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Marketing channel of medicinal and aromatic plants (maps) in the great Himalayan National Park (GHNP), Kullu, Himachal Pradesh India

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Abstract

The evolution of man and the use of medicinal plants are linked and have been in trend since ancient times. Medicinal and Aromatic Plants (MAPs) play an important role in meeting the demand of traditional and modern systems of medicine. An exponential growth has been observed in the market expansion of medicinal plants in the last three decades. The consumption of traditional medicines is more in the developing countries than the developed ones, yet both have similar import values. The developing countries export more than the developed ones. India exports around 80 per cent of the medicinal and aromatic plants in the form of raw material including the dried plants, extracts and isolated ingredients. The present paper is based on the primary and secondary data collected from the selected pockets of Great Himalayan National Park (GHNP), where an effort has been made to study the marketing channel of MAPs trade in the villages of GHNP. In addition to this, comparative analysis has been done to analyse the market price discrepancy over the years mainly after restrictions imposed on collection of medicinal and aromatic plants and to assess the percentage market price change in some special status species of medicinal plants in the area.

Keywords: Medicinal plants, great Himalayan national park, Himachal Pradesh, critically endangered (CR) plants, endangered (EN) plants, vulnerable (VU) plants, marketing channel of MAPs

Introduction

The evolution of medicinal plants goes parallel with the advancement of various human societies. Since times immemorial, medicinal herbs have been considered as “safe haven” for human health. India has been the pioneer in using traditional healthcare practices since 4th millennium BC. More than 95 per cent of medicinal plants used by healthcare industry in India are collected from wild and less than 20 species of these plants are commercially cultivated. The world market value for Medicinal and Aromatic plants was USD 1.1 billion in the year 1999, USD 1.8 billion in 2009 and USD 3 billion in 2015. The estimated market value for the financial year 2020 is 35 Billion USD. India is home for 17,000 species of flowering plants, out of which 8000 plants are used for medicinal purposes. The growth rate for export of raw medicinal plants during 2018 to 2019 is 14.2 per cent with a market value worth USD 330.18 million. In terms of volume and value of medicinal plants exported, India stands second in the world. Total commercial demand of herbal raw drugs in the country for the year 2014-15, converted to dry weight for all entities, has been estimated at 5,12,000 MT (Goraya, and Ved 2017) [5]. There are approximately 3500 flowering plants in Himachal Pradesh, out of which the medicinal plants amount for 900 species and Aromatic plants are 150 in number. There are 150 to 200 commercially available Medicinal and Aromatic plants. Around 100 plants are annually harnessed for trade. Out of the total MAPs 75 species are threatened and endangered. 375 MAPs can be cultivated in different agro-climatic zones of Himachal Pradesh. More than 100 species of plants are endangered in Himachal Pradesh. In 2006, Chauhan enlisted 78 endangered species of medicinal and aromatic plants. Owing to the tremendous stress that flora of the state is subjected to the biodiversity is at serious threat. Various reasons for decline in floral diversity include illegal extraction and trade of MAPs, developmental activities, encroachment of forest land, habitat fragmentation, habitat degradation and many more. Keeping in mind the seriousness of the damage to flora the Department of Environment, Science & Technology, Government of Himachal Pradesh enlisted the plants under various categories. The plants have been enlisted as follows:

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Critically Endangered (CR) Plants: Twelve plants have been enlisted in the critically endangered plants list. These are highly important plants which require immediate conservation efforts. These are those plants which are on the verge of extinction with a probability of 50 per cent for being extinct in the next two generations.

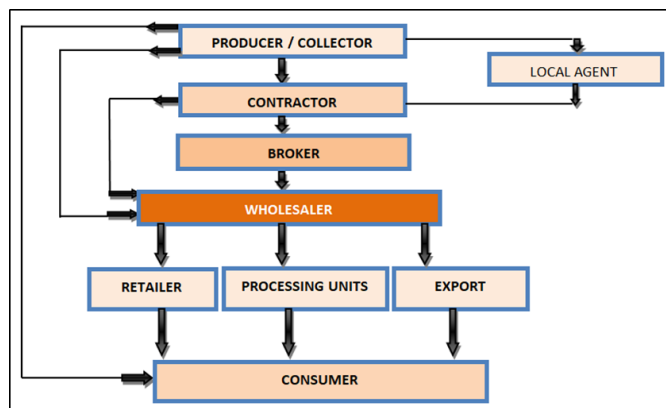
Endangered (EN) Plants: Twenty-one plants have been listed in this category. These are those species whose number has reduced to a critical level and have a 20 per cent probability of being extinct within 10 generations.

Vulnerable (VU) Plants: 27 plants have been enlisted as vulnerable. This category includes the plants that are at a potential risk of being endangered in the near future, if not taken care of at present. These plants have a probability of 10 per cent extinction within the next 100 years.

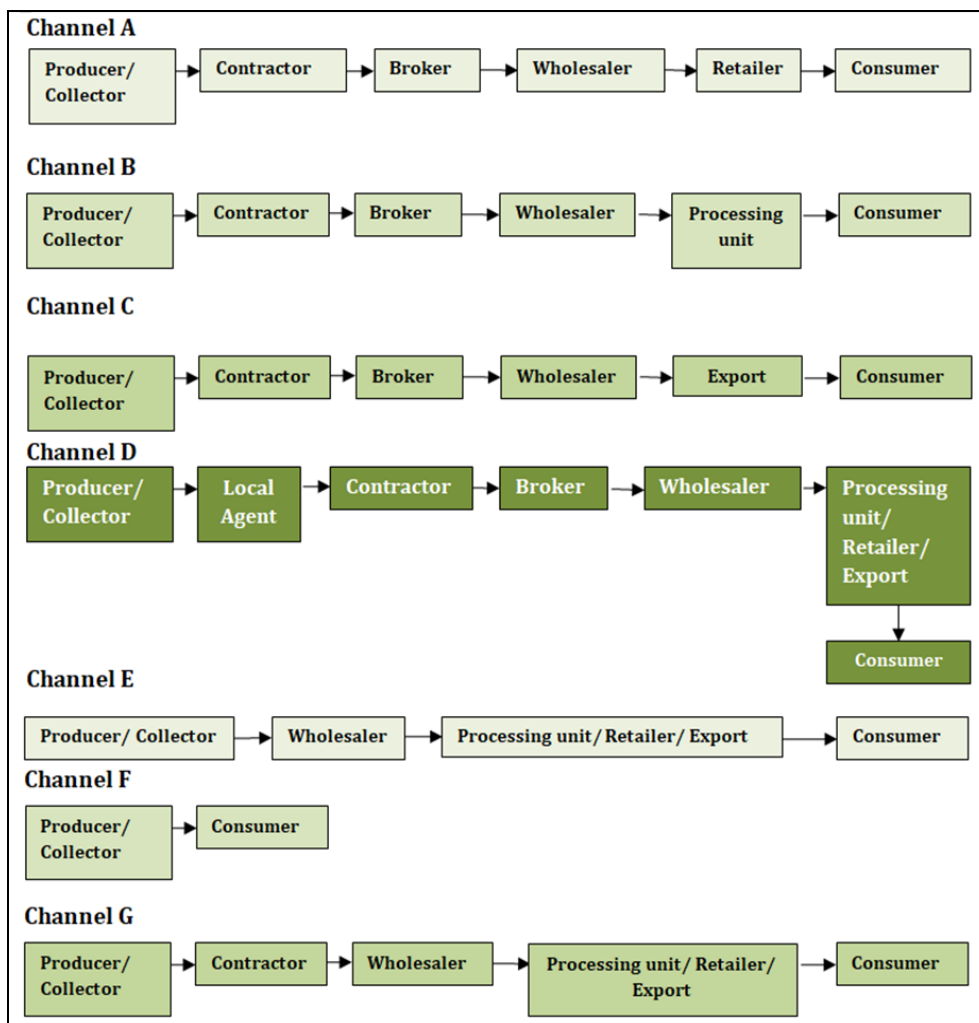
Trade of Medicinal Plants

MAPs are one of the important sources of forest revenue for the State forest department. The revenue generated by minor forest produce including medicinal plants was 11.18 lakhs for the time period of 2011-2012. The out turn of medicinal plants and their contribution to forest revenue in terms of quantity for 2012-2013 was 253 quintals with an estimated value of 333.23 lakhs. Commercially identified Medicinal Plants in the study area and their Permit Fee are listed in the table 1. The Himachal Pradesh Forestry Sector Medicinal Plants Policy, 2006 was notified under the Notification number FEE-B-C (16)-8/2005 on 27 November 2006. The Policy has been framed for “conserving and strengthening

medicinal plant resource base in forest areas as well as out of forests for use towards enhancing health and livelihood security of the people of the State on sustainable basis.” The HP Medicinal plants policy envisages the state to be one of the supreme herbal states in India by the year 2025. It aims at recognition of various medicinal plant resources of Himachal Pradesh as crucial forest produce. It also envisages providing employment to various rural and urban populations. One of the important visions of the policy is *in-situ* conservation of germplasm of medicinal plants. The main objectives of policy include management of plant resources in their natural habitat, i.e. the *in-situ* conservation of resources; pricing of wild harvest; establishment of germplasm banks; and documentation of diversity and status of medicinal plants.



