 07 ferns

1.5 Pauri Garhwal

Pauri Garhwal is blessed with splendid view of snow-bound peaks of Himalayas, scenic valleys & surroundings, meandering rivers, dense forests and hospitable people with a rich culture. Diverse in topography, the district of Pauri Garhwal varies from the foothills of the 'Bhabar' areas of Kotdwara to the soul-lifting meadows of Dhudatoli, sprawling at an altitude of 3,000 meters. The majestic Himalaya and its mountain range can be seen from anywhere in the district, which remains snow-bound during the winter months. Filled with places of tourist interest, most locations in Pauri Garhwal offer a breathtaking view of the snow laden Himalayan splendor.

1.5.1 Pauri Garhwal climate

The district enjoys pleasant weather in summers and cold weather during winters. In rainy season it is very cool with full of greeneries. However, Kotdwar and the adjoining areas of Bhabar

experience quite hot weather during summers with the temperature reaching to a maximum of about 40 degree Celsius.

District Pauri Garhwal which is surrounded by the districts of Chamoli, Nanital, Bijnor, Haridwar, Dehradun, Rudraprayag and Tehri Garhwal, offers a panoramic view of the great Himalayas form its towns and villages.

Pauri Garhwal, a district of Uttarakhand state encompasses an area of 5230 sq. km and situated between 29° 45' to 30°15' Latitude and 78° 24' to 79° 23' E Longitude. This district is ringed by the districts of Chamoli, Rudraprayag & Tehri Garhwal in North, Bijnor & Udhamsingh Nagar in South, Almora & Nainital in East, Dehradun & Haridwar in West. The District is administratively divided into nine tehsils, viz., Pauri, Lansdown, Kotdwar, Thalisain, Dhumakot, Srinagar, Satpuli, and Yamkeshwar and fifteen developmental blocks, viz., Kot, Kaljikhal, Pauri, Pabo, Thalisain, Bironkhal, Dwarikhal, Dugadda , Jaihrikhal, Ekeshwer, Rikhnikhal, Yamkeswar, Nainidanda, Pokhra & Khirsu.

1.5.2Social economy

1.5.2.1 Demography

The total population of the district is 6,97,078 with male population of 3,31,061 and female population of 3,66,017. There is an increase of 3.87% in population in comparison of 1991 census. The population was 5,75,208 in 1981 and 6,71,541 in 1991. The district is not densely populated. The population density per sq. km., which was 126 in 1991, now increases to 133 in 2001. The majority of the population lives in villages as indicated by the rural population of 6,07,203. Due to the migration problem of males for employment, the sex ratio in the district is 1106 females per 1000 males. The total population of Scheduled Castes and Scheduled Tribes is 1,08,247, which is 15.52% of total population.

1.5.2.2Agro –Economy

Agriculture is not a profitable means of employment in this hilly district due to its uneven geographical conditions, small terraced fields and non-availability of proper irrigation facilities. The Nayyar (the main river system of the district) catchments are richly endowed with various natural resources viz. Soil, Water, Minerals, Rocks, Forests and a Scenic Landscape. It is still economically under developed. The present form and level of agro economy of the area is considerably poor.

1.5.2.3Land Use Pattern

As per the statistics available for year 1999-2000 for land use pattern of the district, only 10.74% of the total area is under cultivation and its only 9.49 percent area falls under irrigation. It reveals that dry farming prevails in the region.

Item	Data (In hectare)
Total area	752364
Forest	443977
Non agricultural	35584
Barren uncultivated	46127
With permanent pasture	18692
Misc. Tree crops	18182
Fallow land	44998
Net sown	80817
Sown more than once	44490
Gross cropped	125307
Net irrigated area	14837
Gross irrigated area	7667

1.5.3Agriculture Production

In the district, the agricultural land is in the form of narrow terraces and scattered holdings except in the case of river valleys and in most cases uneconomical for cultivation. The cultivated land is a mostly non-irrigated, terraced field with undulating slopes, with extreme climatic variations and abrupt changes in altitudes. Due to these variations the cropping pattern changes with the altitude and the climatic conditions. Wheat and Barley are the main 'Rabi' crops while Rice, Kodo, Sanva are main 'Kharif' crops of the district. Urad, Arhar are the main pulses grown in the district while Mustard and Soybean dominate in oil seeds.

1.5.4 Crop Production

Crop name	Production (in metric tons.)	Yield (in quintal per hectare)
Rice	23143	10.91
Wheat	42751	11.70
Mandua	38013	14.03
Sanwa	22546	12.19
Jau	7690	11.92
Potato	10389	225.36

1.5.5Horticulture

The agricultural land of the district is much suitable for fruit and vegetable production in comparison of agricultural production. Vegetables can be produced around the year in the district due to climatic differences of hilly and valley area viz. 'peas', 'cauliflower' etc. is produced in valleys during winter while in hilly areas during summer.

There are orchards situated in Bironkhal block at Seli, Jogimani, Bawunas, Uphraikhal, Meldhar, Bedikhal, Jamria and Kola growing Apple, Peach, Walnut, Plum, Pear, Orange and Lemon respectively. Jahrikhal block also grows a number of fruits units' orchard, situated at Kandu with an area of 4 Hectares growing Apple, Pear, Khubani and Pear. Banduna with an area of 2 Hectares grows mainly Apple. Jahrikhal with an area of 4 Hectares grows Apple, Lemon, Dhurs with an area of 2 Hectares grows Lemon. Silwar with an area of one Hectare grow Mango, Leechi and Lemon and lastly Raitpur with an area of 2 Hectares grows Mango, Leechi and Walnut. Apart from this few less important orchards have also been set up at Rikhnikhal, Pokhra & Thalisain block.

2.Research Objective

- To verify feasibility of herbs cultivation in specific region.
- To develop bankable model for high quality commercial cultivation of herbs.
- Enhancing livelihood opportunities
- Value addition and marketing support.

3. Executive summary

3.1Geography

Pauri Garhwal is bounded by the districts of Chamoli, Rudraprayag and Tehri Garhwal in the north side, Almora and Nainital in the east side, Udham Singh Nagar in the south side and Dehradun and Haridwar in the west side. Geographical area of this district is 5,440 sq km.

Pauri has a wealth of medicinal herbs. There are various medicinal weeds growing on roadsides, forests and crop fields. These weeds are generally familiar to the inhabitants of the place. These weeds are rich source of medicines and drugs. The local people can make an extra income by selling these medicinal weeds.
Firstly, we will be focusing on Thalisian block.

3.2 Material and methods

The collection of various weeds was made from different crop fields of Pauri and the herbarium was prepared for identification of weeds. The identified weeds were further studied for their medicinal value, local people and vaidyas were also interviewed to know the medicinal importance of these weeds. Studies regarding medicinal importance of plants from other parts of Garhwal Himalaya have been conducted by several workers.

3.3 List of Medicinal Weeds.

S.N	Botanical name	Local name	Family	Uses
1.	*Artemisia Capillaris*	Jhirum	Asteraceae	Decoction of leaves taken as a bitter tonic for worms

				and colic.
2.	*Asparagus racemosus*	Satawari	Liliaceae	The sweet and bitter herb is particularly balancing to pitt dosha. Useful for hyperactivity, stomach ulcers, dysentery, and bronchial infection. Roots are good for eyes, muscles reproductive organs, increases milk secretion and help to regain vigour and vitality. Root decoction with jaggery used asarborifacient.
3.	*Berginiaciliata*	Pasanbhed	Saxifragaceae	The rhizomatous part used as tonic and febrifuge, used in digestive and cutaneousdisorders, dry leaves adulterated with tea. An important drug is obtained from rhizome for dissolving kidney and bladder stone.
4.	*Bluplerumhamiltoni*	Jangli jeera	Apiaceae	Roots used in stomach and liver disorders

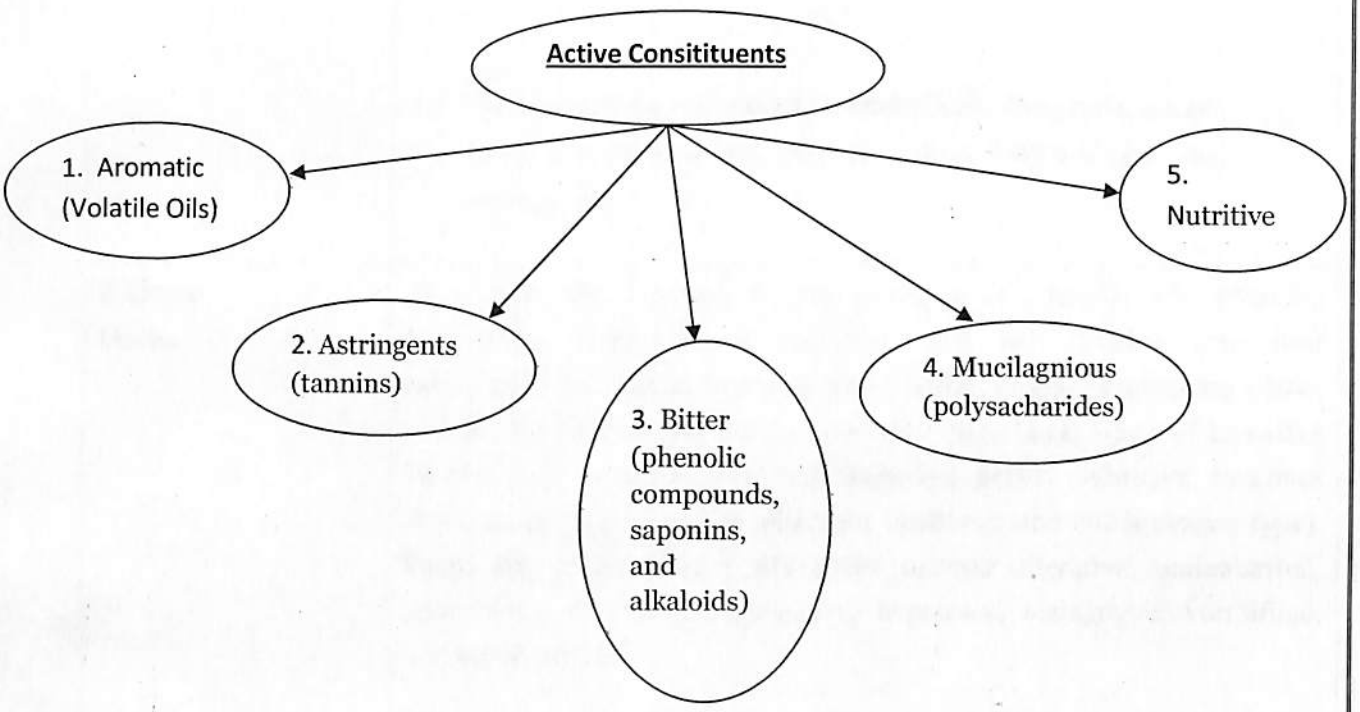
5.	*Cardamineimpatiens*	--	Brassicaceae	Juice of plant given in fever
6.	*Centellaasiatica*	Brahmi	Apiaceae	It is alterative, tonic diuretic and blood purifier. It is remedy for skin diseases, chronic nervous disorders and rheumatism. The powder of leaves mixed with milk and given in mental weakness and to improve memory
7.	*Commelinabengalensi*	Kanjula	Commelinaceae	Plant juice is given in dysentery and paste applied on body swelling and ache.
8.	*Cynodondactylon*	Doob	Poaceae	Root taken in fever and in internal injury. Decoction of root taken as diuretic, in hysteria, epilepsy and secondary syphilis
9.	*Geraniumnepalense*	Syuli	Geraniaceae	The plant infusion is used in fever and renal disorders. The root paste is applied externally on itching and eczema.

10.	*Innulacupsidata*	Jhuri	Asteraceae	Root decoction given in dyspepsia and colic, root also used in local beverages.
11.	*Nepetaciliaris*	Nueet	Lamiaceae	Decoction of leaves and seeds taken in fever, Leaves also yield essential oil.
12.	*Rubiamanjith*	Manjeeth	Rubiaceae	Root medicinal as tonic and astringent, stem used as an antidote to snakebite, flowers extract in bacillary dysentery.
13.	*Rumexhastatus*	Almoru	Polygonaceae	The leaf extract of plant are applied on wounds and cuts to check bleeding. Plant is also believed to relieve from suffering of nettle sting.
14.	*Thalictrumfoliosum*	Mamiri	Berberidaceae	Roots used in ophthalmic and also in colic and fever. The rhizome used as an antiperiodic, and purgative .Paste of plant locally used in skin diseases.

15.	*Taraxacumofficinale*	Kanfulia	Asteraceae	The root extract is used in treatment of migraines, hepatitis and headache.
16.	*Trifoliumprantense*	Mithla	Fabaceae	The dried pods are used in cough and bronchitis root paste applied externally onvenereal diseases.
17.	*Utrica diocia*	Kandali	Utricaceae	The seed oil of plant is believed to be medicinal in sciatica; rheumatism and several skin ailments .Hair wash from leaf extract believed to avoid baldness. Its leaves extract is given to cure anemia.
18.	*Violacanescens*	Banfsa	Violaceae	The decoction of plant is useful in malarial fever, bronchitis and asthma. Root used as emetic, flower demulcent Leaf juice applied on wounds and cuts

4. Literature review

Based on Active Constituents the herbs are divided in five types:-



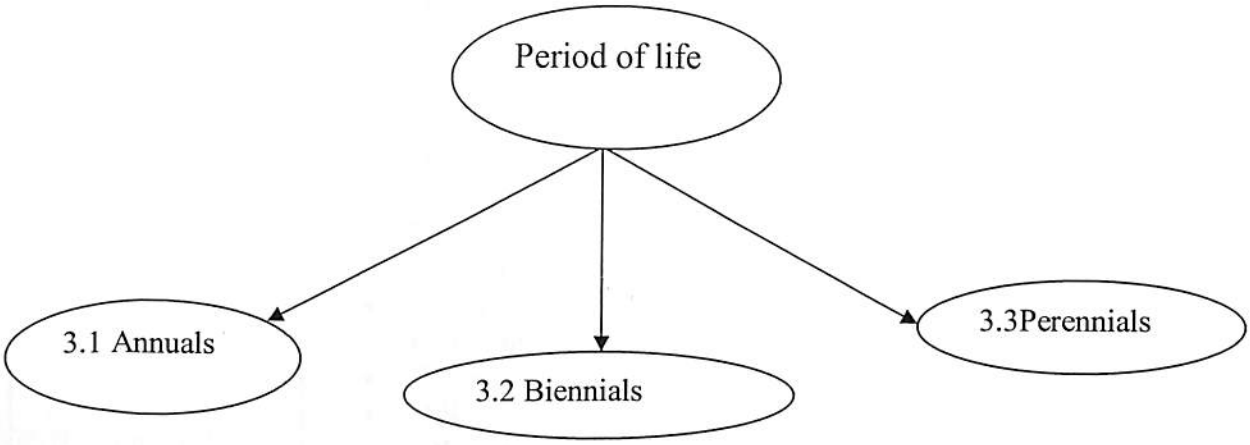
The different types of herbs in each categories and there uses are :

1.Aromatic	They are mainly to volatile oils and used in therapeutically and perfumes. They are of two types-stimulants and nervines. Stimulants help in increasing the energy of body and activites of the organs. Nervines are used to heal and soothe the nervous system, and

	often affect the respiratory, digestive, and circulatory systems as well. 1.1 1.1Stimulant Herbs:- Damiana, fennel, garlic, ginger, peppermint, sage, thyme, catnip, feverfew, lemon grass, penny royal, and damiana. 1.2 Nervines herbs :- chamomile, crampbark, dong quai, ginger, hops, lobelie, scullcap, valerian, catnip, lady's slipper, and sarsaparilla
2.Bitter Herbs	They have the property to the presence of phenols and phenolic glycosides, alkaloids, or saponins, and are divided into four subcategories: laxative herbs, diuretic herbs, saponin-containing herbs, and aloaloid-containing herbs. There are three basic types of **Laxative Herbs**: bulk laxatives (see mucilaginous herbs), lubricant laxatives (such as mineral oil), and stimulant laxatives (the antraquinone type). Properties of Laxative Bitter herbs include alterative, anticatarrhal, antipyretic, cholagogue, purgative, hepatonic, sialagogue, vermifuge, and blood purifier. Examples of Laxative herbs include aloe, cascara, licorice, pumpkin, senna, yellow dock, yucca, barberry, gentian, safflowers, and golden seal. four subcategories: laxative herbs, diuretic herbs, saponin-containing herbs, and aloaloid-containing herbs:- *2.1 Laxative Bitter herbs* include alterative, anticatarrhal, antipyretic, cholagogue, purgative, hepatonic, sialagogue, vermifuge, and blood purifier. For e.g. aloe, cascara. 2.2 *Diuretic Herbs* induce loss of fluid from the body through the urinary system. The fluids released help cleanse the vascular system, kidneys, and liver. They are alterative, antibiotic, anticatarrhal, antipyretic, antiseptic, lithotriptic, and blood purifier in nature. For e.g.