Marketing channel of MAPs in Himachal Pradesh



The following Market chains have been identified in above mentioned Flow Diagram:
Some of the important features of various marketing channels for Medicinal and Aromatic plants are:

Producers: In most of the cases, the farmers are the sole producers since collection of MAPs is no longer allowed for most of the plants. The small farmers sell their cultivar in the local market or to a larger producer. The larger farmer either sells it through middlemen or to wholesalers or various retailers or directly to the consumer.

Middle Men: The two main types of middle men involved in MAPs marketing are either the Contractors (*Arhatias*) or the Brokers.

Wholesaler: The 10 Herbal Mandies are present in Amritsar, Bengaluru, Chennai, Dehradun, Delhi, Jaipur, Kolkata, Lucknow, Mumbai, Neemuch. These are situated in various cities and work as important transit points. The wholesalers have direct involvement with various retailers and processing units. They also have linkages with various exporters and are often potential exporters of the MAPs.

Retailers, Processing Units, Export: These are the group of various manufacturers of Ayurvedic medicines or other value added products. The Retailers sell the produce as it is to the consumers after proper gradation and packaging. The Processing units use the MAPs as raw materials in manufacturing homeopathic medicines, Ayurvedic formulations, cosmetics, perfumery and many more. The Exporters export the MAPs to other countries such as USA, France, Germany, Switzerland, UK and Japan. About 70-80 per cent of total export of crude drugs to these nations is from India. The most common exported MAPs and their products are *Aconitum heterophyllum*, *Dioscorea deltoidea*, *Plantago ovata*, *Podophyllum hexandrum*, *Rawvolvia serpentina* and many more.

Consumers: The consumers form the final node of the supply chain of MAPs. The final consumers may be the Ayurvedic medicine manufacturing firms, the Ayurveda practitioners and the households. The products reach the consumers through various supply channels and in different forms.

Material and Methods

The study area was selected in the Eco-development zone of the Great Himalayan National Park, district Kullu, Himachal Pradesh. The eco-zone of GHNP consists of around 160 villages. The Great Himalayan National Park is a repository of many important endangered and threatened species of medicinal plants. The study is based on the primary data gathered from the field and secondary data consisting of reports and relevant publications of GHNP. The case study of Chanyara Medicinal Plant Farm is presented in the paper. The farm is situated in Shangarh Panchayat of District Kullu. The Great Himalayan National Park Management initiated a project in early 2000's in which the seedlings of *Picrorhiza kurroa* were raised at the GHNP nurseries and cuttings were distributed to various WSCG's for plantation trials. Most of the trials didn't give satisfactory results except the Chanyara Farm Nursery.

Results and Discussion

Collection of Medicinal Plants in Great Himalayan National Park

Singh and Rawat (1999) stated that the GHNP represented approximately 26 per cent of the flora of Himachal Pradesh. "The Himalayan Medicinal Plants" are traded to Europe and North America. Polunin and Stainton (1984) enlisted the

major genera of these herbs. These include the following *Berberis*, *Daphne*, *Desmodium*, *Lonicera*, *Indigofera*, *Ribes*, *Rhamnus*, *Sorbaria*, *Viburnum* and two species of hill bamboo. In the earlier studies conducted by ICFRE under FREEP project, the trade of medicinal plants was studied along with detailed assessment of herb and mushroom collection in the GHNP area. The studies dealt with various stakeholders and their role in marketing of medicinal plants. The various stakeholders identified are:

The Collectors: Anderson's Forest settlement Act gave eleven villages in the GHNP right to collect the medicinal plants. The act is no longer applicable and in May 1999 all rights pertaining to collection of medicinal plants and various claims of land in GHNP were legally extinguished. Collection period varied from April to November. Various collection areas were demarcated in Sainj and Tirthan Valley. Detailed study in Sainj Valley included four panchayats. Shainsher and Shangarh were among the four panchayats. Herb collection was carried on in two areas:

- The forest area and the forest adjoining the villages where mostly family members collect the herbs.
- The Alpine pastures, the *Thatches* situated at high altitude, where collection was limited to a fixed period. Only young men of family were able to collect herbs from the area.

The herb collector's groups are of two types

- Higher altitude group: This included the graziers (the *fuwals*) and the local young men that would collect MAPs from high alpine meadows.
- Slightly lower altitude group: This included all the family members of the collector's household.

The herb collectors of adjoining villages were aware of regeneration capacity of various herbs. Hence they followed the "System of rational closure." The area that has been accessed in the present year will be taken up after a year's gap, i.e. alternate years. They considered the root as the most important part and made sure that a particular length of root is left behind. Local knowledge about the root depth of various plants was gathered and presented in the table 2.

The Traders: The traders coordinate with the DFO Seraj for transit of the MAPs. The traders were less than the collectors. Various types of traders identified are:

- Village Traders:** These village traders would collect the MAP raw materials from the villages at cheaper rates and sell it to other road head traders with a profit margin.
- Road head Traders:** In 8 villages situated at the road head, 20 road head traders were identified in GHNP. They buy MAPs from the collectors or the village traders and store them in their shops situated at road heads. The larger traders have linkages with them and later buy the material. The road head traders form an essential link in the marketing channel. They are not the fulltime dealers of MAPs.
- Regional Traders:** The regional dealers are fulltime businessmen engaged in MAPs and their trade. They are mostly situated in Bhuntar, Shamshi, and Kullu. They manage various activities such as road taxes. They pay royalties for various MAPs traded, handle export permits and transportation.
- The End Markets:** The major end markets are situated in the cities such as Amritsar, New Delhi, and Jaipur.

Amritsar was identified as the main end market. The exporters are present at the end markets who are involved in trading the material further after proper grading and packaging to international markets. Mostly they are sent the material to Europe and the processed form is further exported to other countries. The major firms that are associated with MAPs are Dabur International, Zhandu, Baidyanath.

GHNP Administration: The GHNP administration deals with the following:

- The post-harvest activities related to MAPs.
- Collection of various royalties and permit fee over the MAPs.
- They would take care of the ban period on the extraction of special status MAPs.
- Export fee is collected for 42 MAPs. A particular nominal of royalty ranging from Rs 50 per quintal to Rs 100 per quintal has to be deposited by the traders at the concerned DFO office.

Stakeholders and their Concerns

1. **Households of the area:** The 657 households in the two panchayats and a population of 2600 people living in eco-development area of the Great Himalayan National Park are the main stakeholders. The stakeholders that are primarily dependent on the forest resources include the women, the IRDP and BPL families and the SC population of the area. They are dependent on the forest resources for collection of fodder and cattle grazing, fuel wood collection, timber, collection of morels and the sale of other authorised NTFP's in the market.
2. **Farmers of medicinal plants:** Only one licensed cultivator was identified in the study area. The illegal extraction of MAPs is still one of the major concerns of the area. People involved in it are often sheltered by villagers and no information was revealed about them by anyone.
3. **Himachal Pradesh Forest Department:** The HP Forest Department deals with various activities linked with the protection, conservation and economic development of the GHNP. Various Eco-development plans and alternate income generation activities have been introduced and carried out in the area for the people.
4. **Panchayats:** Panchayats have a major role in the overall development of the concerned villages. The elected members are active and interested in the development of their respective panchayats.
5. Other Government departments and agencies.
6. Various village level institutions such as Self-Help Groups, Mahila Mandals, Yuvak Mandals, Devta Committee.
7. The Government of India through Wildlife (Protection) Act, 1972.

The vulnerable groups of the society are mostly dependent on the forests for fodder, fuel wood, timber and other non-timber benefits. The women are mostly dependent on the forests for fodder and fuel wood for their day-today activities. They are more responsible towards forests and have a keen eye towards activities going on in the forests. With the recent developments made by various Self Help Groups and WSCG's, the women have become more concerned and aware about the sustainable use of forest resources. The major concern of the households is the increased pressure on forest

resources with the increasing population.

1. Due to increasing pressure on the forest resources, the *Ghasnis*, thatches and other grassland areas are under tremendous pressure.
2. The involvement of local deity in the forests has ensured that the religious sentiments of the people towards the forests are maintained. This has helped in the conservation of forests and biodiversity linked with the sacred groves.
3. Due to settlement of rights meant for the collection of MAPs, the illicit extraction of the plants has increased and is one of the major issues of concern. The farmer associated with cultivation is not fully supported by the forest department. Hence, more activities must be undertaken to encourage people to cultivate MAPs.
4. The village level institutions involved in the area carry out various activities for awareness and income generation in the villages. The devta committee has a huge influence as devta is linked with the forests. The committee and the villagers collect fuel wood and timber from forests only when required for the religious activities linked with the village. The rules and regulations maintained by the devta must be integrated with the contemporary concept of Protected Area Conservation to curb poaching, illicit felling and illegal trade of MAPs from the area.
5. The Wildlife (Protection) Act, 1972, has all of a sudden banned all human activities in the Park which has led to a feeling of resentment among the local communities. Due to high dependence on natural resources associated with the park, the people dependents are left with the sense of weirdness towards their own surroundings.

Present Scenario of Cultivation of MAPs

As the traditional rights of the local community of GHNP were settled in May 1999, through an elaborate procedure prescribed in the Indian Wildlife Act, 1972; the collection of MAPs was banned for most of the important MAPs. While considering the livelihood options for the associated people, the GHNP management initiated various activities in the area, which also included propagation of medicinal plants. Various projects have been developed for MAPs and to support various collective marketing and small-scale enterprises based on MAPs collection and cultivation. The GHNP Management took the following initiatives:

- Training of staff and people involved in collection of medicinal plants for sustainable methods of harvesting methods.
- Establishment of MAP nurseries in various areas of GHNP and employing people on daily wage basis.
- Integration of Vermi-compost production, medicinal plants propagation and income generation on daily wage basis for various Women Savings and Credit Groups (WSCG's).

Comparative Analysis of Medicinal Plants Prices

The Great Himalayan National Park Management conducted a study with cooperation of ICFRE under the FREEP – GHNP Project on various aspects in the late 1990's. One of the studies conducted by Maureen A. DeCoursey, reported in November 1997, consisted of analysis of price fluctuation over the years in order to analyse the prices, profits and risks involved in the collection and trade of medicinal plants in GHNP. The market price of MAPs in 1997 has been compared with the present prices of and the difference

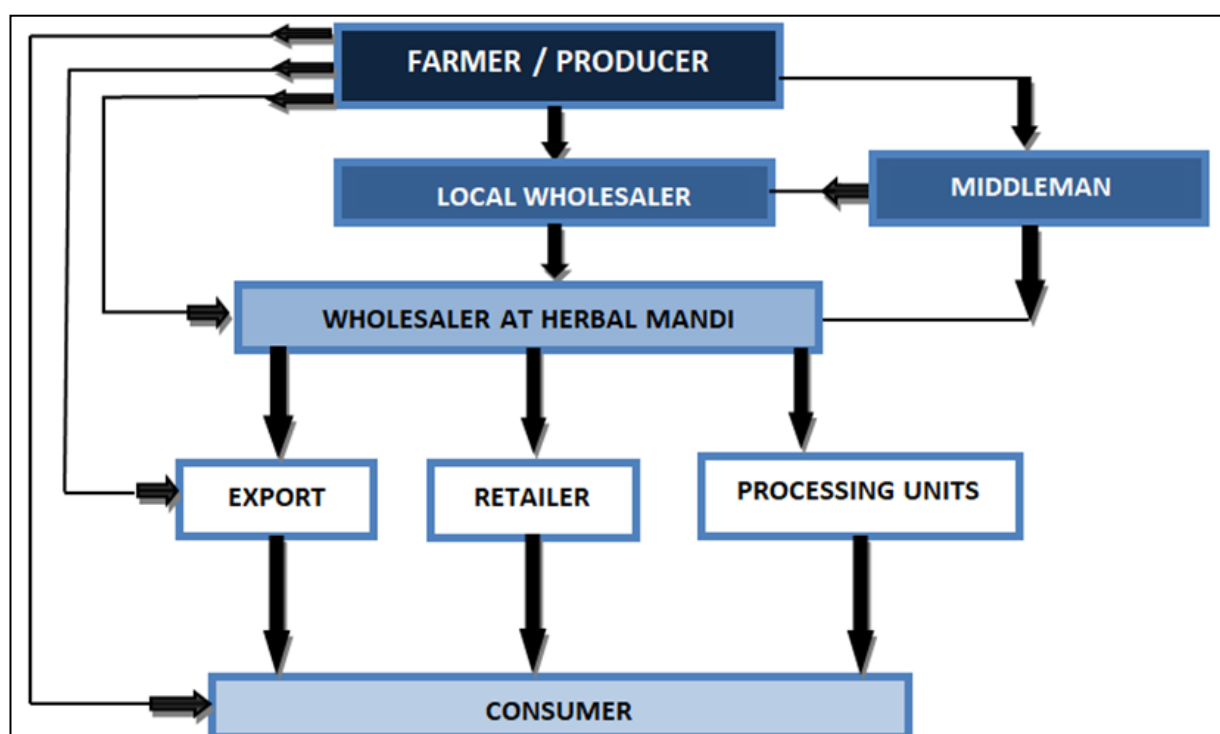
between the prices is evaluated. The Market Price of 1997 is that of the collected medicinal herbs and the present prices are of mostly cultivated herbs and some collected herbs. In case of plants that have a range of prices mentioned in 1997 study, the average price is evaluated for the two upper and lower ranges and then the average price is further compared to derive the difference. The market price of *Dioscorea deltoidea* for the year 1997 is unavailable, therefore the Market price of 1996 has been compared to the present price and a price difference of Rs 155 has been evaluated. Figure 1 reveals the analysis of percentage price change for the years 1997 and 2019. It shows that there has been a huge increase in the market prices of medicinal plants. This increase in market prices is mostly in *Valeriana jatamansi* which is 2300 per cent increase over 1997 price, followed by *Hypericum perforatum* depicting a price increase by 1900 per cent. The two leading plants are followed by *Permelia spp.* and *Picrorhiza kurrooa* with a percentage increase of 1650 per cent and 1488.23 per cent respectively. *Dactylorhiza hatagirea*, *Aconitum heterophyllum*, *Valeriana hardwickii* and *Viola spp.* have depicted a percentage increase of 682 per cent, 531.5 per cent, 525 per cent and 366 per cent respectively. *Jurinea macrocephala* which is locally used as incense and is used in commercial production of incense sticks and *dhoop* has increased its market value by 242 per cent over the last 22 years. The species that have portrayed least increase in price are *Podophyllum hexandrum* and *Morchella esculenta* with an increase of 25 per cent and 16.25 per cent respectively. In case of *Dioscorea deltoidea* the percentage increase of market price over the year 1996 is 775 per cent. There has been a huge positive change in the prices over the period of 22 years. The changes may be due to the following factors that determine the price:

1. Government regulation on restrictions imposed on extraction of MAPs.
2. Reduced extent of competition in the market as the number of collectors earlier was more than the number of farmers now.