	asparagus, blessed thistle. 2.3 *Saponin-containing Herbs* are known for their ability to produce frothing or foaming in solution with water. Their most important property is to enhance the body's ability to absorb other active compounds.
3. Astrinigents	They owe the properties mainly to their tannins, which have the ability to precipitate proteins, and which tightens, contracts, or tones living tissue, and helps to halt discharges. Properties of Astringent herbs include analgesic, antiseptic, antiabortive, astringent, emmenaggogue, homostatic, and styptic. Examples of Astrinigents include bayberry, comfrey, eyebright, golden seal, pau d'arco, peppermint, red raspberry, slippery elm, white oak.
4. Mucilaginous Herbs	They eliminate the toxins from the intestinal system, help in regulating it and reduce the bowel transit time. They are antibiotic, antacid, demulcent, emollient, culnerary, and detoxifier in nature. For e.g. althea, aloe, burdock, comfrey, dandelion, echinacea.
5. Nutritive Herbs	Herbs derive both their name and their classification from the nutritive value they provide to the diet. They are true foods and provide some medicinal effects as fiber, mucilage, and diuretic action. But most importantly they provide the nutrition of protein, carbohydrates, and fats, plus the vitamins and minerals that are necessary for adequate nutrition. For e.g. rosehips, acerola, apple

2. Based on Period of life herbs can be of three types:-



Their uses, properties and types can be :

3.1.Annuals	Starting from the seed the life cycle of annuals herbs are one year. They bloom one season and then die. Annual herbs include 15 types- • Anise • Basil • Borage • Calendula (Pot Marigold) • Chamomile • Chervil • Cilantro/Coriander • Dill Bouquet • Dill Dukat • Fennel, smoky • Marjoram • Parsley • Shiso • Saffron • Summer Savory
3.2Perennial herbs	These kinds of herbs grow more than one season and they include sweet marjoram, parsley, mint, sage, thyme and chives. Except parsley most of them can be started from young plants. They include

	• Alfalfa • Allspice • Aloe Vera • Angelica • Agrimony • Asafoetida • Avens • Bee Balm • Bay leaves • Catnip • Chamomile • Common Thyme • Dill • Echinacea • Fennel • Lavender • Lemon Balm • Mint: Spearmint/peppermint / applemint/ orangemint • Marjoram sweet • Mitsuba • Oregano • Rosemary • Stevia • Salad Burnet • Sage • Tarragon • Thyme • Watercress • Yarrow
3.3 Biennial herbs	They are the herbs plants which live for two season and bloom in second season. They include 6 types • Caraway seeds • Prime rose • Bai Zhi • Mullein • Teasel • Viper's Bugloss

5. Medicinal and Aromatic plants (MAPs)

Uttarakhand is known for its rich biodiversity owing to its varied topography and climate. The wealth of MAPs in the state has been widely recognized. However the value attributed to many of these species has lent them susceptible to unsustainable levels of commercial exploitation. To conserve rapidly depleting stocks of rare and threatened MAPs species in nature is a challenge facing the state.

The state government has attempted to address the issue by following a two-pronged strategy. Firstly, promote cultivation of MAPs in the state by taking necessary steps to facilitate farmers. Secondly, bring about a scientific balance between conservation and harvest in the wild.

The State Government has now created two separate institutions under the Department of Horticulture to promote the cultivation of herbs. The Herbal Research Development Institute at Gopeshwar in Chamoli district has been established to oversee the push needed to expand the cultivation of medicinal plants. The institute has so far been placing an emphasis on pre harvest procedures. The main thrust has been on arranging for seedlings and improving cultivation awareness amongst marginal farmers.

5.1 Herbal Research and Development Institute

The Herbal Research and Development Institute (HRDI), a nodal agency of Uttarakhand Medicinal Plant Board, has been established at Gopeshwar in 1989 for conservation, development and sustainable utilization of the valuable Medicinal and Aromatic Plant resources of Uttarakhand. It is an autonomous institute of the Uttarakhand Government registered under the Registration of Societies Act, 1860.

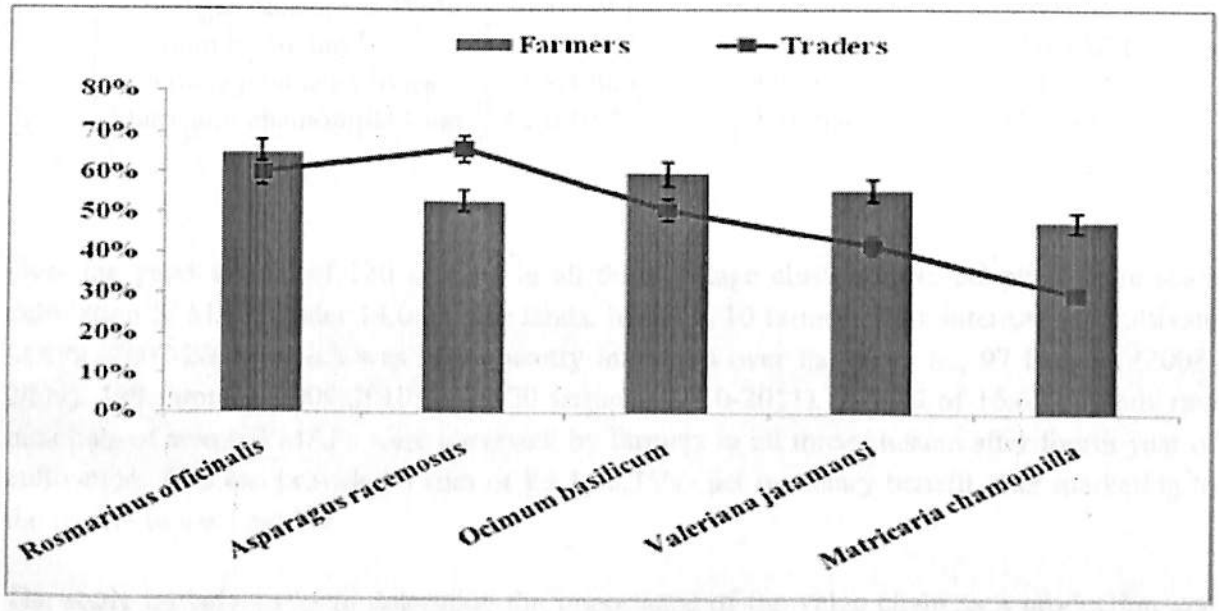
The main objective of HRDI is to co-ordinate medicinal and aromatic plants activities carried out by various Govt. agencies, farmers, research institutes, NGOs, etc. The main field activities of the institute cover the following areas:-

- Cultivation of valuable Medicinal and Aromatic Plants of Uttarakhand, primarily to improve livelihood opportunities.
- Survey, inventorisation and conservation of biodiversity of medicinal and aromatic plants.
- Research on agro-technique, bio-diversity, biotechnology and genetic improvement of Medicinal and Medicinal Plants.
- Development of cultivation techniques for Medicinal and Aromatic Plants and transfer of technology to the farmers and growers.
- Revitalization of traditional knowledge and the ancients' Indian medicine system, Ayurveda.

- Quality control assessment and research on active ingredients and substances of medicinal and aromatic plants.
- Human resource development, extension and dissemination of information relating to medicinal and aromatic plants.
- Co-ordination of activities of institutions/ departments engaged in development of medicinal and aromatic plants in Uttarakhand.

Currently 120 farmers are registered with HRDI.

5.2 Perception of local farmers and traders towards the selection of MAPs species for cultivation



Adoption of five high prioritized medicinal and aromatic for large scale cultivation

S.No.	Name of species	Local name	Use part(dry)	Harvesting period	Production Kg/Nali
1.	Rosmarinus officinalis Linn	Rosemary	Leaves	Oct-Feb	25±2.7
2.	Asparagus racemosus Willd	Satawar	Roots	Oct-Dec	10±1.8
3.	Ocimum basilicum L	Bantulsi	Leaves	Sep-Oct	18±2.3
4.	Valeriana jatamansi Jones	Tagar	Roots	Nov-Dec	15±2.1
5.	Matricarai chamomilla Linn	Chamomile	Flowers	May-June	7±1.1

Note- 1 Hectare= 50 Nali

5.3 Cost- benefit analysis and monetary benefit to local farmers through selected MAPs cultivation/Nali

S.No.	Name of species	Income(Rs)	Agricultural cost(Rs)	Net profit(Rs)/year
1.	Rosmarinus officinalis Linn	3375±62.4	1700±32.7	16750±28.3
2.	Asparagus racemosus Willd	2000±39.1	800±26.5	1200±22.2
3.	Ocimum basilicum L	2970±53.2	1000±29.4	1970±32.1
4.	Valeriana jatamansi Jones	1200±30.6	300±9.1	900±23.5
5.	Matricarai chamomilla Linn	420±10.7	200±6.4	220±4.1

Over the years a total of 120 farmers in all three village clusters were adopting large scale cultivation of MAPs under 14.0 hectare lands. Initially, 10 farmers were interested to cultivate MAPs (2007-2008) which was subsequently improved over the years ie., 97 farmers (2008-2009), 109 farmers (2009-2010) and 120 farmers (2010-2011). A total of 16.65 quintals raw materials of selected MAPs were harvested by farmers in all three clusters after fourth year of cultivation. This has provided a sum of Rs 1,55,750/- net monetary benefit after marketing to the traders in local market.

The study initially seeks to determine the importance of the value chain as a production and marketing approach, as well as its significance for improving the livelihoods of the primary producers. The integrated value chain were developed taking into account the experiences and expertise of different disciplines which might be able to provide the most effective way of understanding the issues and solving the problems related to cultivation and marketing(figure)

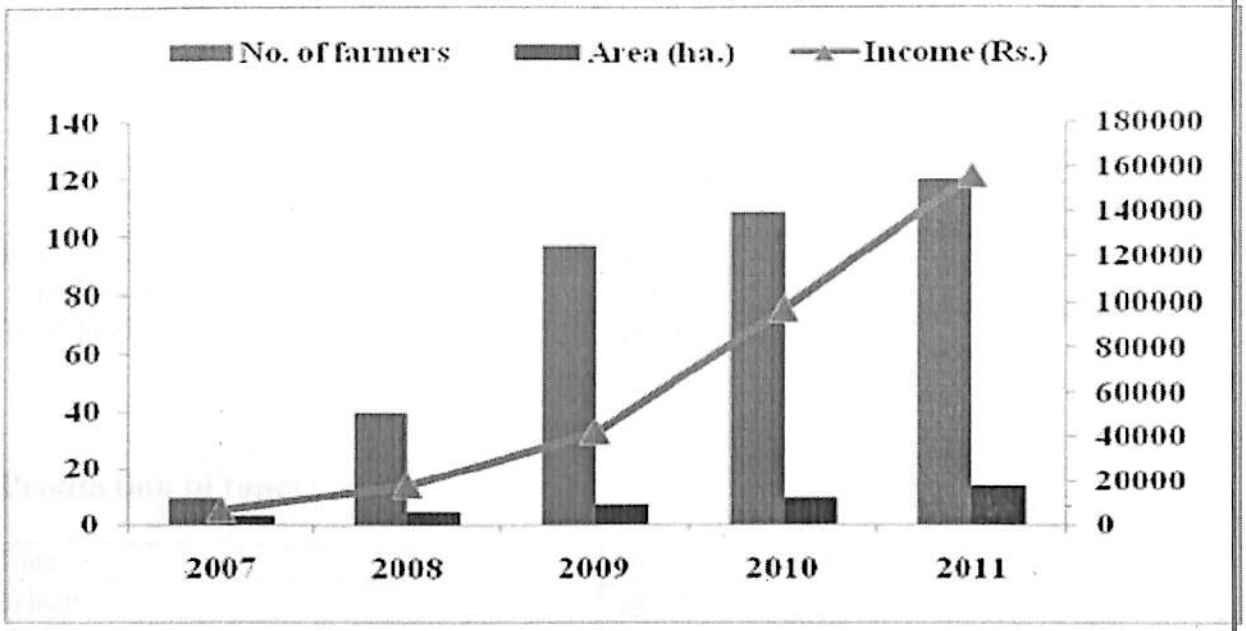


Figure: Increase the number of farmers and their income from MAPs cultivation in different clusters

As such, medicinal and aromatic plant cultivation has great potential for employment generation and enhancement of livelihood security in Uttarakhand Himalaya considering the favorable climatic and soil conditions. In this context, farmers need to be encouraged to grow species that have economic potential at one hand and ecological significance on the other so as economical as well as ecological sustainability could be maintained.

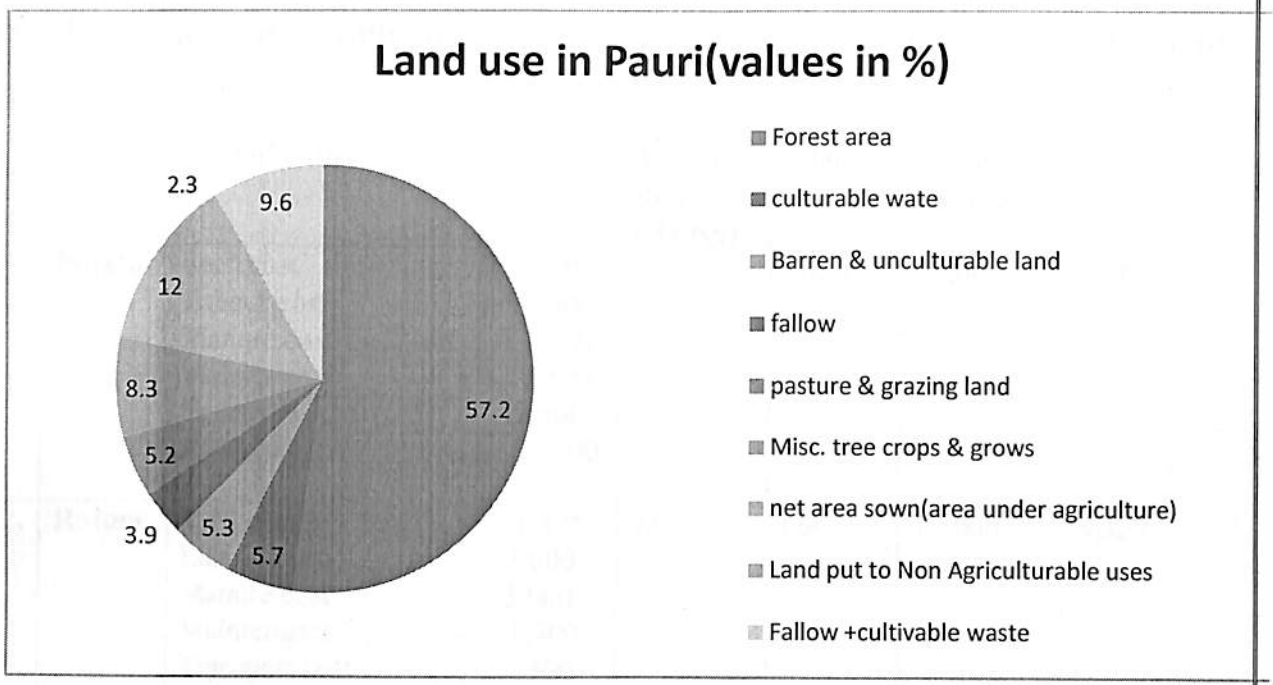
5.4 Area and production patterns of Pauri district of Uttarakhand

Crops	Pauri Garhwal
Area (in hectares)	
Rice	25455
Wheat	36641
Barley	6115
Bhatt	3
Gahat	3118
Maize	3162
Manduwa	27096
Sanwa	18503

Total cereal	52636
Rajma	384
Chana	82
Masoor	117
Urad	3160
Arhar	526
Peas	26
Total Pulses	5548
Total foodgrains	14205

Production in tones

Rice	29011
Wheat	34091
Barley	5557
Bhatt	2
Gahat	1939
Maize	4259
Manduwa	38013
Sanwa	22546
Total cereal	50661
Rajma	316
Chana	79
Masoor	80
Urad	1311
Arhar	393
Peas	36
Total Pulses	2939
Total foodgrains	153400



5.5 Comparative Study of medicinal plants and other crops

The medicinal plants are great source of income for rural people the collection and processing of MAPs contribute to at least 35mn workdays of employment annually. The combination of Guchhi and medicinal herb sales contributes an average income of over Rs 10,000 per family and which keep on increasing every year as per the growth and processing of MAPs. MAPs are essential as they meet the health need a and are used to treat variety of ailment. The Bhotia people of Himalayas use 150 MAPs of different variety in treating more than 105 combinations of diseases. The issues of medicinal plants involve tremendous contemporary relevance as it provide health security to millions of people and on the other hand it provide us with new and safe herbal drugs. The cultivation of medicinal plants has helped not only the farmers but also the contributed to conservation of bio-diversity by reducing pressure on wild resources. The growth and cultivation of MAP are more beneficial and more profitable than growing cash crops.