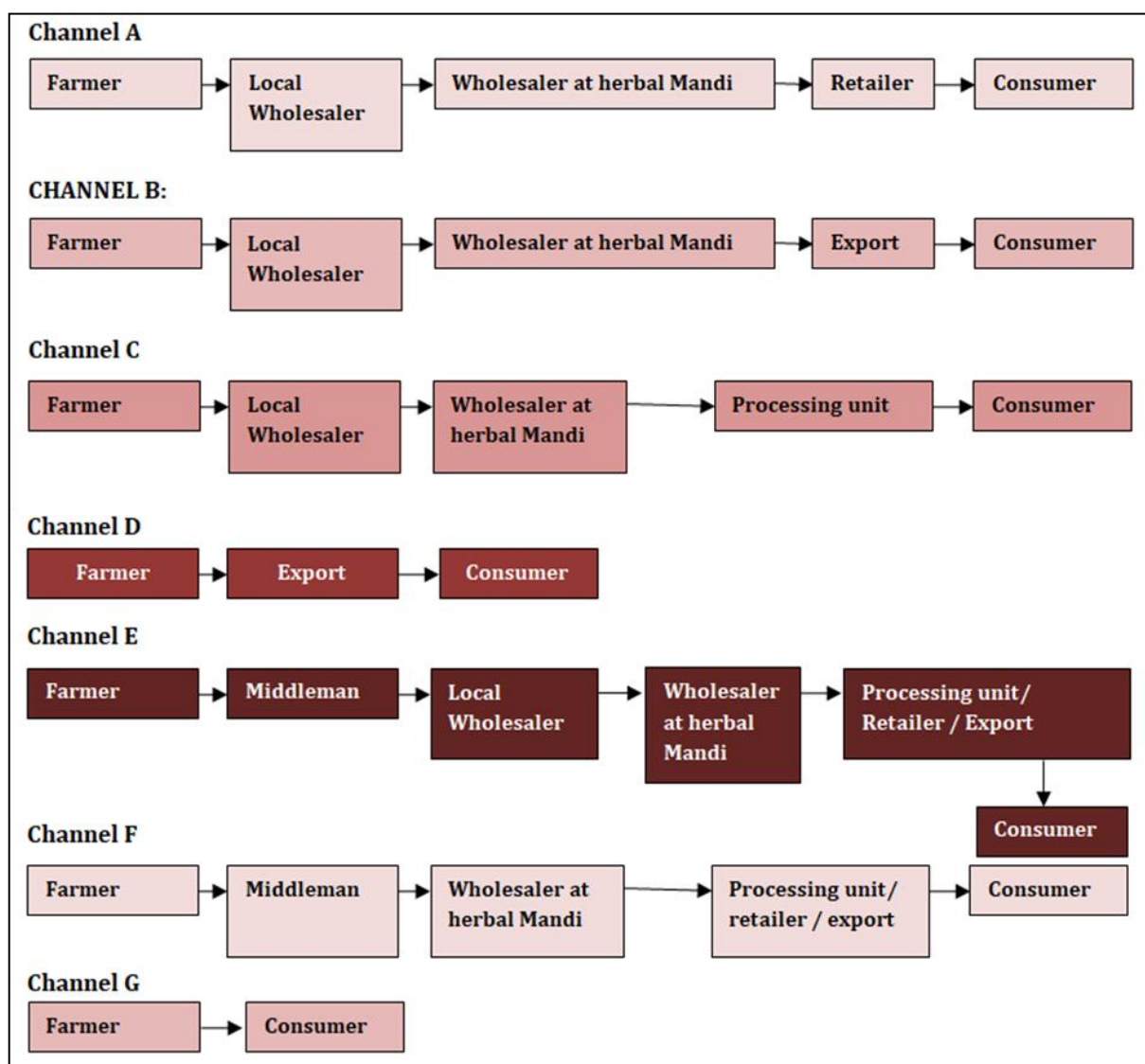
3. Change in the marketing method of medicinal plants.
4. Increase in demand of various herbs in different markets.

Case Study of Chanyara Farm

For getting an insight into the success of cultivation of Medicinal and Aromatic plants, the case study of medicinal plants farmer in two panchayats was undertaken. There was only one licensed cultivation farm situated at Chanyara, in Shangarh Panchayat. The farm situated an altitude of 2400 meters in Shangarh started commercial cultivation of medicinal plants in the year 2007. The plants from the farm are either directly transported to Herbal Mandis located at Amritsar, or sold in the local market. Initially the produce underwent a lot of tests to fulfil the quality requirements of Pukka Herbals, situated at the United Kingdom. Due to various stumbling blocks such as delay in CITES export permit which took two years, the inaccessibility of road from the farm and the strenuous attitude of the Government and Forest Department; the export to Pukka was no longer made after one produce. At present the plant species that are being cultivated at the farm are- *Picrorhiza kurroa*, *Podophyllum hexandrum* and *Angelica glauca*. The cultivation of medicinal plants is entirely organic and the harvested material is sold either in the local markets or directly sold in Herbal Mandis situated at Amritsar and Delhi. The produce is sold to the highest bidder in the market. There is involvement of middle men and they buy the produce directly from the farm at around Rs 50 or less per kg. The present case study is an attempt to analyse the marketing system and economies of production of medicinal plants in the GHNP study area, with the objective to examine and study the trends in marketing and existing marketing channel of the MAPs produced in the study area; to assess the cost of production of the MAPs; assessment of cost pattern for cultivation of the concerned medicinal herbs; and to analyse the existing problems and prospects in cultivation and marketing of medicinal plants in the study area.



Marketing Channel of MAPS in the study area: The following Marketing Channel has been identified in the case study:



The following Market chains have been identified in above mentioned Flow Diagram:

Cultivation of Kuroo

Scientific Description about the Plant

A brief description about the plant under study is given below:

Scientific Name: *Picrorhiza kurooa* Royale ex Benth.

Common Name: Kuroo, kutki

Family: Plantaginaceae

IUCN Status: Endangered

Altitude: 2700 to 5000 meters above mean sea level.

Description: The plant is an herb, with very strong roots that are 15 to 25 cm deep. The roots are zigzag underground Rhizomes. The leaves are spatulate and denate. The raceme consists of densely arranged bluish white flowers. Flowering occurs from June to September. Capsules shed seeds after ripening that can be collected in September and October. The part that is used is the rhizome. The chemical constituents of the roots are Picrorhizin, which is a brown resinous glucoside, kutkin which is the bitter substance, kurrin which is the non-bitter substance, alkanol, and alkane.

Cultivation: Vegetative propagation of the plant is carried out for commercial cultivation in the farm. The soil type that is most preferable is well-drained porous soil with ample

sunlight. The cuttings from Rhizomes and stolons are planted in April in the first year and harvested in the month October of second year.

Harvesting, Drying and Yield: The plants are harvested in October of the Second year. The plants after harvest are washed in water, shade dried and sundried separately. The entire plant is harvested and dried. The average yield is 450 kg per hectare. In order to facilitate the regeneration, a cutting is taken from every plant before its harvesting.

Grading and Storage: The plant parts are graded after drying. The roots are graded according to their thickness. The plants after grading are stored in dry sheds that have low moisture content. After drying and grading the plants are directly packed in sacks.

Diseases and Pests: The only disease observed in the study area for kutki is Powdery mildew *Podosphaera fuliginea* on the aerial parts of the plants. The fungus is controlled by spraying Sodium bicarbonate over the plants.

Market Rate: The present market rate of the rhizomes is Rs 1350 per kg.

Economic Viability of Cultivation of *Picrorhiza kurooa*

The study on the economic viability of cultivation of kuroo is carried out to analyse the worth of cultivation of the medicinal plant. The Cost-benefit analysis of cultivation of kuroo has been carried out to measure all the costs involved, and to assess the possible benefits and profits from the cultivation. The case study has helped in assessing various costs involved in the cultivation and marketing of kurro and comparing them to the benefits so as to assess whether the cultivation is a feasible project or not.

Details about the Cultivation

1. Total farm size (Bigha/ hectare): 15 Bighas
2. Area of production of karoo: 15 Bighas
3. Total production (kg) 2019: 1200 kg
4. Rate of 1 kg karoo received by farmer: Rs 1350 kg

The table 4 shows the total cost of production, total cost of harvesting and post harvesting and the marketing cost. The total cost of production for 2019 is Rs 1, 79,700 and the gross return is Rs 16, 20,000. The cost of production for 2018 is Rs 1, 55,330 and for 2017 is Rs 1, 19,300. The cost of cultivation of Kutki for 3 years on bigha basis has been calculated. The cost for planting material is incurred in the first year of the plant and not in the two successive years. The total cost of production shows an increasing trend in the successive years. The cost of transportation for the first year is nil as kuroo takes approximately 18 months to give good yield for commercial harvest. The fertiliser cost is nil for all the years as the cultivation is fully organic and only vermin compost is added to the soil in the farm. The various production costs involved are the following:

- Cost of seeds or planting material
- Labour cost
- Irrigation and weeding cost
- FYM cost
- Fertiliser cost
- Vermicomposting cost
- Harvesting, Post harvesting and miscellaneous cost.
- The marketing cost includes the packaging cost and the transportation cost.

Figure 2 is a graphical representation of percentage share of each production cost and the marketing cost to the total cost of production over the time period of 3 years, i.e. 2017, 2018, and 2019. This represents the cost pattern in the cultivation of Karoo. The planting material cost is incurred only in the first year of cropping which accounts for 25.14 per cent of the total cost of production in 2017. The next planting material cost would incur after 3 years, i.e. in 2020.

The cost on human labour accounted for 41.9 per cent of the total cost in 2017, 51.51 per cent of the total cost in 2018 and 50.08 per cent of the total cost in 2019. Irrigation and weeding operations amounted for 16.76 per cent, 25.75 per cent and 25 per cent of the total cost for the years 2017, 2018 and 2019 respectively. The Harvesting of the plants in the first year constituted 5.8 per cent of the total cost, 10.3 per cent of the total cost in the second year and 11.6 per cent of the total cost in the third year. The post-harvest handling share in the total cost accounts for 3 per cent, 2.57 per cent, and 3.3 per cent for the years 2017, 2018 and 2019 respectively. The miscellaneous costs were incurred only in the third year that forms 0.58 per cent of the total cost of production. The Marketing cost which includes the packaging and transportation cost is dominated by transportation cost

accounting 3 per cent, 5.9 per cent and 5.5 per cent of the total production cost for 2017, 2018 and 2019 respectively. The packaging cost for 2017, 2018 and 2019 forms 1 per cent, 0.96 per cent and 1.11 per cent respectively of the total production cost. The total costs incurred in production, post-harvesting and marketing for 1 bigha of land holding, for the year 2019 has been calculated in the table 4. Total production on 1 Bigha is calculated to be 80 kg and the cost incurred by the farmer for one kg production is Rs 1350. The Total cost for production and marketing of Kuroo is estimated on Bigha basis. In Table 5, the total cost incurred in production and marketing of Karoo per Bigha has been calculated and presented. Total cost of production on 1 Bigha landholding is Rs 13,180 and the Cost incurred by the farmer on 1 kg production of Kuroo is calculated to be Rs 164.75. The packaging and transportation cost when totalled as the Marketing cost amounted for Rs 2000. The production factors constitute Rs 11,180 towards the total cost of production.

The Cost-Benefit Ratio: The cost-benefit ratio for the production of kuroo has been evaluated in the table 6. The cost incurred for production of 1 kg kuroo is Rs 164.75 and the price received by the producer for 1kg Kuroo is Rs 1350. Hence, the evaluated benefit is Rs 1185.25. The cost-benefit ratio in the case study of cultivation of kuroo is 7.194. The Ratio derived is more than 1 therefore the cultivation of kuroo in the GHNP area is a feasible project with high benefits. This also indicates that the various factors of production and allocation of the resources are done effectively and efficiently. Kuroo is used in preparation of local “*churans*” which are prepared by mixing it with few other medicinal plants.

Producer’s Share in Consumer’s Rupee: Producer’s share in consumer’s rupee is an indicator of marketing efficiency of the produce. There is a positive relation between the producer’s share in consumer’s rupee and the marketing efficiency. Higher the producer’s share in the consumer’s rupee, greater is the marketing efficiency and vice-versa. Table 7 represents the calculated value of Producer’s share in the Consumer’s Rupee. The price received by the producer for one kilogram of *Picrorhiza kurooa* is Rs 1350 for the year 2019. The price paid by the consumer for one kilogram of kuroo is Rs 1750. The producer’s share in the consumer’s rupee turned out to be 77.14 per cent. As the producer is getting high percentage of consumer’s share therefore this depicts that the producer is getting satisfactory price for its produce. The high percentage also depicts that the producer follows the modern market chain which involves least intermediaries and has direct connections with local wholesalers and the wholesalers at the herbal *mandis*.

Price Spread: Price spread is an economic efficiency indicator of marketing system. It is the difference in the price paid by the consumers and the price received by the producers for a commodity. There is a negative relationship between price spread and the efficiency of the marketing system. Smaller the price spread; greater is the efficiency of marketing system. The price spread for Kuroo has been calculated and presented in the table 8. The price spread for one kg produce turned out to be Rs 400 which forms 22.8 per cent of the consumer’s price. This implies that 22.8 per cent of the consumer’s Rupee constitutes the costs incurred by various intermediaries and their margins.

Cultivation of Chora**Scientific Description of Plant**

A brief description about the plant under study is given below:

Scientific Name: *Angelica glauca*

Common Name: Chora

Family: Apiaceae

IUCN Status: Endangered

Altitude: 2700 to 3000 meters above mean sea level.

Description: It is a perennial aromatic herb with a thick, erect and hollow stem. Roots contain thick rhizomes which are brown, fleshy and long and are aromatic. Leaves are pinnate which have a dark green upper surface. The inflorescence is white or purple coloured compound umbel. Seeds are small and winged. Flowering occurs from July to September. Roots are the official parts that are mostly used. The rhizomes yield valeric acid, angelic acid, a resin known as angelisine. The roots also contain a volatile oil in 1 to 1.5 per cent proportions.

Cultivation: Seeds are sown in the months of November and December. On the onset of monsoons the seedlings are transplanted in the field. Raised seed beds are used for their propagation. Before planting, green manuring of sheep and goat manure is preferred.

Harvesting, Drying and Yield: The plants are harvested in September and October of the second or third year. Harvesting of the plant is done after every two years. After harvesting the roots are washed with water and then dried in partial shade. The average yield is around 600 kg per hectare. In order to facilitate regeneration, apical portion of the rhizome is transplanted in the field.

Grading and Storage: The plant parts are graded after drying. The roots are graded according to their thickness. The rhizomes after grading are stored in dry sheds that have low moisture content. The rhizomes after drying and grading are directly packed in cloth bags.

Diseases and pests: No diseases reported yet.

Market Rate: The present market rate of rhizomes is Rs 200 per kg in the local market.

Economic Viability of Cultivation of *Angelica glauca*
Details about the Cultivation

1. Total farm size (Bigha/ hectares): 15 Bighas
2. Area of production of Chora: 310 sq. Feet
3. Market rate of 1 kg Chora: Rs 250 per kg

Table 9 illustrates the total cost of production, total cost of harvesting and post harvesting and the marketing cost. The total cost of production for 2019 is Rs 7250. The cost of transportation for the first year of the medicinal plants is nil as Chora plants give good yield after one year of cultivation. Also the produce was very less for the first year hence it was not transported to any market. The fertiliser cost is nil in all the years as the cultivation is fully organic. The farm produces its own vermi-compost. Figure 3 is a graphical representation of percentage share of each production cost and the marketing cost to the total cost of production for first year of cultivation. The planting material cost accounts for 68.9

per cent of the total cost of production in 2019. The cost on human labour accounted for 13.7 per cent of the total cost. Irrigation and weeding operations amounted for 6.89 per cent. The harvesting of the plants in the first year constituted 6.89 per cent of the total cost. The post-harvest handling share in the total cost accounts for 2.7 per cent. The marketing cost which includes the packaging and transportation cost constitute 0.68 per cent of the total production cost. The cultivation of *Angelica glauca* is a new venture taken up by the farm and hence the total produce couldn't be assessed as it was less than one kilogram.