5.5.1 Comparative study of growing Kutki and traditional cash crops of farmers in Pauri

	Crop	Cost of cultivation(in Rs)		Market price (Rs/Kg)	Yield	Gross Income	Net profit
1.	**Potato**	Seed cost	1,800	5	90qts	45,000	12,600
		Labour cost	3,600				
		Manure cost	3,000				
		Maintenance	1,500				
		Transport cost	22,500				
		Total cost	32,400				
2.	**Rajma**	Seed cost	1,875	25	6qts	15,000	5,325
		Labour cost	3,000				
		Manure cost	3,000				
		Maintenance	1,500				
		Transport cost	300				
		Total cost	9,675				
3.	**Kutki**	Seed cost	2,591	250	4.42qts	110,500	88,284
		Field preparation cost	8,000				
		Manure cost	4,500				
		Maintenance	5,000				
		Harvesting/packing	1,000				
		Transport cost	1,125				
		Total cost	22,216				

6. Herbs which we will be cultivating in hilly areas

6.1KUTH (Cost of cultivation & Profitability)

a. Technical Parameters-

Soil - Sandy loam rich in organic matter.

Climate - Cool and humid temperate to alpine areas.

Attitude for cultivation - 2000-3500 m.

Propagation - through seeds and root cuttings.

Germination Period - 10 to 15 days.

Planting Material / Nali - 75 gm to seeds

Sowing season - April-May (in rows).

Vegetative Propagation - Offset / stolon cuttings are transplanted in nursery beds in April-May for rooting that become ready for planting in July. It is more successful method with higher yield.

Planting Season - July

Spacing - 60 cm x 60 cm

No. of plants / Nali - 550 plants.

Crop duration - 2 years 3 months after planting

Harvesting Time - October

Post Harvest Practices - Wash roots with running water, cut into small pieces, fumigate, dry in sunlight, grade & store in gunny bags.

Avg. Yield / Nali - 70 kg dry roots (127 gms / plant)

Market Rate - ` 50-70 / kg (dry roots).

According to HRDI -

Cultivation Cost - ` 500 / Nali

Gross return - ` 3500 / Nali

Net return - ` 3000 / Nali

Average Return - ` 1000 / Nali / year

Scale of Finance

(Amount in ₹)

S.N.	Items	1st year	2nd year	3rd year
A	Cost of cultivation			
a	Cost of planting material @ ₹ 1 / Plant (500 plants / nail)	500	nil	nil
b	Land Preparation, mulching, Fertilizer, & labour etc	₹ 2000 / nali	₹ 2000 / nali	-
c	Irrigation and weeding	Nil	Nil	Nil
d	Plant protection measures	Free Provided under MNREGA Scheme		
e	Agricultural Tools	₹ 300		
f	Harvesting expenses			2000
g	Cost of Cultivation			6800
B.	Income	Produce 70 Kg dry root / nali after 2 years 6 months		
i.	Sale of dried leaves @ ₹ 200 / per kg			
				14000
C	Profit (B-A)	₹ 14000 - ₹ 6800 = ₹ 7200		

Description:

It is found in Himachal Pradesh, Uttaranchal, Jammu & Kashmir, Sikkim and Arunachal Pradesh.

Active Compounds:

Curcumene

MedicinalProperties:

The roots are bitter, acrid, sweet, thermogenic, aromatic, deodorant, aphrodisiac, anodyne, carminative, digestive, stimulant, and tonic.

Uses:

This is very useful in chronic and foul ulcers, leprosy, leucoderma, pruritis, amenorrhoea etc.

6.2KUTKI (Cost of cultivation & Profitability)

a. Technical Parameters-

Soil - Sandy loam

Climate - Moist temperate to alpine areas, preferably with partial shade.

Attitude for cultivation - 200-3500 m.

Propagation - through seeds and offset / stolon cuttings.

Germination Period - 25 to 30 days.

Planting Material / Nali - 5 gm to seeds

Seed sowing season - March-April (in rows), preferably in Polyhouse.

Vegetative Propagation - Offset / stolon cuttings are transplanted in nursery beds in April- May or rooting that become ready for planting in July. It is more successful method with higher yield.

Planting Season - July-August (Plants raised from seed should be planted.

Spacing - 30 cm x 30 cm

No. of plants / Nali - 2200 plants.

Crop duration - 2 years 3 months after planting

Harvesting Time - October

Post Harvest Practices - Dry at Room temperature, remove dust particles and store in air tight containers or gunny bags

Avg. Yield / Nali - 22 kg dry stolon / roots (9 gms / plant)

Market Rate - Rs150-200 / kg (dry stolon / roots).

According to HRDI

Cultivation Cost - Rs 1000 / Nali

Gross return - Rs 3000 / Nali

Net return - Rs2000 / Nali

Average Return - Rs666 / Nali / year

Scale of Finance (Amount in ₹)

S.N.	Items	1st year	2nd year	3rd year
A	Cost of cultivation			
a	Cost of planting material @ ₹ 1 / Plant (2200 plants / nali)	₹ 2200	nil	nil
b	Land Preparation, mulching, Fertilizer, & labour etc	₹ 2000 / nali	₹ 2000 / nali	-
c	Irrigation and weeding	Nil	Nil	Nil
d	Plant protection measures	Free Provided under MNREGA Scheme		
e	Agricultural Tools	₹ 300		
f	Harvesting expenses			2000
g	Cost of Cultivation			8500
B.	Income	Produce 22 Kg leave / nali after 2years 6 months		
i.	Sale of dried leaves @ ₹ 800 / per kg			
				17600
C	Profit (B-A)	₹ 17600 - ₹ 8500 = ₹ 9100		

Uses:

Remedies For:

Small doses-bitter stomachic and laxative. Large doses-cathartic; anti-periodic, cholagogue.

Ayurvedic Applications: Epilepsy, paralysis, emmenagogue, emetic, abortifacient, skin diseases, improves eye sight, constipation due to small intestine secretion; with equal parts licorice, raisins, neem bark; for bilious fever; with aromatics for worms in children, fever, malaria.

Actions: anti-inflammatory, antidysbiosis, antasthmatic, laxative, immunoenhancer, antiarthritic, hepatoprotective, anti-allergic, immunostimulant (all aspects of immunity; T lymphocytes, B lymphocytes and phagocytes), bitter tonic, choleretic, antioxidant, cathartic; cholagogue, laxative, digestive, alterative, and Liver Protectant against chemical hepatotoxins, hepatic.

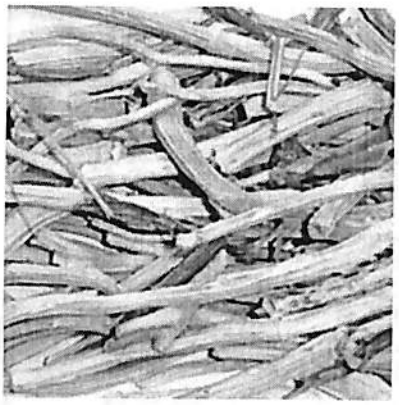
Traditional uses: asthma, candidiasis, constipation, arthritis, dysbiosis, eczema, liver diseases, viral liver disease especially Hepatitis B Virus (decreases bilirubin levels), toxic liver damage,

liver infections, increases protein synthesis in the liver (needed for repair of liver cells), acute and chronic infections, weakened immunity (enhances many aspects of immune system - T lymphocytes, B lymphocytes & phagocytes, auto-immune diseases, asthma, Vitiligo (reduces the number and size of unpigmented skin patches), fevers, jaundice; bronchitis; dyspepsia, anemia.

The roots and rhizomes (underground stems) of this flowering perennial are used medicinally. It is native to mountainous regions of India, Tibet, and Nepal.

Traditional Indian (Ayurvedic) healers have relied on this plant for centuries to treat lung and liver disorders including hepatitis and poor bile production, constipation, digestive upset, and snakebites, among other ailments.

6.3SATAWAR (Cost of cultivation & Profitability)



a. Technical Parameters -

Soil - Sandy loam with good drainage.

Climate - Humid and warm sub tropical areas.

Attitude for cultivation - 350-1500 m.

Propagation - By seeds and discs.

Germination Period - 20-25 days.

Planting Material / Nali - 150 gm seeds

Sowing season - June.

Planting Season - July

Spacing - 60 cm x 60 cm

No. of plants / Nali - 550 plants.

Crop duration - 18 months.

Harvesting Time - December-January.

Post Harvest Practices - Root peel should be removed by giving a sharp longitudinal cut, dried in sunlight and stored in gunny bags.

Avg. Yield / Nali - 75 kg dry roots (135 gm / plant)

Market Rate - Rs30-45 / kg (raw dry roots).

According to HRDI Cultivation

Cost - Rs800 / Nali

Gross return - Rs 2250 / Nali

Net return - Rs1450 / Nali

Average Return - Rs725 / Nali / year

Scale of Finance (Per acre) (Amount in Rs)

S.N.	Items	1st year	2nd year
A	Cost of cultivation		-
a	Cost of planting material (seeds) or	2500	-
	Plants / acre (12000 plants)		
b	FYM	2000	2000
c	Labour (including weeding & harvesting)	15000 (for 2 year)	
c	Irrigation	Nil	Nil
d	Plant protection measures	Free Provided under MNREGA Scheme	
e	Agricultural Tools	₹ 300	
g	Cost of Cultivation		19800 or say 20,000
B.	Income	(i) Produce 20 Kg seeds/ acre after 2 years (ii) 18 kg roots produce / acre	
i.	Sale of seeds @ ₹ 2000 / per kg seed (ii) Sale of roots @ ₹ 400 / kg processed roots	₹ 2000 x 20 kg seeds	40000
		₹ 400 x 18 kg roots	7200
C	Profit (B-A)	₹ 47200 - ₹ 20000 = ₹ 27200	

Profitability-

Net Profit - Profit - Interest @10% p.a. for 2 years (assumption) - Rs 27200 - Rs1700 = Rs 25500

In view of the above the production of Satawar is **profitable.**

Gestation Period - 18 months

Total Cultivation Cost - Rs 20000 / acre

Bank Loan - Rs17000 / acre

Repayment Period - In one installment after 2 years

Medicinal-Properties:

Asparagus is diuretic, laxative, blood purifier, anti- rheumatic, restorative, cleansing, acts on bowels, liver and kidneys, promotes fertility, reduces menstrual cramping, increases milk production, stimulates hormone production, antispasmodic, know to prevent anemia, and is used for aches, pain and swelling in joints

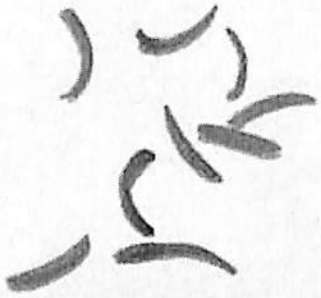
- Threaten abortion, Leucorrhoea, Seminal debility
- Efficient in treating dryness of the lungs and throat, consumptive diseases (lingering cough, dry cough), tuberculosis and blood- tinged sputum
- Counteracts thirst
- Enhances the rate of urine production
- Congestive heart failure, a disorder in which the heart loses its ability to pump blood efficiently, is relieved by the recommended intake of Asparagus

Advantages:

Useful in nervous disorders, dyspepsia, tumors, scalding of urine, throat infections, tuberculosis, cough bronchitis and general debility

- General debility, Agalactia, Headache, Hysteria, Reduces, blood pressure; Useful in acidity and ulcer patient, Extract of cladode is Anticancer
- Effective in treating kidney, and lower back pain
- Sedative for the nervous system, used internally for cystitis, pyelitis, kidney disease, rheumatism, cancer, neuritis, enlarged heart, and gout

6.4KALA JEERA (Cost of cultivation & Profitability)



a. Technical Parameters-

Soil - Sandy loam / loam

Climate - Dry and cold temperate and alpine areas.

Attitude for cultivation - 2000-3500 m.

Propagation - through seeds and multiplication of root stock.

Germination Period - 8 to 15 days.

Planting Material / Nali - 100 gm seeds

Sowing season - March-April (in rows).

Planting Season - July

Spacing - 30 cm x 30 cm

No. of plants / Nali - 2200 plants.

Crop duration - 10 years

Harvesting Time - August-September.

Post Harvest Practices - Cut aerial parts, Sun dry, thrash, separate seeds and protect from moisture to avoid fungal infection.

Avg. Yield / Nali - 220 kg / nali (100 gm kalajeera / plant)

Market Rate - Rs200-300 / kg (dry seeds).

According to HRDI Cultivation

Cost - Rs800 / Nali

Gross return - Rs 12500 / Nali in 10 years

Net return - Rs11700 / Nali in 10 years.

Average Return - Rs1170 / Nali / year

Scale of Finance (Amount in ₹)

S.N.	Items	1st year	2nd year	3rd year
A	Cost of cultivation			
a	Cost of planting material @ ₹ 1000 / Kg seeds (250 gm seeds / nail) or	₹ 25	nil	nil
	plants (2200 plants / nali)	2200		
b	Land Preparation, mulching, Fertilizer, & labour etc	₹ 2000 / nali	₹ 2000 / nali	2000
c	Irrigation and weeding	Nil	Nil	Nil
d	Plant protection measures	Stone fencing Free Provided under MNREGA Scheme		
e	Net for crop protection from hail storm (20 net / nali @ ₹ 1000 / net. If required	20,000		
e	Agricultural Tools	₹ 300		
f	Harvesting expenses			2000
g	Cost of Cultivation	24500	2000	4000
B.	Income	Produce 100 gm kalajeera / plant in one year (220 Kg / nali)		
i.	Sale of kalajeera @ ₹ 200 / per kg	44000	44000	44000
C	**Profit (B-A)**	₹ 44000 - ₹ 24500 = ₹ 19500		

Description

Nigella sativa or kalajeera is an annual flowering plant used widely in India and other Asian countries. Nigella sativa has been used for medicinal purposes for centuries, both as a herb and pressed into oil, in Asia, Middle East, and Africa. It has been traditionally used for a variety of conditions and treatments related to respiratory health, stomach and intestinal health, kidney and liver function, circulatory and immune system support, and for general well-being. The seeds have been traditionally used in the Middle East and Southeast Asian countries to treat ailments including asthma, bronchitis, rheumatism and related inflammatory diseases, to increase milk production in nursing mothers, to promote digestion and to fight parasitic infections. Its oil has been used to treat skin conditions such as eczema and boils and to treat cold symptoms.

6.5LARGE CARDAMOM (Cost of cultivation & Profitability)

a. Technical Parameters-

Soil - Moist loam

Climate - Shady and moist forests of oaks, alnus etc.

Attitude & Cultivars - Dzongu Golsey (900-1100 m), Sawney (1100-1500 m), Varlangey (1500-2000m).

Propagation - through seeds and suckers.

Planting Material / Nali - 25 gm seeds

Sowing season - October & November (in rows).

Germination Period - March

Transplanting season - July (in secondary nursery)

Planting season - Next year in July.

Spacing - 1.5 cm x 1.5 cm

No. of plants / Nali - 80 plants.

Crop duration - 10 years

Harvesting Time - October-November.