Cultivation of Bankakri**Scientific Description of Plant**

A brief description about the plant under study is given below:

Scientific Name: *Podophyllum hexandrum*

Common Name: Bankakri

Family: Podophyllaceae

IUCN Status: Endangered

Altitude: 2600 to 4000 meters above mean sea level.

Description: It is an erect, succulent, glabrous herb about 30-50cm tall. The rhizomes are creeping and knotted. Leaves are alternate and palmate. Florets are creamy white to pink, solitary and are cup shaped. Flowering occurs from April to June. The roots and rhizomes yield a resin. Roots have more quantity of resin than the rhizomes. Its principal constituents are Podophyllin, Podophyllotoxin, Astragalin. Its roots also contain essential oils, starch, mineral salts.

Cultivation: The plant can be propagated through both seeds and rhizome splits. The propagation through rhizomes is preferred owing to the better pace of growth of the rhizome split. In case of propagation by seeds, the sowing should be done before the winters start. The plant takes approximately three years to mature.

Harvesting, Drying and Yield: The plant roots are harvested in the month of March and April in the third year. The entire plant is dried first. Then the roots and rhizomes are separately cut into pieces and washed and shade dried. The average yield from 10kg seeds is 3 ton to 4 ton of dried rootstock.

Grading and Storage: The plant parts are graded after drying. The roots are graded according to their thickness. The rhizomes after grading are stored in clean containers and packed later in gunny bags.

Diseases and Pests: No diseases have been reported yet.

Market Rate: The present market rate of the rhizomes is Rs 250 per kg in the local market.

Economic Viability of Cultivation of *Podophyllum hexandrum*

Details about the Cultivation

1. Total farm size (Bigha/ hectare): 15 Bighas
2. Area of production of Bankakri: 310 sq. Feet
3. Market rate of 1 kg Bankakri: Rs 500 per kg

The table 10 illustrates the total cost of production, total cost of harvesting and post-harvesting and the marketing cost. The total cost of production for 2019 is Rs 1250. The cost of

transportation for the first year of the plants cultivated was zero as there was no marketing in the first year. The produce was very less; hence, the packed harvest is to be sold at the farm itself. Since the farm produces fully organic produce hence the cost of fertiliser is zero. Figure 4 is a graphical representation of percentage share of each production cost and the marketing cost to the total cost of production for 2019. The planting material cost accounts for 40 per cent of the total cost of production in the first year. The cost on human labour accounted for 20 per cent. Irrigation and weeding operations constitute 8 per cent of the total cost of production. The harvesting of the plants in the first year constituted 16 per cent of the total cost. The post-harvest handling share in the total cost accounts for 12 per cent. The marketing cost which includes the packaging and transportation cost constitute 4 per cent of the total production cost. The cultivation of *Podophyllum hexandrum* is also a new venture taken up by the farm; hence, the total produce of Bankakri couldn't be assessed as it was less than one kilogram. The case study clearly reveals that the cultivation of *Picrorhiza kurooa* has high net returns per bigha and is feasible for the farmers to undertake its cultivation. The profit per bigha may vary from farmer to farmer but the project is profitable. The producer's share in the consumer's rupee can be increased by incorporating the suggestions made under the case study. The findings of the study suggest that, although the collection of MAPs reduced, the scope of cultivation of medicinal and aromatic plants in the area has increased by many folds. The people living in the GHNP area have knowledge about various important herbs and need to be informed about the practice of cultivation of the MAPs to unite the traditional wisdom with practical skills. The new venture that has been taken up by Chanyara farm seems to be favourable as the farm is a well-established institution with various facilities available at such remote places. Since the farm is situated just outside the forest area, the cultivation of high priority MAPs is one of the ways to reduce pressure on the medicinal herbs of the GHNPCA and an alternate income generation activity for the farmers associated. The conservation of Himalayan medicinal plants require ex-situ conservation which can be achieved with the help and involvement of local people, who were once the collectors, so as to achieve sustainable development targets at different levels of associated community.

Problems related to production of MAPs

- Planting material costs form a major constituent in the production of MAPs. The case study revealed that the planting material cost formed 25 per cent, 68.9 per cent and 40 per cent of the total production cost for Kuroo, Chora and Bankakri respectively. The high cost of planting material is one of the problems.
- Unavailability of good planting material is another problem related to the production of MAPs.
- Lack of subsidies and the formalities involved in getting the same was one of the reasons for the lack of interest among most farmers in undertaking cultivation of MAPs.
- Lack of irrigation facilities due to the remoteness of the area is also a problem faced by the producers.
- Insect and pest attack isn't a big problem in the cultivation of MAPs.

Problems related to Marketing of MAPs

- The regulated markets of the MAPs are very less and the herbal *mandis* are situated in some big cities of the

country.

- Even from the GHNPCA the markets for MAPs are situated at a distance of more than 50 km for local markets and more than 100 kms for the herbal *mandis*.
- Due to the distant markets, the transportation cost adds a lot to the total cost of production.
- No cooperatives or APMC's are available for the medicinal plants to regulate their marketing.
- No minimum support price is available for the farmers involved in MAP production.
- The export of MAPs requires the CITES permission which is a very long and hectic process and often discourages farmer interest in the export of his/her produce.
- Due to the lack of technical knowhow, the proper gradation of the cultivar is not done; hence, the producer doesn't get the price in accordance with the quality of produce. Instead the producer often gets the price as a whole of the produce.

Problems related to policies

- Less government intervention for development of better marketing opportunities and promotion of cultivation of MAPs as cash crop.
- There is lack of R & D support for the farmers that produce high quality MAPs.
- Lack of extension activities and training for the cultivation of MAPs.
- The farmers aren't aware of various subsidies and projects being run by the government for the conservation of the medicinal plants.

The GHNP management has been making various efforts to ensure overall development of the area; hence, various policies and programmes are being run to help people generate a stable livelihood. The overall conservation of medicinal plants is one of the prior objectives of the GHNP management. Hence to study the overall role of the authority is managing the area, the study about forest policies and programmes and their impact on indigenous community has been taken up in next section. Nagpal and Karki (2004) [6] stated that in the last few decades the demand for traditional medicines has increased many folds. The "back-to-nature" movement has been reflected in the demand for various MAPs in medicinal applications and other applications such as perfumery, cosmetics, health, dyes and so on. Hence, the MAPs represent a global segment of high performance business. The present study details about the cultivation and marketing of medicinal plants in the study area and the feasibility of the activity as an alternate income generation scheme. Study on indigenous knowledge, marketing channels, conservation practices, various market forces and policies and their impact in Chakkhinal Watershed in district Kullu, Himachal Pradesh was conducted by Singh (2004) [7]. The study revealed that the present policies and programmes require changes for conservation and sustainable management of MAPs in the area. Coursey (1997) stated that any management option will have to keep in mind that herb collection in and around GHNP is of great significance to the local economy. Numerous people are involved in the collection / extraction of the MAPs.

Since the Government banned the collection of MAPs in the GHNP on May 28, 1999, various entities related to the cultivation and marketing of medicinal plants has changed. The people involved in the collection of MAPs as their primary occupation have now shifted to other agricultural

activities. Hence, the present study deals with various entities in the marketing of medicinal plants and compares the marketing channels at present to the marketing channels of collected MAPs. Since the MAPs collection is of great significance to the economy of local people a brief case study about the Chanyara Farm has been undertaken to assess the feasibility of cultivation of medicinal plants in the study area. The Chanyara Farm has set a successful example of organic cultivation of MAPs without any significant help from the Park management. The main medicinal plant that is being cultivated in the farm is the endangered *Picrorhiza kuroo*. The

kutki cultivation has shown high cost-benefit ratio and high net returns. The cost of production at each phase of cultivation and marketing has also been assessed. Although, the collection of MAPs has reduced, the scope of cultivation of medicinal and aromatic plants in the area has increased many folds. Other plants that are cultivated in the case study are *Angelica glauca* and *Podophyllum hexandrum*. Edward (1993) [4] highlighted that the reasons behind the difficulty in trade and marketing of MAPs has been fluctuations in seasonal prices, less established markets, lack of technology and certification facilities.

Table 1: Commercially identified Medicinal Plants in the Study Area

Vernacular Name	Scientific Name	Plant part	Permit/pass fee in H.P Rs. /qtl.	Average market price of last 6 months (Rs/kg)
Patish	<i>Aconitum heterophyllum</i>	Rhizomes	5000	7143.94
Bach	<i>Acorus calamus</i>	Rhizomes	150	118.06
Sathjalari	<i>Ainsliaea aptera</i>	Roots	150	----
Chora	<i>Angelica glauca</i>	Roots	150	----
Ratanjot	<i>Arnebia benthamii</i>	Root	200	----
Pashan bhed	<i>Bergenia ciliata</i>	Roots	150	115.95
Pathar tor	<i>Berginia legulata</i>	Rhizome	150	----
Kashmal, Daru haldi	<i>Berberis aristata</i>	Roots, stems	200	63.15
Kala zira	<i>Bunium persicum</i>	Fruits	2000	----
Ban haldi	<i>Curcuma aromatica</i>	Rhizomes	150	60.17
Hathpanja	<i>Dactylorhiza hatagirea</i>	Root tubers	6000	----
Singli mingli	<i>Dioscorea deltoidea</i>	Root tubers	900	----
Somlata	<i>Ephedra gerardiana</i>	Stems	200	----
Basanti	<i>Hypericum perforatum</i>	Whole plant	250	----
Dhoop	<i>Jurinea macrocephala</i>	Roots	500	----
Pudina	<i>Mentha longifolia</i>	Leaves	125	----
Kadipatta	<i>Murraya koenigii</i>	Leaves	150	----
Jatamansi	<i>Nardostachys grandiflora</i>	Roots	1000	1194.47
Salam Misri	<i>Polygonatum verticillatum</i>	Rhizomes	1000	----
Karoo	<i>Picrorhiza kuroo</i>	Roots	1000	1749.58
Bankakri	<i>Podophyllum hexandrum</i>	Fruits and rhizomes	Fruits: 250 Rhizomes: 450	----
Gulab	<i>Rosa moschata</i>	Flowers, Fruit	----	236
Majith	<i>Rubia cordifolia</i>	Stems and roots	----	177.17
Bhootkesi	<i>Selinum vaginatum</i>	Roots	400	----
Janglee ajwain, Ban ajwain	<i>Thymus serpyllum</i>	Aerial parts	125	----
Rakhal, Yew	<i>Taxus wallichiana</i>	Needles	600	----
Nag chhatri	<i>Trillidium govanianum</i>	Roots or Rhizomes	8000	----
Musakbala	<i>Valeriana jatamansi</i>	Rhizomes	600	467.27
Banafasha	<i>Viola serpens</i>	Whole plant	----	2315.45

Source: For Permit/Pass Fee in HP: State Forest Department Report

Source: For Average Market price of last 6 months: <https://echarak.in/echarak/main.do>

Table 2: Local knowledge about the root depth of various plants

Sr. No	Common Name	Scientific Name	Root Depth (In Inches)
1.	Hath panja	<i>Dactylorhiza hatagirea</i>	5
2.	Koudi	<i>Podophyllum hexandrum</i>	2
3.	Patish	<i>Aconitum heterophyllum</i>	4
4.	Dhoop	<i>Jurinea macrocephala</i>	7
5.	Lal chudi	-----	5
6.	Chuchi	<i>Rheum australe</i>	8
7.	Masangar	-----	10
8.	Haini	-----	6
9.	Sathu Jalyadi	-----	4
10.	Naihnu	<i>Valeriana jatamansi</i>	2
11.	Shiringli	<i>Dioscorea deltoidea</i>	12
12.	Chorga	<i>Angelica glauca</i>	5

Table 3: Relative prices of MAPs for the years 1997 and 2019

Sr. No	Scientific Name	Vernacular Name	Market Price (Rs Per Kg) 1997	Market Price (Rs Per Kg) 2019	Price Difference (Rs)
1.	<i>Jurinea macrocephala</i>	Dhoop	40-100	240	170
2.	<i>Valeriana jatamansi</i>	Nyani	50	1200	1150
3.	<i>Valeriana hardwickii</i>	Musakbala	30-50	250	210

4.	<i>Dactylorhiza hatagirea</i>	Salaam Panja	400-750	4500	3925
5.	<i>Parmelia spp</i>	Mendi	20-40	140	110
6.	<i>Viola odorata, Viola serpens</i>	Banafsha	80	1400	1320
7.	<i>Aconitum heterophyllum</i>	Patish	800-1100	6000	5050
8.	<i>Picrorhiza kurrooa</i>	Karoo, Kutki	60-110	1350	1265
9.	<i>Morchella esculenta</i>	Guchhi	1800-2500	2500	350
10.	<i>Hypericum perforatum</i>	Basanti	75-100	1500-2000	1662.5
11.	<i>Dioscorea deltoidea</i>	Singli Mingli	NA for 1997 (Rs 20 per kg in 1996)	150-200	NA for 1997 (price difference between 1996 and 2019 is Rs 155)
12.	<i>Podophyllum hexandrum</i>	Bankakri	200	250	50

Table 4: Cost incurred in production, post-harvest handling and marketing of kutki for 15 Bighas

Sr. No	Factors	Total Costs (Rs) 2019	Total Costs (Rs) 2018	Total Costs (Rs) 2017
Production factors				
a.	Seeds cost / Planting material cost	-	-	30000
	Labour cost	90000	80000	50000
	Irrigation and weeding cost	45000	40000	20000
	FYM cost	-	-	-
	Fertiliser cost	-	-	-
	Vermicomposting cost	5000	4500	3500
	Harvesting cost	21000	16000	7000
	Post-harvest handling cost	6000	4000	3600
	Miscellaneous cost	700	-	-
Marketing factors				
b.	Packaging	2000	1500	1200
	Transportation	10000	9300	4000
	Grand Total	1,79,700	1,55,300	1,19,300

Table 5: Cost in incurred in production, post harvesting and marketing for 1 bigha of land holding

Sr. No	Factors	Total Costs (Rs) For 1 Bigha In The Year 2019
Production factors		
a.	Seeds cost / Planting material cost	-
	Labour cost	6000
	Irrigation and weeding cost	3000
	FYM cost	-
	Fertiliser cost	-
	Vermicomposting cost	333
	Harvesting cost	1400
	Post-harvest handling cost	400
	Miscellaneous cost	47
Marketing factors		
b.	Packaging	1333
	Transportation	667
	Grand Total	13,180

Table 6: Cost-Benefit Ratio for production of Kuroo

Cost incurred for 1kg production of kuroo (Rs)	Rate received by the producer for 1kg kuroo (Rs)	Benefit (Rs)	Benefit Cost Ratio
164.75	1350	1185.25	7.194

Table 7: Producer's Share in Consumer's Rupee for Kuroo

Medicinal Plant	Price received by the farmer/ producer for 1kg produce (Rs)	Price paid by the consumer per kg (Rs)	Producer's share in consumer's rupee
<i>Picrorhiza kurrooa</i> (kuroo, kutki)	1350	1750	77.14per cent

Table 8: Price Spread Analysis

Medicinal plant	Price paid by consumer (Rs)	Price received by producer (Rs)	Price spread (Rs)	Price spread percentage
<i>Picrorhiza kurrooa</i> (kuroo, kutki)	1750	1350	400	22.8per cent

Table 9: Cost incurred in production, post-harvest handling and marketing of Chora for 310 sq. feet

Sr. No.	Factors	Total Costs (Rs) 2019
Production factors		
a.	Seeds cost / Planting material cost	5000
	Labour cost	1000
	Irrigation and weeding cost	500
	FYM cost	-
	Fertiliser cost	-
	Vermicomposting cost	-
	Harvesting cost	500
	Post-harvest handling cost	200
	Miscellaneous cost	-
	Marketing factors	
b.	Packaging	50
	Transportation	-
	Grand Total	7250