Post Harvest Practices - Cut fruiting spike, separate fruits and dry in shade or process in curing machine.

Avg. Yield / Nali - 10 kg dry fruits (127 gm / plant) per year from 3rd year

Market Rate - Rs150-200 / kg (dry fruits).

According to HRDI

Cultivation Cost - 800 / Nali

Gross return - Rs12000 / Nali in 10 years

Net return - Rs11200 / Nali in 10 years

Average Return - Rs1120 / Nali / year

Scale of Finance (Amount in Rs.)

S.N.	Items	1st year	2nd year	3rd year
A	Cost of cultivation			
a	Cost of planting material @₹ 5/ plant (80 plants / nail) or	400	nil	nil
b	Land Preparation, mulching, Fertilizer, & labour etc	₹ 400 / nali	₹ 400/ nali	400
c	Irrigation and weeding	Nil	Nil	Nil
d	Plant protection measures	Stone fencing Free Provided under MNREGA Scheme		
e	Agricultural Tools	₹ 100		
f	Harvesting expenses		500	500
g	Cost of Cultivation	900	900	900
B.	Income	Produce 500 gm dry fruit / plant in one year (40 Kg / nali)		
i.	Sale of cardamom @₹ 150 / per kg			6000
C	Profit (B-A)	₹ 6000- ₹ 900 = ₹ 5100		

Net Profit - Profit - Interest @10% p.a. for one year (assumption) - Rs5100 - Rs77 = Rs5023

In view of the above the production of Kalajeera is profitable.

Gestation Period - 3 years (crop production after 3 years)

Total Cultivation Cost - Rs900

Bank Loan - Rs765 in 1st year

Repayment Period - Repay up to 7 years (yearly repayment after 3 years)

Health benefits of cardamom

- This exotic spice contains many plant derived chemical compounds that are known to have anti-oxidant, disease preventing and health promoting properties.
- The spicy pods contain many **essential volatile oils** that include pinene, sabinene, myrcene, phellandrene, limonene, 1, 8-cineole, terpinene, p-cymene, terpinolene, linalool, linalyl acetate, terpinen-4-oil, a-terpineol, a-terpineol acetate, citronellol, nerol, geraniol, methyl eugenol, and trans-nerolidol.

- The therapeutic properties of cardamom-oil have found application in many traditional medicines as antiseptic, antispasmodic, carminative, digestive, diuretic, expectorant, stimulant, stomachic and tonic.
- Cardamom is a good source of minerals like potassium, calcium, and magnesium. Potassium in an important component of cell and body fluids that helps control heart rate and blood pressure. Copper is required in the production of red blood cells.
- It is also an excellent source of manganese and iron. Manganese is a co-factor for the enzyme superoxide dismutase, which is a very powerful free radical scavenger. Iron is required for red blood cell formation.
- The pods are rich in many vital vitamins including riboflavin, niacin, vitamin-C that are essential for optimum health.

Medicinal use

The therapeutic properties of cardamom oil have found application in many traditional medicines as antiseptic and local anesthetic, antioxidant and; health promoting and disease preventing roles.

7. Analysis

There are several reasons which prevent famers from cultivation of medicinal plants. There are many factors which result for this

7.1. Economic factors

a) High Risk. As the farmers do not have experience of these techniques they face risks concerning both the quantity and quality of production. On a large scale the implementation of these technologies has not been practiced yet which proves number of risks for farmers to cultivate MAPs. Due to the fluctuation in prices and demand for MAPs results in increasing risks which make them reluctant to convert their large parts of land to medicinal plants.

b) Long Gestation period. Gestation period is another reason as according to medicinal plants they can be harvested only after three years or more because of high altitude where as in low altitude plants have low gestation period so farmers are not prepared to wait for such a long time.

c) Low prices .according to farmers the returns on cultivation of medicinal plants is very low which do not compensate for difficulties and uncertainties because of two reasons. Firstly , the low cost of collection (both legal and illegal) puts a downward pressure on the price, making cultivation unattractive .Secondly, the primary producers have comparatively low bargaining power.

d) Trade. Increased competition from imports has also led to a decline of prices .With the increased liberalization of import policies, the import of medicinal plants has increased significantly.

7.2. Lack of Technological Support –

Many medicinal plants need specific cultural practices and agronomical requirements. Farmers face serious difficulties, as they have no experience in cultivating medicinal plants. There is a clear need for the development of technologies related to cultivation, harvesting, storage, transportation and quality control. The problem of technologies arises because of

a) Sub-optimal use of resources. The resources available for research on medicinal plants are distributed too thinly, as research is being done on a large number of species. This creates a situation where none of the research work has sufficient resources to achieve success.

b) Most of the research is focused only on cultivation of MAPs but it's very important to focus on problems related to p
ackaging, storage, transportation and quality control. As these processes are vitally important for achieving high quality, greater efforts are needed.

c) Linkages between institutes and farmers are weak. Most of the research is being done in laboratories. There is very little on-farm research and farmers' participation in the research process is negligible. Due to them many implications has arose

I. The problems faced by farmers are not fully reflected in research efforts.
II. Researchers are unable to take advantage of farmers' experience.
III. As farmers are not involved in the research process, diffusion of technology is hampered.

d) Presently, the focus of research activities is to develop cultivation technologies for threatened species. The choice of species is not based on the availability of technology and market. It would be better if species with greater economic relevance for a large number of farmers were also covered by research programmes.

7.3. Supply Chain and Market Related Problems

The number of actors in the supply chain is large. These include: primary collectors and producers, local contractors, local middlemen, regional wholesale markets, markets in large centres such as Delhi, Calcutta and Amritsar and specialized suppliers. In almost all cases, the primary collectors and producers sell to local contractors and middlemen. As they are tied to these agents through debts and other obligations, their bargaining power is negligible. Also, as they have only small amounts to sell, they do not have the option of selling directly to wholesalers.

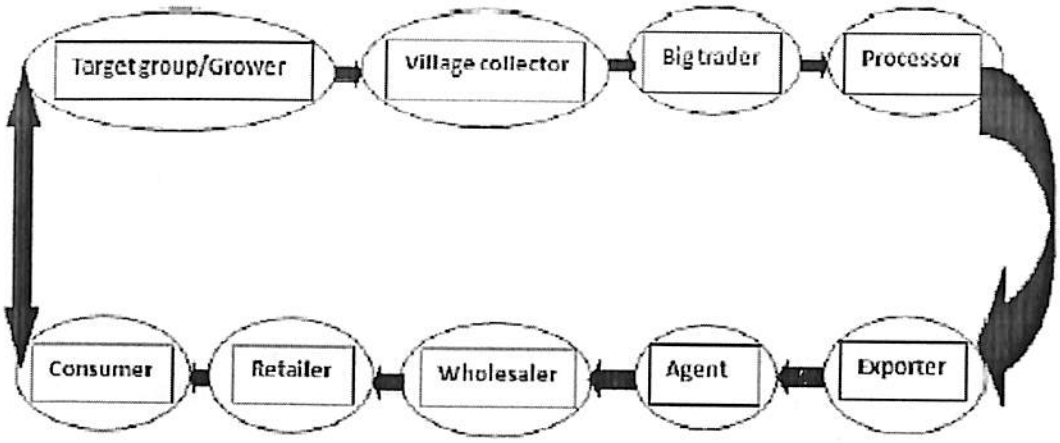


Figure: Existing Value chain developed for marketing of medicinal and aromatic plants

The marketing of medicinal plants by farmers is one of the central problems. The collectors and farmers are completely dependent on local traders for the marketing of their products. As there are no open trading facilities (such as mandis) for medicinal plants, the market is controlled by a handful of traders in the wholesale centres. Direct selling to industry by groups of farmers is sometimes suggested as one way of reducing the control of contractors and traders. However, as the traders play a crucial role in the smooth functioning of the supply chain, it is unlikely that direct selling to industry could become a practical option.

Here comes up the issue of buy back arrangements wherein corporate and large trading companies enter into arrangements with farmers to supply crucial farm and management inputs and buy-back the produce, making it advantageous both for the producer as well as the industry. Large traders may be interested in offering buy-back arrangements for species which are difficult to obtain, whose supply fluctuates or when an arrangement at a lower than market price can be made. Large exporters may also find buy-back arrangements attractive in the future, as the requirement of traceability will become increasingly important. At present it is impossible to trace the origin of any material, as there is little transparency and documentation.

7.4. Government Policies

The governments in the Himalayan states are seriously concerned about the rapid depletion of medicinal resources. They have introduced polices both to conserve resources in situ and to promote cultivation by farmers caused by their large scale collection from the wild. Most states have also established State Medicinal Plant Boards. These Boards are responsible for coordinating various activities to promote the development of the medicinal plant sector. The Government has made government departments, such as the Horticulture Department, Forest Department, Department of Rural Development and Research Institutes. The measures to promote cultivation include:

a) Strengthen research and development activities

b) Providing subsidies and financial support for the purchase of planting material, land improvement and cultivation of medicinal plant

c) Promotional activities to familiarize farmers with the potential of medicinal plants as cash crops

d) Training of farmers to familiarize them with cultivation and post harvesting technologies

e) Development and diffusion of cultivation and other technologies

f) Setting up of nurseries and other facilities to propagate and deliver planting material to farmers

The Uttaranchal government has taken a number of initiatives in recent months to promote the cultivation of medicinal plants. For example, it has strengthened the Herbal Research Development Institute (HRDI) to coordinate various activities concerning medicinal plants in the state. The Institute will act as the nodal agency for the promotion of the cultivation of medicinal plants. The government is also making efforts to involve the private sector and non government organizations (NGOs) in promotion activities. It has recently given a number of government farms to private companies, research institutes and NGOs to carry out large- scale cultivation of medicinal plants. It also plans to take steps to increase the availability of technology and planting materials to farmers. There is emphasis on an extensive increase in the number of nurseries, in order to meet the expected growth in demand for planting material.

In addition to state level research institutes, a number of national institutes also work on the promotion of medicinal plant cultivation in the Himalayan states. These include institutes belonging to the Council of Scientific and Industrial Research (CSIR), the Indian Council of Agricultural Research (ICAR) and the Ministry of Environment. The important institutes include: Regional Research Laboratories (RRL), Jorhat, GB Pant Institute of Himalayan Environment and Development, Kosi and Srinagar (Uttaranchal),
G.B.Pant Institute of Himalayan Environment and Development, Mohal- Kullu (Himachal Pradesh)

Horticulture-
WALNUT

1. Abstract

In India walnuts are grown in Arunachal Pradesh, Himachal Pradesh, Uttrakhand and Jammu and Kashmir. The last State contributes around 98% of the country's output. Production in Jammu and Kashmir State suffers from lack of proper maintenance and the continued civil unrest in the Kashmir valley, the traditional walnut growing area. Total requirement for walnut in India are projected to increase from 36,000 tonnes produced currently to 72,550 tonnes by 2020/21. India will need to bring in additional area to meet the projected demand. Owing to the scarcity of suitable land in Jammu and Kashmir State, it would be essential to expand walnut production to other states.The analyses provide comprehensive estimates of costs involved with the establishment of a walnut orchard, maintenance and other recurring costs during the non-bearing and bearing stages, total cost per hectare of walnut production, income and return, gross and net, from the walnut orchard and the cost/benefit ratios.

2. INTRODUCTION

Walnut, Juglans regia, is called by different names in different parts of India. The most commonly used name is akhroot, while in Kashmir it is called dun. In India, walnut grows in the northwestern Himalayan belt, expanding up to Darjeeling and Sikkim. It flourishes in temperate belts, however, at altitudes of 900-3 500 m. The tree normally grows well in cool climates that are free from frost during spring but does not thrive in areas with hot summers. The production of a good quality walnut crop is, however, dependent on altitude, temperature fluctuations and humidity/moisture during the main fruit development stage.

Frost or snow during flowering destroys young flowers and new shoots, thereby affecting crop production. Normally, an evenly distributed annual rainfall of 760 mm is considered the optimum for a good quality crop. Well drained, fairly deep silt-loam or friable clay-loam, well supplemented with lime and rich in humus, are considered best for successful walnut cultivation. The accumulation of water is harmful for the development of trees and also affects the quality of nuts. Trees grown on shallow soils with scant moisture content remain stunted and are very often affected by sunburn. Walnut trees can be raised either from seeds or through budding or grafting methods. Planting using vegetative propagation is almost non-existent. Young walnut plants raised from seedlings come to fruit at the age of 10-15 years but optimum production is not expected until the plant reaches the age of 20-25 years.

Walnut trees are susceptible to pests and disease such as walnut weevil (Alcides porrectirostris Marsha), walnut blue beetle (Monolepta erythrecephale), Sanjose- scale (Quadraspidiotus perniciosus Comst), and walnut green aphid (Chromaphis juglandicola Kalt). Among the different pests prevalent in the walnut-producing areas, walnut weevil is considered serious in

some places. In areas at lower elevations, flowering occurs early, whereas at higher altitudes it occurs late. The walnut shell in most varieties begins to harden in the middle of June, after which there is little or no increase in size. The most rapid growth of nuts takes place during the 5-6 weeks after flowering. Quality, with a light-coloured kernel and a characteristic thin shell. At lower elevations, the kernel usually turns brown because of high temperatures at the time of ripening.

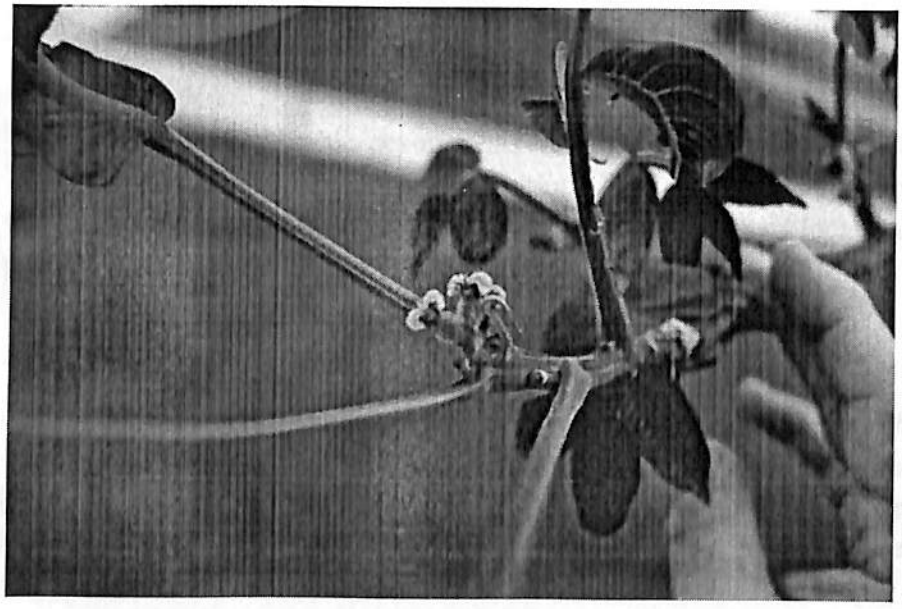
Walnut can be classified on the basis of packaging and trade practices. On the basis of packaging, the walnuts are divided into two categories, bag and box quality. Thin-shelled kagzi walnuts are usually brought to market in wooden boxes and baskets. Nuts with thicker shells are usually transported in bags. In terms of taste, Kashmir walnuts are considered superior but the variations in the colour and size of the crop are not favourable attributes. Walnuts can be classified into three categories based on the thickness of their outer shell: Burzil, Kagzi, and Wont In-shell walnuts for export are graded and sold under marketing rules set in 1966. Those of a minimum size of 32 mm, a good cracking rate of over 90 per- cent and the fewest internal defects are assigned the grade designation of India Super-special. Nuts with a minimum size of 30 mm are designated India-Special and nuts of 24-26 mm are graded India I and India B-grade.

2.1 BOTANICAL DESCRIPTION

2.1.1 Plant

A medium to large tree (to 100 ft in nature, 20-50 ft in cultivation) with spreading crown. Leaves are compound, composed of 7-9 leaflets, which have prominent, herring-bone venation. Leaflets are ovate, with pointed tips and smooth margins. The shuck of Persian walnut does not split into 4 regular sections at maturity as it does in pecan and hickories; it splits, but irregularly.

Eastern black walnut, produced laterally on one-year-old wood



Persian walnut female flowers produced terminally on current season's growth

2.1.2 Pollination

Walnuts are similar to pecans in that the time of pollen shedding does not always overlap well with the time of female flower receptivity to pollen. Hence, although most walnuts are self-fertile, they sometimes require another cultivar for pollination since the timing of the functions of male and female flowers is different. This condition is referred to as dichogamy (see pecan page for description). Most walnuts are protandrous. As with most catkin-bearing species, walnuts are wind pollinated.

2.1.3 Fruit

A nut. Nuts are borne singly or in clusters of 2-3 on shoot tips. A green, fleshy shuck surrounds the nut, which splits irregularly at maturity. The shell is rough, wrinkled or furrowed, and thin. Nuts are ovoid to round, ½ -2" in diameter, containing two kernels separated by a thin, papery central plate extending from the inner layer of the shell.

3.Possible Problems Encountered With Walnut Trees

Walnut trees offer valuable benefits including hardwood lumber used in a variety of products. Also, the nuts from the tree are a nutritious food source for humans and wildlife alike. But walnut trees can also cause problems when it comes to their location in the landscape and the pests and diseases that attack them.

3.1 Diseases

- One of the most common diseases walnut trees face is walnut blight. Walnut blight causes black spots on the leaves as well as holes and blotches on the fruit of the tree. Sometimes new shoots die back. Another disease, walnut leaf blotch, consists of a fungus that causes the nuts to turn black and fall off. Sometimes the leaves fall off the tree, too. The disease spreads easily during wet weather.

3.2 Pests

- The pests that attack walnuts trees may not destroy the tree, but they may limit the nut harvest while causing minimal damage. The walnut leaf gall mite causes raised bumps to appear on the leaves. The leaves may look unattractive, but the damage is not usually life-threatening for the

plant. Codling moth is another pest that attacks walnut trees, staining he shells and sometimes destroying the fruit.

3.3 Toxicity

- Walnut trees produce a chemical called juglone.Walnut produces a large quantity of the substance, sometimes causing toxic reactions in nearby plants. Juglone affects the plants by depriving them of the energy they need to perform metabolic activities. Affected plants cannot exchange carbon dioxide or oxygen properly. Symptoms of the toxicity include stunted growth and partial or total wilting or death of the plant. The reaction can occur quickly, sometimes killing the plant in just a day or two. Once the plant begins to wilt, the process cannot be reversed. Gardens should be planted away from walnut trees to avoid the problem. Or, make sure to include plants that are not affected by juglone.

4.All India Production

YEAR	AREA (IN 000'HA)	PRODUCTION (IN 000' MT)	PRODUCTIVITY (IN MT/HA)
2001-02	107	114	1.1
2002-03	117	114	1.0
2003-04	106	121	1.1
2004-05	106	121	1.1
2005-06	130	149	1.2
2006-07	132	150	1.1
2007-08	132	177	1.3
2008-09	136	173	1.3
2009-10	142	193	1.4
2010-11	137	201	1.5

4.1 India Facts and Figures :

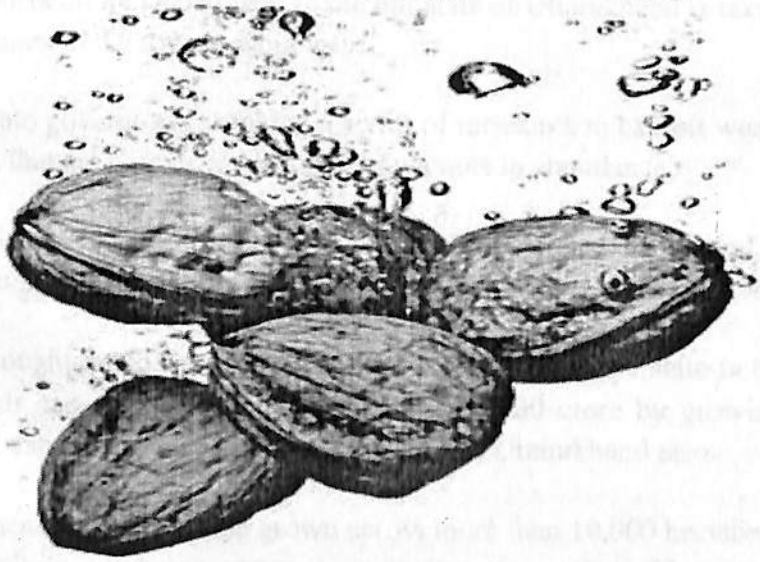
The total area under walnut in India is 85 thousand hectares with an annual production of 107 thousand MT. The country has exported 5,244.61 MT of Walnuts to the world for the worth of Rs. 892.94 crores during the year 2010-11.

Walnut trees, especially young trees, cannot tolerate shade. Walnut trees are dormant during the winter. The fruits that fall from the trees have trouble getting started unless they're along the edge of the forest where the sun gives them a better chance to grow. Squirrels can't transport the golf-ball-sized nuts far, either. This means that the only way for the seeds to be disbursed long distances is via water. Walnut trees overcome these challenges with fast-growing young trees that can take advantage of sunny gaps in the forest. The young trees also produce a chemical that kills off nearby competing plants.

Indian walnuts are classified on the basis of their size and shell cracking rate. The main grades are:

- India-Special light half
- Indian Light broken
- Indian Light pieces
- Indian Light crumbs
- Indian Light-my-fire
- Indian Light Amber halves
- Indian Light Amber broken
- Indian Light Amber pieces

Starting a Walnut Tree From Seed



The biggest problem you are likely to encounter when starting a walnut tree from seed is squirrels getting to the nuts before you can gather them. The tree grows readily from seed, gathered in September and October when it falls from the tree. Walnut trees are stately giants that can live over 200 years. Although six walnut species grow in the United States, the black walnut is the one most home growers choose to plant. Choose a planting location that sits at a

higher elevation in the landscape. Lower elevation locations can become frost pockets, where cold air settles. Walnut cultivation could not develop rapidly due to a number of constraints like low scientific research, improper, random classification, long gestation period, low tree density etc.

Walnuts are the richest plant source of protein and are famous all over the world. Walnuts undergo the processes of Washing, Grading, Cracking, Quality Check, and Packaging.

Walnut (Juglans sp.) is the most important temperate nut fruit of the country. Walnut in India are found in differet sizes and shapes. The Indian walnuts are categorized into 4 categories viz., paper-shelled, thin-shelled, medium-shelled and hard-shelled. Walnuts flourished at altitudes of 900 to 3000. Total area under walnut is 67053 hectares with annual production over 71758 metric tons. Walnut growing suffers from lack of suitable methods of propagation, inadequate vegetatively propagated plants, lack of standard rootstocks/ cultivars, problems of re-establishment of nursery plant in the orchard, specific climatic requirements, pollination behaviour and lack of suitable pollinizers, long juvenile period and harvesting.

5.1 Uttarakhand State plans to reap benefits of walnut plantation

The Horticulture Department in the hill state of Uttarakhand is taking steps to promote plantation of walnuts in the state in a big way.

The state government is taking a series of measures to exploit weather and soil conditions of the region that are congenial for growing walnuts in abundance.

It can be a major source of revenue generation for those employed in the farm sector, particularly the marginal farmers who have less chunks of land in higher reaches.

The thought behind promoting walnut production in the state is that if the state of Jammu and Kashmir can earn an annual revenue of Rs 200 crore by growing walnut, with a little effort walnut can also be made a prime cash fruit of Uttarakhand also.

At present, walnut is being grown across more than 10,000 hectares in the state. But, the problem is that it is not being grown in a systematic manner. Now, the emphasis is being laid on developing walnut orchards across the hill tracts of Garhwal and Kumaon that are congenial for its growth.

The government is now aiming at distributing these plants to farmers across the state in the districts of Uttarkashi, Tehri, Pauri and Pitthoragarh. Officials say these plants will be ready to bear fruit in a little more than one year and each tree has the potential to give at least 50 kg per

annum. Fruit of these walnut trees have a potential to fetch a market price of Rs 100 per kg and thus can be a good revenue earner.

Walnut growing is also being promoted through seedlings and once the plant takes shape it is grafted and more plants are grown. A new technique has also been developed whereby a 15-year-old plant can be replaced by a fresh one.

An advantage for promoting walnut production lies in the fact that there is no problem in marketing the produce.

India: Walnut production likely to jump 50% to 45,000t
India's walnut production is expected to rise by 50 per cent to a record 45,000 tonnes in the 2011-12 marketing year, but adverse weather conditions could hit output by 20 per cent, says a USDA report. The country produced about 30,000 tonnes in the 2010-11 marketing year (August-July), the United States Department of Agriculture (USDA) said in a report. "However, adverse weather conditions could always lower the crop estimate by 5-20 per cent, as reflected in last year's (2010-11) production," the report said. Heavy rains and abnormal weather during the flowering season in August last year reduced the output to about 30,000 tonnes.

5.3 Harvesting and post-harvesting activities

Nuts are collected from the ground between the months of September and October. After collecting nuts, these are cleaned, washed and dried by spreading them on sheets or floor. Sometimes in order to improve the appearance of nuts, these are bleached with either alkali or acid solution. Nuts which fall down with their husks intact are generally second-grade. After removal of the husks, cleaning and drying, they should be stored and marketed separatelyto fetch a higher price. Delay in drying causes rapid loss in nut quality and makes walnuts susceptible to the mold. Drying of nuts stabilizes the product's weight and prolongs storage life. Walnuts are stored in gunny bags in a small ventilated room free from excess humidity. For export purpose, these are packed in double gunny bags.Walnuts are consumed in the winter season, so the problem of their shelf life is seldom felt. The quality of nut meat, however, deteriorates due to darkening and rancidity which are affected by air, moisture, heat and light.

5.2.1 Post-harvest bottlenecks

- Improper storage, drying, grading practices at farm level
- Lack of awareness about sanitary condition to handle nuts
- Lack of integrated handling system to manage the nuts
- Non-adoption of international standards on grades

- Lack of processing, storage and orchard management facilities
- Increased competition from overseas suppliers
- External competition from California, Mexico, China and other countries

6. Benefits of Walnuts or reasons why growing walnuts could be a positive endeavour

- Present projections of costs and returns indicate that walnuts will have a positive cash flow five years after planting.
- The cost of trees is about the same as trees of any licensed fruit variety.
- Walnut trees are free-standing – no trellis is required. Staking young trees may be required in areas that are not protected from strong winds.
- Excellent varieties on precocity-inducing rootstocks are now available in Australia.
- Densities of between 500 (5mx4m) and 660 (5mx3m) trees/hectare are possible to induce early precocity and obtain high yields.
- The 'central leader' system of growing walnuts permits a uniform tree complexity, high light interception per hectare, and good light distribution throughout the canopy for sustained production.
- Inducing branching, general vigour control, and maintaining fruitfulness similar to fruit trees has already been researched and can be implemented.
- Advice is available on how to manage a high density walnut planting and how to increase precocity without the use of a size-controlling rootstock.
- There is minimal risk of frost damage to flowers and nuts, because walnut trees bloom in late November.
- No honeybees are required, because walnuts are wind pollinated by polliniser trees.
- Walnuts are mechanically harvested and processed.
- Mature walnut trees under micro-irrigation need approximately 6 megalitres of water per hectare.
- Pest and disease pressures of walnut trees are much less than for fruit trees.
- Walnuts are not affected by fruit fly quarantine regulations.
- Walnuts in shell have a long storage life.
- Walnuts have health and cosmetic properties.
- Walnuts have excellent export potential.
- The wood of walnut trees also has commercial value.
- Walnuts are of the best sources of anti-oxidants that protect the human body from ageing
- Walnuts are used to induce sweating
- Walnuts can also serve the purpose of an astringent
- Walnuts are used to extract oil.

6.1 Nutritional Value of Walnuts

- Walnuts are a good source of omega 3 essential fatty acids
- It is the richest plant source of protein
- Walnuts are rich in fiber vitamin, magnesium and vitamin E.

7. Processing

- **Washing**: We wash the walnuts manually in water, rather than sulphuric acid to protect the kernels from damage. We keep some of best graded walnuts unwashed to crack them and get their kernels.
- **Grading**: After washing, walnuts are graded into three different qualities i.e. super walnuts (32mm), special walnuts (28mm) and number one walnuts (26mm).
- **Cracking**: After washing and grading, some of walnuts are kept unwashed and then cracked to get their kernels. The walnut kernels are also graded into three different categories i.e. light half (llh), light half (lh), and amber half (ah).
- **Quality Check**: After every above mentioned step, walnuts and their kernels are sent to the quality control division where our skilled and dedicated food- technologists check the quality and further send it to packaging division

8.Marketing

Walnuts are marketed as nuts or kernels. These arrive into the market from September onwards and the kernels follow two to three weeks afterwards; the peak arrival season being from November to January.

Walnuts produced in Himachal Pradesh and Uttarakhand are consumed almost locally, whereas in Jammu & Kashmir the produce is brought to the assembly market in Jammu, which is the biggest market for walnuts in India. Efforts have been made to assemble quality nuts in Shahia market of Chakrata hill (Dehradun) and send to Delhi market. The nuts in the market are roughly sorted out and empty, stony, highly blighted, shriveled, moldy and darkened nuts removed. Thin shelled nuts are packed in wooden boxes, while medium-shelled nuts are packed in gunny bags. The product then moves either to the commission agents or the exporters

Points to Remember

Walnut trees are fussy about where they grow and like rich deep soil, and they need reliable rainfall and cold to temperate winters without frost in late spring. They take about a decade to fruit and need a lot of room to grow. They have a large root system, so should not be planted near a house or driveway.

They grow to roughly 30 meters in 100 years. Walnut trees are an investment for future generations. Their longevity will depend on the richness of the soil and availability of water.

Their limbs form a large umbriferous canopy which makes a beautiful summer shelter over a large back yard, reducing the heat by degrees. It's good to plant two trees if you have room because you will get more nuts from cross-pollination.

Finally while harvesting walnuts, don't forget to air them for six to eight weeks in a well-ventilated warm spot like an attic or glasshouse, or by a window. Tumble them by hand from time to time. Never store nuts in airtight containers: wicker or wire baskets are best.

FLORICULTURE

FROURICULTURE

1.INTRODUCTION

Gerbera is one of the most important cut-flowers, successfully grown under different conditions in several areas of the world and meeting the requirements of various markets. This success is primarily due to the wide range in colour and shape of the flower. In the past, all Gerbera's where grown from seed. This changed in the seventies, when techniques for multiplication with in-vitro became available. These methods allowed a different approach in breeding and selection of Gerbera.
Presently,Gerbera is a plant which is multiplied 100% in-vitro, the most modern way of propagation in horticulture.
In modern hi-tech method gerberas are grown in polyhouses. The quality of flowers produced is superior, because inside climate or micro-climate such as temperature, humidity, light, ventilation etc is controlled. With changing life styles and increased urban affluence, floriculture has assumed a definite commercial status in recent times and during the past 2-3 decades particularly. Appreciation of the potential of commercial floriculture has resulted in the blossoming of this field into a viable agri-business option.
Availability of natural resources like diverse agro-climatic conditions permit production of a wide range of temperate and tropical flowers, almost all through the year in some part of the country or other. Improved communication facilities have increased their availability in every part of the country. The commercial activity of production and marketing of floriculture products is also a source of gainful and quality employment to scores of people.

2. OBJECTIVE

- The main objective of this report is to present a bankable model for high quality commercial cultivation of the crop.
- Implementation of Information technology using e-commerce in flower trading.

3. BACKGROUND

Gerbera species belong to the family Asteraceae (or Compositae) which is the largest family of plants. The native distribution of this genus, comprising of ca. 30 species, extends to Africa, Madagascar, tropical Asia and South America.The first official description of the South

African species Gerbera jamesonii, also known as Transvaal daisy or Barberton daisy, was made by J. D. Hooker in 1889 in Curtis Botanical Magazine . It bears a large capitulum with prominent, yellow, orange, white, pink or various red coloured ray florets . The breeding of gerbera started at the end of the 19th century in Cambridge, England when two South African species, G. jamesoniiand G. viridifolia, were crossed by R.I. Lynch. He named the hybrid as Gerbera × cantebrigiensis, known today also as Gerbera hybrida. The majority of the present commercially cultivated varieties originate from the crossing progenies of these two species. Natural hybrids of the two species have not been found . It is possible that also other wild gerbera species have been used in breeding, but for that hardly any information exists . Already at the turn of the century, gerbera was cultivated in England, Belgium, USA, Germany and Italy . Today, gerbera is known as an important article of trade and it belongs to the most important ornamental plant species in the world together with rose, chrysanthemum, carnation and tulip. In 1991 gerbera was ranked sixth in sales through Dutch flower auctions and it is sold both as cut flowers and pot plants.

3.1 Origin

Gerbera daisies (Gerbera jamesonnii) originated in South Africa. They are compact plants with brightly colored daisy-like blooms. Gerbera daisies are easy to grow and are commonly used in flowerbeds or containers and as cut flowers. Gerbera daisies grow in dense clumps up to 12 inches high and wide with long, slender hairy leaves.

The flowers bloom on stalks held above the leaves in numerous colors including yellow, orange, red, pink, salmon, purple and white. The plants are hardy to 30 degrees Fahrenheit and are grown as perennials in warm areas. In areas with extended periods of frost, gerbera daisies are grown as annuals or in containers that are Protecte in winters.

3.2 Area & Production

Country wise production

YEAR	AREA(000 HA)	PRODUCTION(LOOSE) IN 1000 MT	PRODUCTION(CUT) MILLION FLOWER	PERCENTAGE CHANGE
2007-2008	166	868	43654	
2008-2009	167	987	47942	
2009-2010	183	1021	66671	
2010-2011	191	1031	69027	

State-wise estimates of area, production and productivity of GERBERA during 2010-11 are given in **table1**.for year 2010-2011.

Flower species	Total area under production in (Hecs)	Total production in (MT)
Gerbera	60.69	8817.39
Gladiolous	5230.47	3705.24
Marigold	2243.63	3105.18
Carnation	119.21	2577.54
Rose	759.94	735.17

3.3 Economic Importance

Agriculture GDP:

As one of the world's largest agrarian economies, the agriculture sector contributed approximately 14.6% of India's GDP (at 2004-05 prices)during 2009-10. Gross Domestic Product(GDP) of Agriculture and Allied Sectors and their share in total GDP of the country duringthe last 3 years including the current year, at2004-05 prices is as follows:

In Rs crore

Year	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Gdp of agriculture and allied sectors	619190	655080	654118	656975	692499
% to total GDP	17.4	16.8	15.8	14.6	14.2

Source: Central Statistical Organization, Ministry of Statistics and Programme Implementation, Govt. of India

3.4 Floriculture yet to bloom in state

Dehradun

With potential in floriculture still untapped, Uttarakhand has made considerable progress in increasing the area under flower production in the last 10 years. Still in infancy in 2002, when the total area under floriculture was 618 hectare, the efforts of the Horticulture Department have now begun to bear fruits.

In 2010-2011, the total area under floriculture had gone up to 9130.19 hectare, with different varieties of flowers like gerbera, gladiolous, rose, marigold, carnation and other flowers being grown in the state. A majority of these flowers except marigold gladiolus and rose are being grown in polyhouses under controlled conditions. The total production for 2010-2011 was at 19452.66 metric tonne.

"The Horticulture Department under the horticulture mission project is providing a number of incentives to the growers where they can avail finances even up to Rs 10 lakh. Depending on the kind of polyhouse a grower wants to set up, the government is providing finances up to Rs 1.50 lakh," said IA Khan, Director, Horticulture.

Between the two divisions of Kumaon and Garhwal, the total area under floriculture in the Kumaon division comprising the districts of Nainital, Udham Singh Nagar, Almora, Bageshwar, Pithoragarh and Champawat is 315.99 hectare, more than that of the Garhwal division.

"The districts of Udham Singh Nagar, Nainital lead in the producton of gerbera which is sold as a cut flower while the remaining districts have made their presence felt in the production of gladioli," said Khan.

However, this cannot be said of the Garhwal division where floriculture is yet to pick up in the hill districts of Pauri, Tehri, Rudraprayag and Uttarkashi.

In the Garhwal division, the growers in the districts of Haridwar, Dehradun and Chamoli have taken to floriculture in a big way.

"Due to conducive climate in Dehradun and other districts, several varieties of flowers can be grown. We had tried orchids in several places and these yielded good results. Several progressive farmers in Dehradun too have begun to grow marigold due to the huge potential it has in the flower market," emphasised Khan.

In Uttarakhand, the area under gerbera flower in 2010-2011 was 60.69 (hectare) and the production was 8817.39 metric tonne, while for gladiolous, the total area was 5230.47 hectare, production was 3705.24 metric tonne.

For Marigold, the total area covered was 2243.63 hectare and the production 3105.18 metric tonne. In the case of carnation, the total area was 119.21 hectare, the production was 2577.54 metric tonne. While for rose, the total area was 759.94 hectare and production 735.17 metric tonne.

4. MARKET ANALYSIS AND STRATEGY

4.1 Demand and Supply patterns

Demand – supply mismatch

Sharing his views with Floriculture Today, Shiv Kumar Thakur, president of Phool Patti Utpadak Kalyan Samiti, said, "There is a gross mismatch between demand and supply of flowers. The demand in local market as well as in other states is not in accordance with the supply." Hailing the government policy as responsible for increase in production, he said that government schemes have helped to some extent. "The schemes lure the farmers into growing flowers through subsidies. As a consequence, more & more farmers are being encouraged to grow flowers in bulk, resulting in abundant supply in the market. Unfortunately, the demand of flower has not kept pace with the supply. Experts, however, differ with Thakur, saying the rising income and increasing population certainly have a direct impact on flower use during different occasions and in daily life. The demand for flowers could rise much higher. Owing to lack of kiosks and shops in convenient places in cities and towns for sale of flowers, people do lose their interest in buying flowers for gifts. Traditionally, people here buy flowers in bulk on the occasion of marriage and other ceremonies or consume loose flowers for puja (worship) in mandir and gurdwara on a daily basis. Gradually, cut flowers are becoming popular with people who use them for expressing their feelings or as a gift. Though it is at nascent stage, hopefully this culture of flower use will get rooted in our psyche in the days to come. For this purpose, cooperatives and private bodies like organised retailers could set up shops and kiosks in greater number, say experts.

Delhi's-status

APEDA lists Maharashtra, Karnataka, Andhra Pradesh, Haryana, Tamil Nadu, Rajasthan and West Bengal having emerged as major floriculture centers. But what about Delhi, one wonders? Delhi makes available a good market by connecting with every part of the country. It has a large consumer base as well. Although in quantitative terms, its production is not much, Delhi has successfully carved out a distinct place and emerged as the largest market in floriculture business in the last couple of decades. Growers and sellers across the country converge here for their flower business. It is unfortunate that the establishment of a proper flower market equipped with modern facilities remains still on paper. India boasts of having a long floriculture history and growing flower for worship, decoration and other aesthetic purposes. But commercialization of floriculture in an organised way began only in the 1990's. The growing demand for flowers in the

domestic as well as in the export market will require concerted efforts on the part of the government as well as the private entrepreneurs. Government needs to implement the policy under way on a war footing to help develop floriculture industry in a more organised way. Paying attention to the input needs, better resource management and making the policy entrepreneur-friendly would lead to balanced growth of the industry.

4.2 Import/Export trends

Table-2 : Country-wise export of GERBERRA from India during 2009-2010 to 2011-12

Quantity(Tonnes), Value (Rs. lakhs)

Country	1999-2000		2000-2001	
	Quantity	Value	Quantity	Value
Bahrain	29.59	13.00	0.70	0.50
Belgium	87.20	27.19	155.00	147.22
Canada	0.60	0.12	-	-
France	48.00	9.31	-	-
Korea Republic	14.00	1.71	-	-
Kuwait	1.90	0.37	6.96	2.04
Norway	-	-	0.75	0.28
Oman	-	-	2.05	0.48
Philippines	28.00	4.82	-	-
Qatar	2.45	0.60	-	-
Saudi Arabia	26.79	5.86	0.90	0.69
Spain	24.00	3.70	-	-
Sri Lanka	14.00	2.17	-	-
U.K.	1.00	0.23	-	-
UAE	7.86	2.46	0.75	0.62
USA	13.76	2.27	-	-
Total	**299.15**	**73.81**	**167.11**	**151.83**

Source : APEDA, New Delhi

Indian Floriculture Industry is been shifting from traditional flowers to cutflowers for export purpose. The liberalized economy has given an impetus to the IndianEntrepreneurs for

establishing export oriented Floriculture units under controlled climatic conditions. In India, Maharashtra, Karnataka, Andhra Pradesh and Haryana have emergedas major Floriculture units in recent times. There are six Agriculture Export Zones set upfor floricultural produce in the states of Sikkim, Tamil Nadu, Uttaranchal, Karnataka and Maharashtra. Main export destinations for Indian floricultural products are United Statesof America (USA), The Netherlands, United Kingdom (UK), Germany and Japan.Under the Foreign Trade Policy for the period from 2009-2014 following steps have been taken to strengthen the Horticulture as well Floriculture Industry in India:-

(1)The incentive available under Focus Market Scheme (FMS) has been raised from2.5% to 3%.

(2)The incentive available under Focus Product Scheme (FPS) has been raised from1.25% to 2%.

To reduce transaction and handling costs, a Single Window System to facilitateexport of perishable Floriculture produce has been introduced. The system willinvolve creation of multi-functional Nodal agencies which will be accredited byAPEDA.

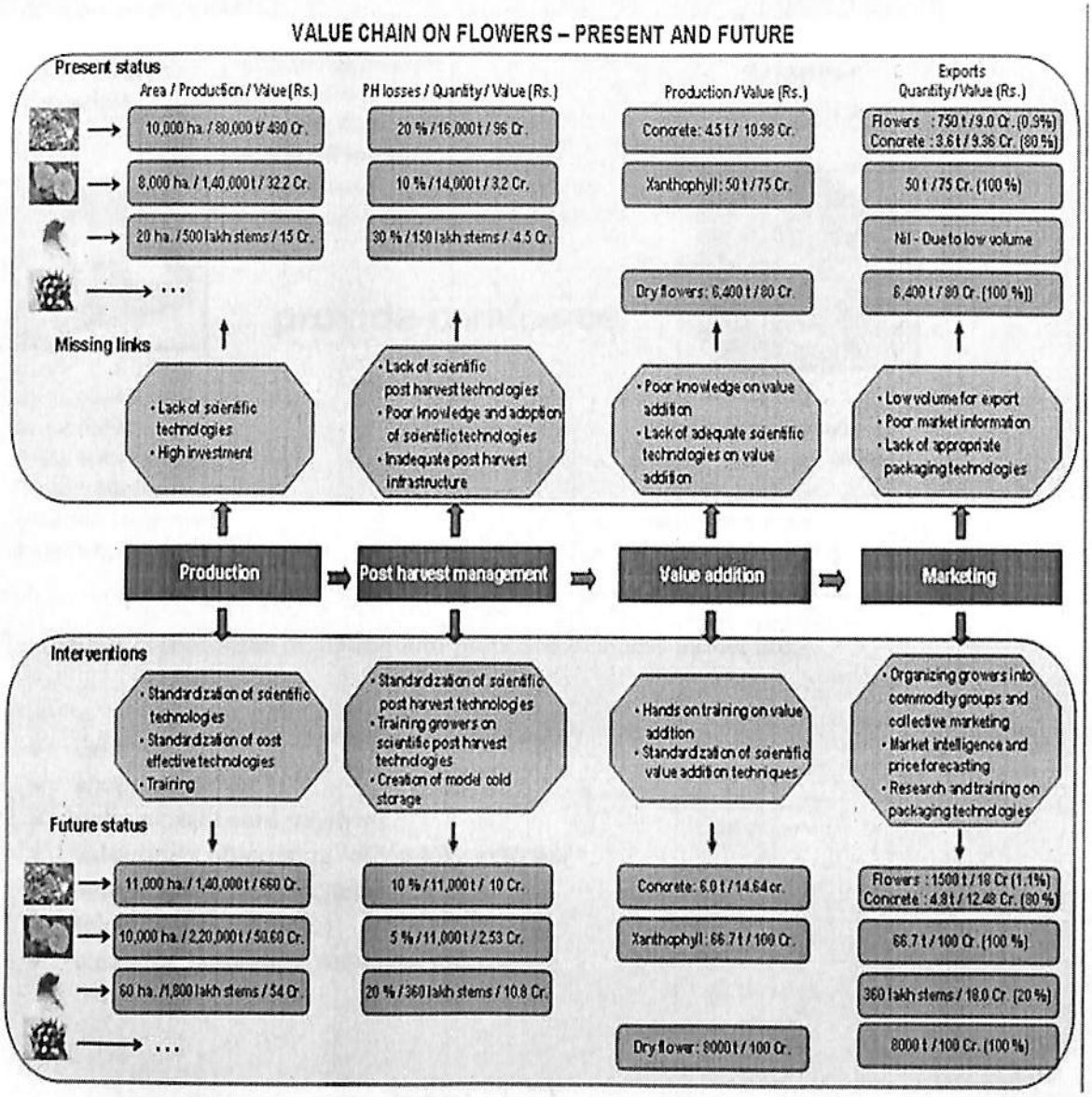
4.3 Analysis and Future Strategy

FLOWERS has a vast untapped potential in the domestic as well as the global market. However, inappropriate production practices, lack of regular maintenance, absence of infra-structure facilities (for cold storage, processing and canning) and of institutional support are some of the critical factors impeding the exploitation of the untapped potential.

The following measures need to be considered in order to boost production and marketing of Gerbera

(1) A three-tier system involving growers, processors and exporters may be formed along with export processing zones and marketing boards.
(2) Storage, pre-cooling and transport facilities to help the growers realize better prices.
(3) Processing units close to production centres, with financial and technical support from various Govt./non-Govt. agencies.

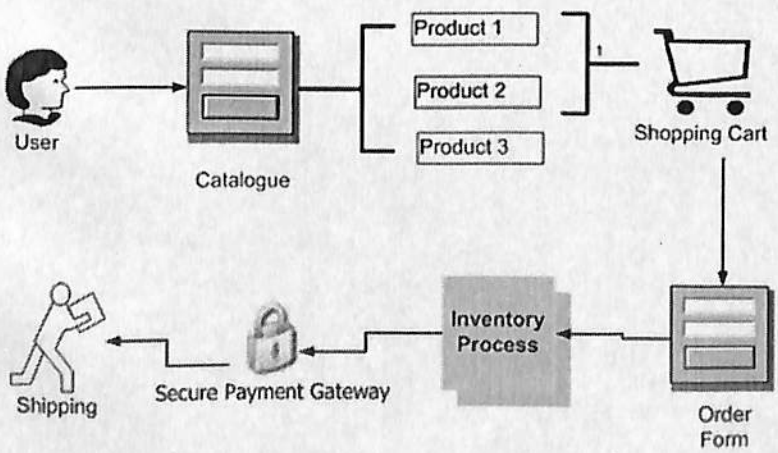
5. Proposed business model



Business Model Advantages

The various components including into proposed business model are:-

- catalogues
- shopping carts
- online credit card payment
- sales order processing / inventory systems
- shipping/ delivery systems
- telemarketing systems
- customer databases/ statistics, etc.



6. PRODUCTION TECHNOLOGY

6.1 Agro-climatic requirements

Details of polyhouse (Naturally Ventilated Polyhouse)

Gerbera cultivars were raised in a naturally ventilated polyhouse (NVP) which was oriented in North-South direction with a size of x m square with central height of 6 m. The frame was constructed with galvanized iron pipe. The area for side ventilation and top was one meter. A rollable low density polyethylene (LDPE) flap was provided on both sides of the polyhouse to control the ventilation area and to cover the side vents during rainy season to avoid the entry of rainwater. Glazing was provided with 200μ (800 guage) thick ultra violet stabilized low density polyethylene film. Shade net of 50 percent (white colour) was fitted inside naturally ventilated polyhouse, which is used to spread and roll according to the requirement of shade and cooling effects inside the polyhouse. Drip irrigation system was installed for the complete cropped area.

The temperature (30 – 34"C) and relative humidity (85% – 90%) inside the polyhouse were maintained by operating the foggers which are placed at 2 m × 4 m apart.

6.2 Growing and Potential Belts

Bageshwar, Pithoragarh and Champawat is 315.99 hectare, more than that of the Garhwal division."The districts of Udham Singh Nagar, Nainital lead in the producton of gerbera which is sold as a cut flower while the remaining districts have made their presence felt in the production of gladioli,".However, this cannot be said of the Garhwal division where floriculture is yet to pick up in the hill districts of Pauri, Tehri, Rudraprayag and Uttarkashi.In the Garhwal division, the growers in the districts of Haridwar, Dehradun and Chamoli have taken to floriculture in a big way.

6.3 Land Preparation

The land is cleared of all vegetation and leveled thoroughly.

6.4 Planting

The details of planting operations are given below :

Planting should be done in uniformly moistened potting mix. Place the plant into the potting mix so the top of the jiffy/plug pot is 1 cm higher of the potting mix. If planted too high, the plants might break at harvest. While planting too deep increases the risk of disease (rotting of the heart). Prevent root damage by carefully pressing the potting mix against the pot. Under conditions with high daytime temperatures in the greenhouse (> 30°C), it is recommended to plant early in the morning or in the evening when the temperature is less extreme. To allow a good contact between pot and soil, it is recommended hand water very soon after planting. Again this should be done early in the morning.

6.5 Nutrition

The following table gives detail of the fertilizers / manures recommended for application :

A feeding unit with an A + B tank is preferred to give the exact quantity of nutrients to the plants. The EC and the pH are measured and directly corrected. The set points of the pH and EC put in the computer are given to the plants.

Fertilizer program:

Calcium Nitrate	**CaNo3**	**26%CaO + 15.5 N**	**75kg**
Ammonium Nitrate	NH4NO3	9%NO3 + 9% NH4	0-3 *kg
Iron Chelate	Fe	Edta 13% or Eddha ** 6 % 	2kg 4kg

Tank A:-1000 ltr concentration:-1:100

Mono Potassium Phosphate	H2PO4	52% p2O5 + 34% K2O	17 kg
Potassium Nitrate	KNO3	13% N + 46% K2O	35 Kg
Potassium Sulphate	K2SO4	52% K2O + 16% MgO	2.5 Kg
Epson Salt	MgSO4	49%MgSO4 = 16%	25 kg
Nitric Acid	HNO3	38%	0-10 *** Litre

6.6 Irrigation

6.6.1 Drip irrigation.

A drip irrigation system is recommended; as each plant receives the same amount of water, and by supplying the water directly on the potting mix, the plant itself does not become wet (so preventing diseases). The pipes of the system are placed on the ground between the two rows, to prevent the dripper line becoming empty, and the water temperature in the dripper line is out the reach of direct sunlight.

6.6.2 Watering, how and when.

Start with irrigation about one or two days before planting, to make the potting mix already wet. This will help the gerbera plant to make a better start.
Start one hour after sunrise when the plants are just planted in the pots. In the first 1-2 months you must be careful that the potting mix does not get too wet, in this period you could stop 5-6 hours before sunset. When the plants are full grown you could stop 3-4 hours before sunset,Use the drip irrigation 2-10 times a day. This depends on the size of the plant and the time of the year. There could be a difference, between a cloudy and sunny day of 40-50% in the usage of water with the gerbera plants.
The drain must be between the 30-40% of the total water gift, Please note that there could be a difference between the structure of the soil, these means that every type of soil require a different amount of water.
Per dripper a minimum of 60cc and maximum of 100cc should be give per irrigation. When the plants are older a minimum of 80cc per irrigation should be given depending on the season.
Check regularly if the moisture of the column just below the drip is the same as at the base of the column. If the top soil is wetter than the soil at the base, increase the water quantity per supply. On the other hand, if the situation is reverse (top soil drier than base), reduce the water gift.

6.6.3 Drippers

A capacity of 2 litre per hour is preferred as the chance of congestion is smaller.
By using a drip system, a wet (water) column is created through which the roots grow.

Place the drippers the first 2-3 weeks next to the jiffy pot, after 2-3 weeks when the roots are growing out of the jiffy pot in to the potting soil replace them approximately 5 cm from the jiffy pot.

6.6.4 Screens

One of the elements that attributes to optimum growing conditions in greenhouses are movable aluminized climate control screens. Such screens are used for different purposes, all linked to the growing climate: shading, cooling, temperature and humidity control. Besides this screens save on heating expenses. Short stems and a pale floral colour might be caused by too much sunlight and/or high temperatures. Shading will be the best solution.

7. Heating.

7.1 Temperature settings.

A gerbera plant require in some parts of India heating, the ideal temperature for a gerbera is night time 15-16 degrees. The absolute minimum for the night is 10-12 degrees, if the greenhouse temperature becomes below this temperature the gerbera plant will show the following effects (shorter stems, colour of flower change, and more chance of botrytis) The day temperature should be at least 17-18 degrees, .

Prevent condensation on the flowers, it increases the problems with Botrytis on the petals (flowers). Avoid a rapid temperature rise, this causes condensation. If a heating system is available, raise the glasshouse temperature several degrees about four hours before sunrise. Start ventilation as soon as the sun starts influencing the glasshouse temperature.

With dark and rainy days it is better to put a minimum temperature of 40 degrees in the heating pipe, this will activate the plant and reduce the change of botrytis.

Monthwise approx yield per 1000sqm

8. Plant Protection Measures

8.1 Crop maintenance

Growing Gerbera's is rather straight forward, however picking leaves is often debated. Leaves, besides allowing photosynthesis, also reduce temperature and

increase humidity, and therefore are an essential part of the plant. However, if the plants do become too bushy, it is recommended to remove only a few leaves at regular intervals. Do not take away too many leaves at once! One can pull the leaves from the plant (natural breaking point), or cut them off leaving half of the leaf still standing. N.B. While pulling the leaves, be careful not to break the plant or damage young buds. After removing leaves it is advised to spray for Botrytis.

9.Harvesting of the flowers.

9.1 Picking the flowers

Depending on the conditions, a Gerbera starts flowering 8-12 weeks after planting. Harvest 2 to 3 times a week, however to get a uniform product some cultivars are recommended to be harvested at least 3 times a week.

9.2 Treatment after picking the flowers

1. Pick the flower from the plant when one or two rows of stamen are visible. This is important because raw flowers need much more energy to develop completely but they have only a few reserves. Due to this the durability of raw 8 flowers is shorter.

2. Pick the flower of the plant instead of cutting it off. When the stem is cut, a part of it will remain on the plant and starts rotting. This part can infect the heart of the plant, which will result in stagnation in the development of new shoots. Therefore it is very important that the entire stem must be picked off the plant.

3. After the flower has been picked, 2 to 4 cm need to be cut off the lowest part off the stem. The lowest part of the stem consists of very narrow xylem vessels, through which the water can hardly be transported into the stem. By cutting off this hard part of the stem the flower can take up the water much better, which is important to avoid breach of the stem and bending necks.

4. Put the stems in clean buckets with clean water immediately after harvesting and place them in a cool area. Before every use these buckets need to be disinfected to avoid the growth of bacteria in it. Bacteria block the stem so that it cannot take up any water. Using clean water is very important, the pH of the water may not be too high, otherwise you create an ideal climate for bacteria. A pH level between 3.5 and 4 is good. Chloride is a good product to be added

to the water, because this kills bacteria and makes the pH of the water reduce. Don't place the buckets in direct sunlight, because it will break down the Chloride.

5. The flowers take up water more easily if a large part of the stem is placed in water, 10 to 15 cm is ideal. The temperature may not be too high, because otherwise the flowers would lose too much water through evaporation. A temperature between 10° and 15° Celsius is ideal.

6. The area in which the gerberas are being watered for a long period should be free from ethylene. Ethylene is an ageing hormone that affects the durability of the gerbera. Ethylene is liberated for example from the exhaust-gases of engines. To avoid ethylene ageing of the gerbera flower, it is recommendable to turn off the engine of the truck during loading, as a precaution.

7. During the long period of watering the flowers, special flower nutrition can be added to the water. This gerbera flower nutrition consists of sugars and ingredients to bring the pH down as well as to reduce the growth of bacteria. Sugars have a favourable effect on the durability of gerbera flowers, but if only sugars would be added, this would seriously stimulate the growth of bacteria, so this is not recommendable. A high concentration of sugars in the petals make it easier for the flower to take up water, which results in a better blooming and durability. We recommend the use of an anti bacterial product (Florisant 500, or Chrysal RVB) to reduce the growth of Bacteria in the flower stems.

8. The loss of water in a gerbera flower causes ageing, so this should be avoided as much as possible. Avoiding draught or wind, as well as increasing the relative humidity around the gerberas up to 70% can decrease the evaporation of water by the flower.

9. During storage and transport the process of ageing can be slowed down by keeping them in a cool climate. By slowing down this process of live, the reserves in the flower won't be used and so they are saved for usage during blooming at the consumer's. The ideal temperature during storage in the cool room and transport is between 6° and 9° Celsius.

10.Marketing

Farmers directly sell their produce to the middlemen. The fruit is sold through a post harvest contractor to the wholesale or commission agent, who undertakes the harvesting and packing, in addition to transporting the produce to the market. More than 65 % of the growers prefer sale through post harvest contractor and about 20 % undertake self marketing.

The main channels of marketing include the following:

- Producer – PHC – wholesaler/commission agent (distant market) – stockists – retailers – consumers.
- Producer – wholesaler/commission agent (distant market) – stockists – retailers – consumers (self marketing).
- Producer – Village level agent – commission agent – stockists – retailers – consumers.

11.TECHNOLOGY SOURCES

The major sources for technology, as well as quality planting material are:

i) Hill Campus, Ranichouri, G.B. Pant University of Agriculture and Technology, Tehri Garhwal, Uttaranchal.

ii) Department of Horticulture and Food Processing, Udhyan Bhawan, Chaubatia, Ranikhet, Almora-263651, Uttaranchal.

iii) Department of Horticulture, Birsa Agricultural University, Kanke, Tel : (0651)-2230691.

12. ECONOMICS OF A 1000 sqm MODEL

Costs & Returns:

12.1 A one acre plantation of the crop is a highly viable proposition. The cost components of such a model along with the basis for costing are exhibited in ***Annexures I & II.*** A summary is given in the figure below. The project cost works out to Rs.1.50 lakh per acre.

Figure-I: Cost of Project

Project Cost:

(Amount in Rs.)

Sl. No.	Component	Proposed Expenditure
1.	**Cultivation Expenses**	
	(i) Cost of planting material	2400
	(ii) Manures & fertilizers	5000
	(iii) Insecticides & pesticides	3000

	(iv) Cost of Labour	5600
	(v) Others, if any (Power)	3600
	Total	**19600**
2.	**Irrigation**	
	(i) Tube-well/submersible pump	50000
	(ii) Cost of Pipeline	-
	(iii) Others, if any, please specify	-
	Total	**50000**
3.	**Cost of Drip/Sprinkler**	**20000**
4.	**Infrastructure**	
	(i) Store & Pump House	10000
	(ii) Labour room	6800
	(iii) Agriculture Equipments	10000
	(iii) Others, if any, (Drying platform)	-
	Total	**26800**
5.	**Land Development**	
	(i) Soil levelling	4000
	(ii) Digging	-
	(iii) Fencing	29600
	(iv) Others, if any, please specify	-
	Total	**33600**
6.	**Land, if newly purchased** (Please indicate the year)*	-
	Grand Total	**1,50,000**

**Cost of newly purchased land will be limited to one-tenth of the total project cost*

12.2 The major components of the model are:

- Land Development: (Rs.4.00 thousand): This is the labour cost of shaping and dressing the land site.
- Fencing (Rs.29.60 thousand): It is necessary to guard the orchard by barbed wire fencing to safeguard the valuable produce from animals and prevent poaching.
- Irrigation Infra-structure (Rs.50.00 thousand): For effective working with drip irrigation system, it is necessary to install a bore well with diesel/electric pumpset and motor. This is part cost of tubewell.
- Drip Irrigation & Fertigation System (Rs.20.00 thousand): This is average cost of one acre drip system for the crop inclusive of the cost of fertigation equipment. The actual cost will vary depending on location, plant population and plot geometry.

- Equipment/Implements (Rs.10.00 thousand): For investment on improved manually operated essential implements a provision of another Rs.10 thousand is included.

- Building and Storage (Rs.16.80 thousand): A one acre orchard would require minimally a labour shed and a store-cum grading/packing room/pump house.

- Cost of Cultivation (Rs.19.60 thousand): The cost on planting material, inputs used and labour in cultivation operations is estimated at Rs.19.60 thousand during the pre-operative period.

12.3 Labour cost has been put at an average of Rs.70 per man-day. The actual cost will vary from location to location depending upon minimum wage levels or prevailing wage levels for skilled and unskilled labour.

12.4 **Recurring Production Cost:** Recurring production costs are exhibited in ***Annexure III***. The main components are planting material (80 plants/per acre at 7x7m spacing), land preparation, inputs application (FYM, fertilizers, liming material, plant protection chemicals etc.) and labour cost on application of inputs, inter-cultural and other farm operations.

12.5 Besides, provision is also included for power charges, labour for harvesting and packing/transportation charges for the produce to the nearest secondary market.

12.6 Inter-cropping with vegetables from year 2 to year 5 has been taken into consideration for economic viability of the project.

12.7 **Returns from the Project:** The yield from the plantation is estimated to go up from 2.0 tonnes in year 5 to 6.0 tonnes in the year 9 at which it levels off. The produce has been valued at Rs.15,000 per tonne.

Project Financing:

12.8. **Balance Sheet:** The projected balance sheet of the model in the post-operative period, is given at ***Annexure IV***. There would be three sources of financing the project as below:

Source	**Rs.Thousand**
Farmer's share	75.00
Capital subsidy	30.00
Term loan	45.00
Total	**150.00**

12.9. **Profit & Loss Account:** The cash flow statement may be seen in ***Annexure V***. ***Annexure VI*** projects the profit and loss account of the model in the post operative period. Over a five year cycle the gross profit works out to Rs.178 thousand.

12.10. **Repayment of Term Loan:** The term loan will be repaid in 11 six monthly installments with a moratorium of 60 months. The rate of interest would have to be negotiated with the financing bank. It has been put at 12% in the model (vide ***Annexures VII & VIIA***). Depreciation calculations are presented in ***Annexure VIII***.

Project Viability:

12.11. **IRR/BCR:** The viability of the project is assessed in ***Annexure IX*** over a period of 15 years. The IRR works out to 28.85 and the BCR to 2.2.

12.12. The Debt Service coverage ratio calculations are presented in ***Annexure X***. The **average DSCR** works out to 3.51.

12.13 **Payback Period:** On the basis of costs and returns of the model, the pay back period is estimated at 6.12 years (vide ***Annexure XI***).

12.14 **Break-even Point:** The break even point will be reached in the 3rd year. At this point fixed cost would work out to 61.3% of gross sales - vide ***Annexure XII***.

ROLE OF IT

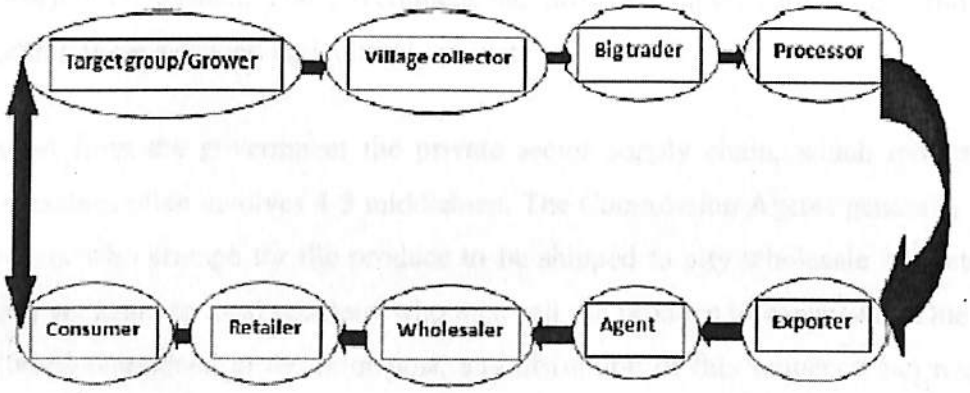
1.Role of IT in agriculture supply chain management

Agriculture supply chain concept:

Supply chain is a kind of network where only one player is involved at each stage a manufacturer a manufacturer may receive material from several suppliers and then supplyseveral distributors. Thus most supply chain is actually networks. A typical supply chain may involve actors like customers, retailers, Wholesalers/distributors, manufactures and raw material suppliers.

The concept of supply chain in agriculture is relatively new. It includes the all stages directly or indirectly involved in fulfilling the customer request in addition to the functions of product development, manufacturing, marketing, distribution, finance and customer satisfaction.

It is the process of managing of these intermediaries and functions efficiently.



Supply chain management and agricultural business are integral part of agricultural marketing system. Efficient supply chain and business models are necessary for creating efficient agricultural market which delivers agricultural produce from the farmer to the consumer in the most efficient way. While output and productivity are supply side factors, markets provide an intermediate link between producers and final demand by consumers.

In India two types of supply chain can be seen– one which is highly-regulated by the government and another that is run by the private sector. Due to food security concern in 1960's, the Indian government decided to make rules on five agricultural products – wheat, rice, pulses, sugar and edible oils. In both supply chain the farmers sell their produce to the commission agent in negotiated prices due to lack in market accessibility after which the commission agent find a

buyer, usually the government or a produce trader, and then charge a percentage commission which generally ranges from 2.5-6% of the transaction value.

The Commission Agents also provide financial assistance to farmers throughout the growing period which is very important since most farmers can't get credit in excess of the value of their next harvest as they have so little land, this means they can rarely afford to make investments that will increase efficiency and reduce waste. The supply chain splits between the government (largest purchasers of crop, wheat) and the private sector.

In case if government is buying, the Food Corporation of India will transact with those commission agent at a regulated minimum support price and the FCI plays a very important role as they distribute the agricultural products to impoverished populations through the Public Distribution System. The government has provided ration card to government employees for getting these subsided agricultural products

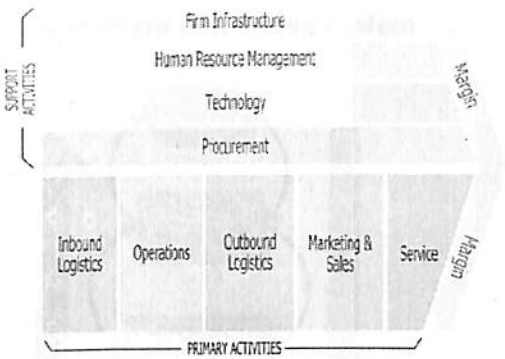
Apart from the government the private sector supply chain, which moves mostly fruits and vegetables often involves 4-5 middlemen. The Commission Agents generally sell to one or more traders who arrange for the produce to be shipped to city wholesale markets. Once there, it is sold yet again to local retailers, who then sell the produce to consumers. Due to the lack of cold storage mentioned in the prior post, any disruption of this sequence can result in tons of food spoiling. The number of commission agent in private are more in government supply chain which results in inflation of agricultural products prices.

The current scenario of upcoming larger food companies is beginning to change the traditional scenario through direct purchases from farmers as well as investment in modern processing and logistics. However, these participants still play a minor role in the overall supply chain, as the government limits and regulates foreign direct investment in India.

1.1Value chain analysis

A value chain is a chain of activities for a firm operating in a specific industry. The business unit is the appropriate level for construction of a value chain, not the divisional level or corporate level. Products pass through all activities of the chain in order, and at each activity the product

gains some value. The chain of activities gives the products more added value than the sum of the independent activities' values



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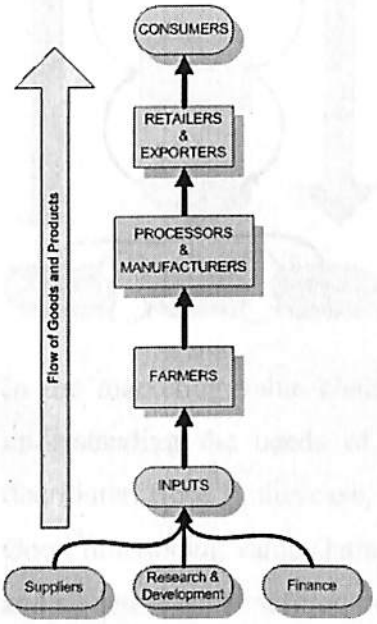


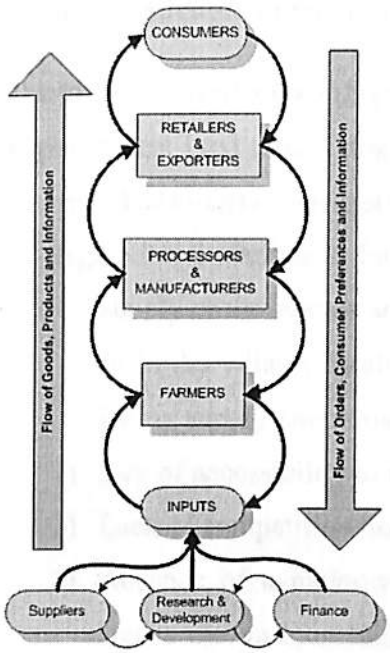
Traditional value chain:

In traditional value chain, farmers produce the raw product and push it or deploy it to the market directly. The raw product is either consumed as it is or it is processed through processes which increases the product value of each level of processing which is generally referred as value chain of the product.

The value of the product increases with respect to the every activity within the process In the value chain, the product which is going through.

In the traditional value chain, the farmer is totally unaware of the progressing value of the product across the value chain.

Value chain marketing system



In the marketing value chain approach, every player within the value chain is benefited by understanding the needs of the consumer and a close relationship between producer and distributer. Here, in this case, a new concept of customized or need based production is emerged. Good functioning value chains are said to be more efficient as they bring products to consumers and all actors get benefitted from value chain development.

Challenges in agri supply chain:

Modern agricultural supply chains have three major flows:

- **Physical product flows-** They are the physical product movements starting from input suppliers to producers to buyers to final customers.
- **Financial flows-** They are the credit terms and lending, payment schedules and repayments, savings, and insurance arrangements
- **Information flows:** They coordinate the physical product and financial flows.

Logistics and communications are integrated in all of these flows. Poor logistics and information is a major source of risk facing an agricultural supply chain

1. Challenges in terms of coordination

Due to Lack of coordination in Supply chain functionaries there is increase in manufacturing Cost, Inventory Cost, Replenishment Lead time, Transportation Cost, Labor Cost, and Level of product availability which ultimately lead to disputes amongst chain partners.

Agricultural markets in India, in particular the business models of agri businesses along with supply chain models are very inefficient. In India, farmers' produce is generally disposed of in the village, rural/primary market or secondary agricultural market. The challenges facing supply-chain management and agri-business in India can be broadly classified

1) lack of accessibility to regulated markets,
2) Lack of competition under the Agricultural Produce Market.
3) Absence of a nationwide common agriculture market. These are challenges that run across the various channels through which the supply-chain and agri-business models operate. These channels are (i) Producer-Consumer, (ii) Producer-Retailer-Consumer, (iii) Producer-Wholesaler-Retailer-Consumer, (iv) Producer-Commission agent-Wholesaler-Retailer-Consumer and (v) Producer-Village Merchant-Wholesaler-Retailer-Consumer
4) Lack of internal infrastructure across the country.
5) Lack of efficient logistics and transportation facilities.
6) Information needs of stakeholders are not satisfied with the existing system.
7) Gaps in demand supply cycle.
8) Agriculture markets in India are regulated through the model APMC Acts.

The model APMC Act allows States to collect market fees from the buyers/traders on the sale of notified agricultural produce which are generally high. The high incidence of commission charges on agricultural/horticultural produce renders marketing cost high. There are other charges like entry tax/octroi tax that vary across states as well as across commodities. These charges prevent the emergence of a nationwide common market for agricultural produce. Moreover, restrictions on the movement of goods under the

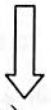
Essential Commodities Act remain in place in various states. These had inhibited free access of agriculture markets. Most of the agricultural markets are also characterized by dominance of cash based transactions where issues of cash management also become important. Also, there are issues of weights and measurements as well as the presence of brokers and commission agents

2. IT Applications in Agri-Supply Chains

Use of IT can be used for the supply chain management process:

For local collectors at village level

Local traders (covering large area)



Middlemen traders (covering large areas)

Wholesalers and regional traders

Retailers and industries / Companies

Consumers

The overall agricultural sector is facing a new trend with the innovation of Information and Communication technology (IT) which has given opportunities for smaller holder farmers in developing nation. There are many challenges where IT can aid in taking advantage of opportunities and mitigating some of the challenges.IT applications guided by business logic has given many advantages in supply chain by reducing costs of coordination in collection of production, distribution and in making transparent decision between partners; reducing transaction costs; disseminating market demand and price information; disseminating weather, pest, and risk-management information; disseminating best practices to meet

quality and certification standards ,collecting management data from the different field and ensuring traceability which could prove to enhance the Agribusiness and motivate the small holders farmers.

The interventions drivers are different and varied from private to public sector. There lies a bigger difference between them. In private sector they view supply chain relationship as a competitive advantage. The IT applications developed by them which provide services are typically exclusive to its suppliers. Larger agribusiness needs resources to deploy available IT solutions within their supply chain and if they are supported by a potential viable business model they will prove to be sustainable but they might focus on smallholders .In public sector the inclusion of small holders are focused as a public good. There supply chain focus on inclusion. The applications created and developed by them are less likely to be exclusive as they usually designed to be specific to particular projects and used one time, public-sector interventions are unlikely to be easily generalizable to other contexts Now organizations have understood the importance of information flow in supply chain and how valuable is it. They are focusing on logistics and supply chain system for reducing the transaction costs of procuring from smallholders. Now any sizeable company nowadays uses SCM systems to handle procurement systems.

There are specified functions performed by supply chain software which are running on networked computers:

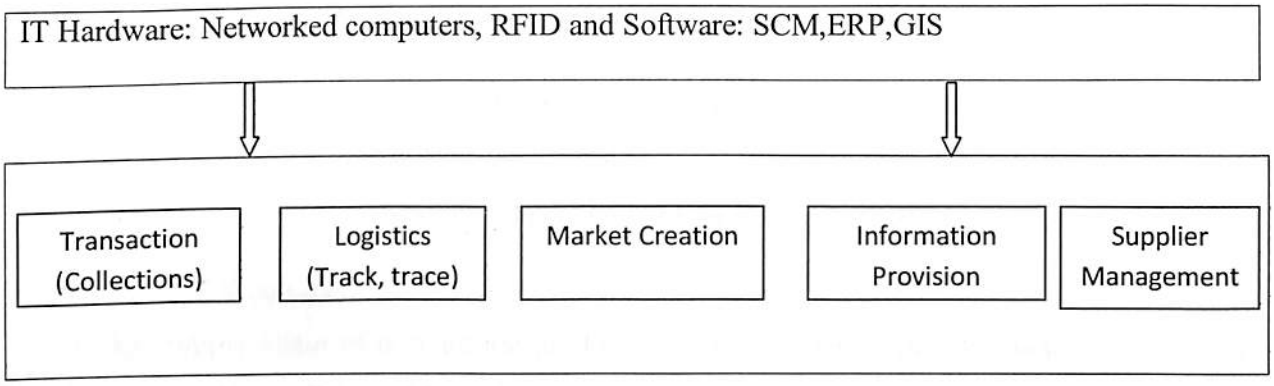
1. Storage of information about the suppliers- the function provide information to food-processing company about which farmers grow what, information about farmers' names, locations, previous transactions, and previous performance. Such a database makes it much easier to deal with a large base of smallholders.

2. Order details-this allows to know what is required, when it will be collected, and how much will be paid for it.

3. Production monitoring can be done effectively making it possible to manage quality and incentivize high-performing suppliers or support poorer performers.

4. At last, SCM software might track the transport of goods from the farm gate to the warehouse or retailer.

Typical IT Applications and services



The use SCM systems can be proven difficult due to lack of context-appropriate software, the prohibitive cost of hardware, and the lack of supporting infrastructure. By the use of IT and their applications analyzed that the technologies can solve many supply-chain problems associated with transactions such as ordering, invoicing, payment, in logistics such as collection, storage, transport, In quality assurance problem like safety, traceability, process management (production oversight, input distribution, extension support) and product differentiation (specialization in organic, fair trade, or regional labels).There are Some applications which are masters in handling activities from transactions to logistics and quality control where as other focus on smaller subset of areas. There is a sense that IT applications can act as glue which will holds together complex supply-chain partnerships. The rapid flow of information between buyers and producers that such applications allow minimizes misunderstandings, allows for risk management, provides higher levels of transparency, and ultimately fosters trust. Better communication between farmers and procurers, and systems which will allow farmers to be paid faster on return can reduce abrupt behavior and help relationships endure. The application of ITs can be expensive from the perspective of software development or purchase, implementation, training. Nowadays IT has played a vital role and helped the organization in keeping real time information, to automate delivery and billing, and retailers are striving to complete the implementation of scanner systems. Successful IT-based coordination between firms and suppliers or distributors occurs in several industries which have proven fruitful and profitable for them.

Typical areas where IT can be implemented and reduce in cost and inventory automation of ordering processes and payment mechanisms, scheduling of warehousing and delivery, and control systemsfor quality assurance in production. The point-of-sale scanner is the key IT tool for tracking retail demand in the grocery industry.

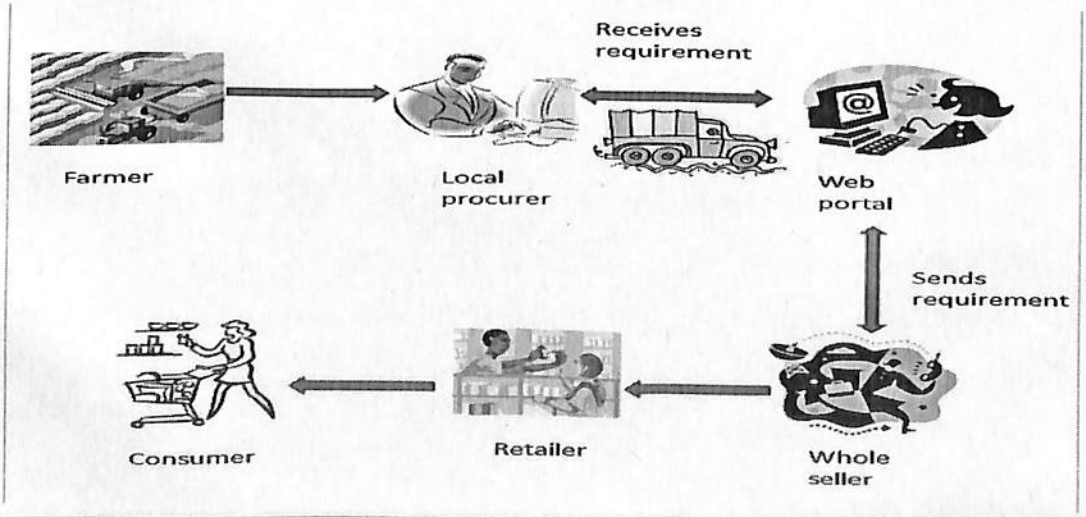
Using ICT to manage distribution and supply chains can increase efficiency and predictability and reduce waste in value chains

Examples of existing agriculture supply chain throughout the world

a) ITC E-choupal
b) Supply chain of agricultural products in Tanzania (Agricultural Products from Regions into Dar es Salaam Market)
c) Supply chain of cashew nut by Tanzania who is world fourth largest producer of cashews after Vietnam, India and Brazil.
d) Wal-Mart Supply chain of agricultural products.
e) Supply chain of Mc-Donald
f) Supply chain Trikaya Agriculture
g) Ghana's processed fruit supply chain
h) South Africa–The Netherlands' Fresh Fruit Supply Chain

3. Proposed Model:

Web based exchange model



How would this model address the challenges of current agri- supply chain model?

1. This model integrates two or more intermediate processes which directly lead to cost reduction.
2. This business model supports the concept of customized farming based upon the analysis of demand and supply patterns.
3. The wastage with tis model is relatively low.
4. This model delivers an efficient collaboration and cooperation across every level of supply chain.
5. The information needs of every stakeholder are satisfied providing the information system developed in order to disseminate timely adequate and accurate information across each level of supply chain.
6. This model efficiently deals with the gap in demand and supply patterns.
7. Farmers get good price for their produce and being informed about day to day market price, and also get aware of new technology, best practices or methodologies of cultivation, government schemes and vendors (seed, fertilizers, technology, etc.)
8. Optimal use of all physical resources

Bibleography

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