Table 10: Cost incurred in production, post-harvest handling and marketing of Bankakri for 310 sq. feet

Sr. No.	Factors	Total Costs (Rs) 2019
Production factors		
a.	Seeds cost / Planting material cost	500
	Labour cost	250
	Irrigation and weeding cost	100
	FYM cost	-
	Fertiliser cost	-
	Vermicomposting cost	-
	Harvesting cost	200
	Post-harvest handling cost	150
	Miscellaneous cost	-
	Marketing factors	
b.	Packaging	50
	Transportation	-
	Grand Total	1250

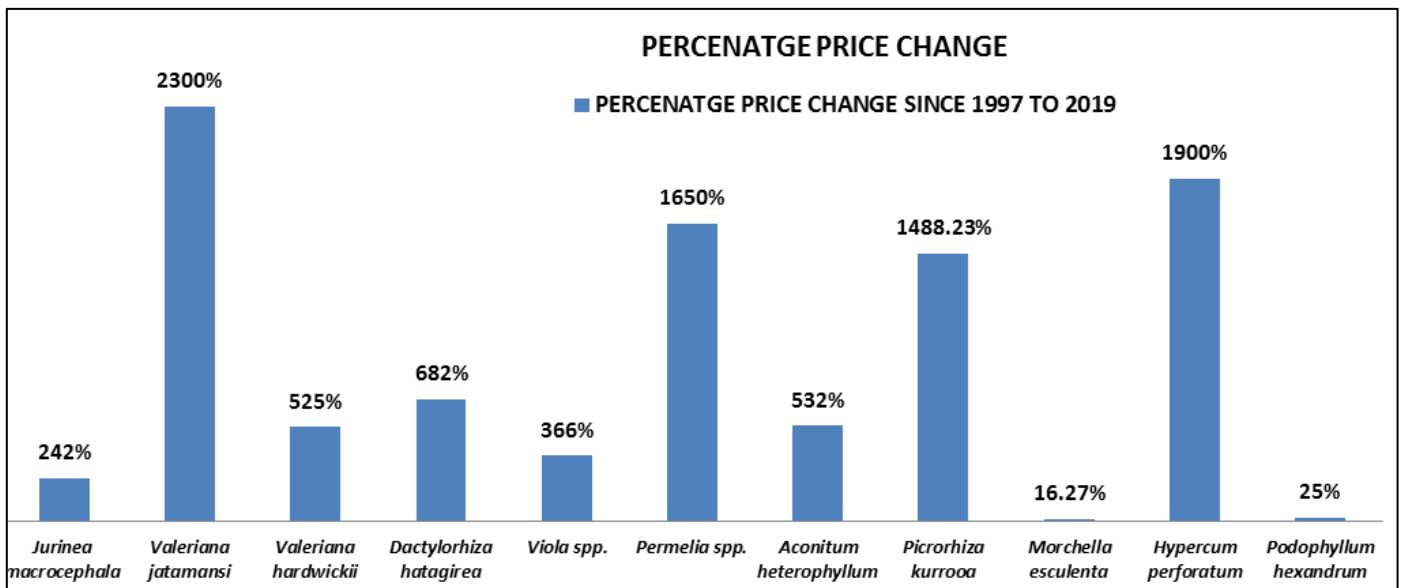


Fig 1: Relative Per cent Difference in Prices

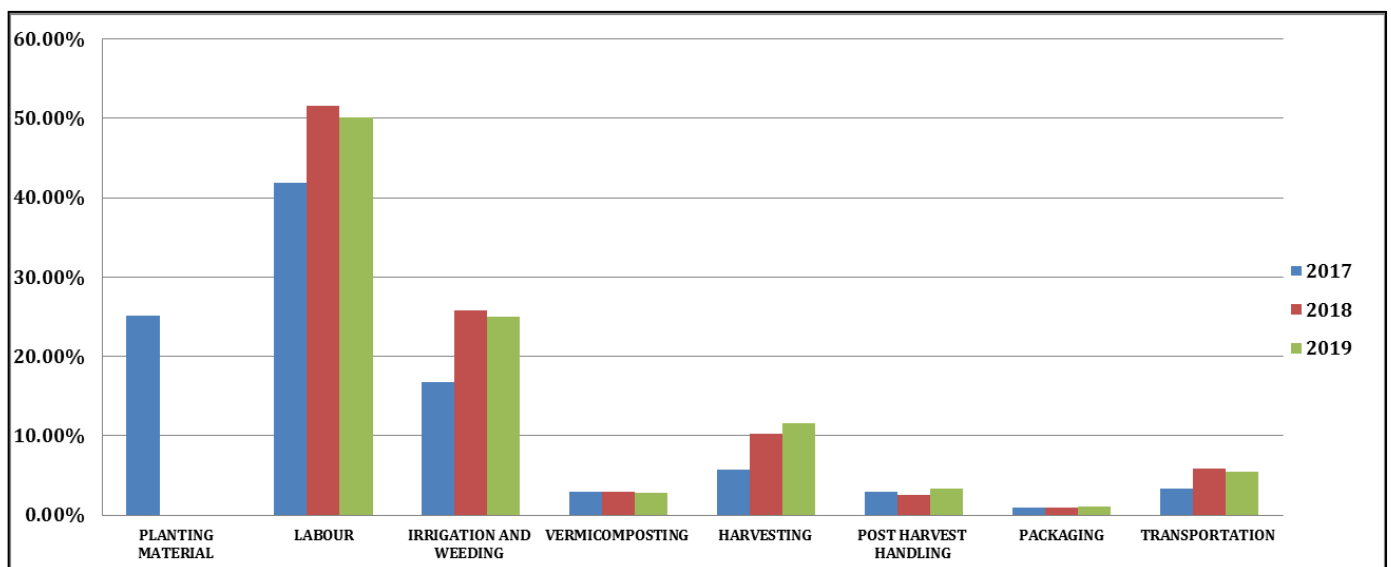


Fig 2: Percent Share of Various Costs over Successive Years

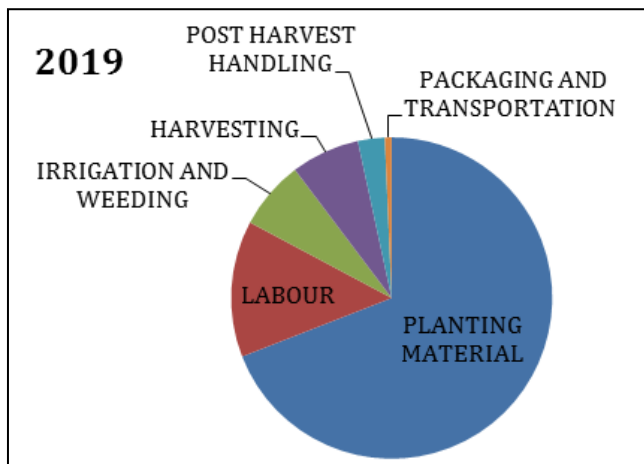


Fig 3: Percent Share of Various Costs for the first year of Cultivation

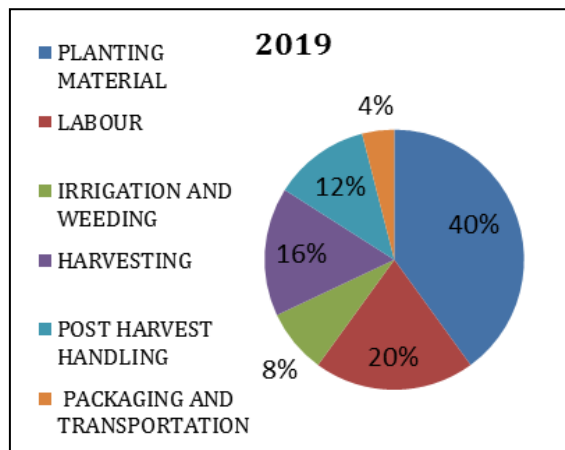
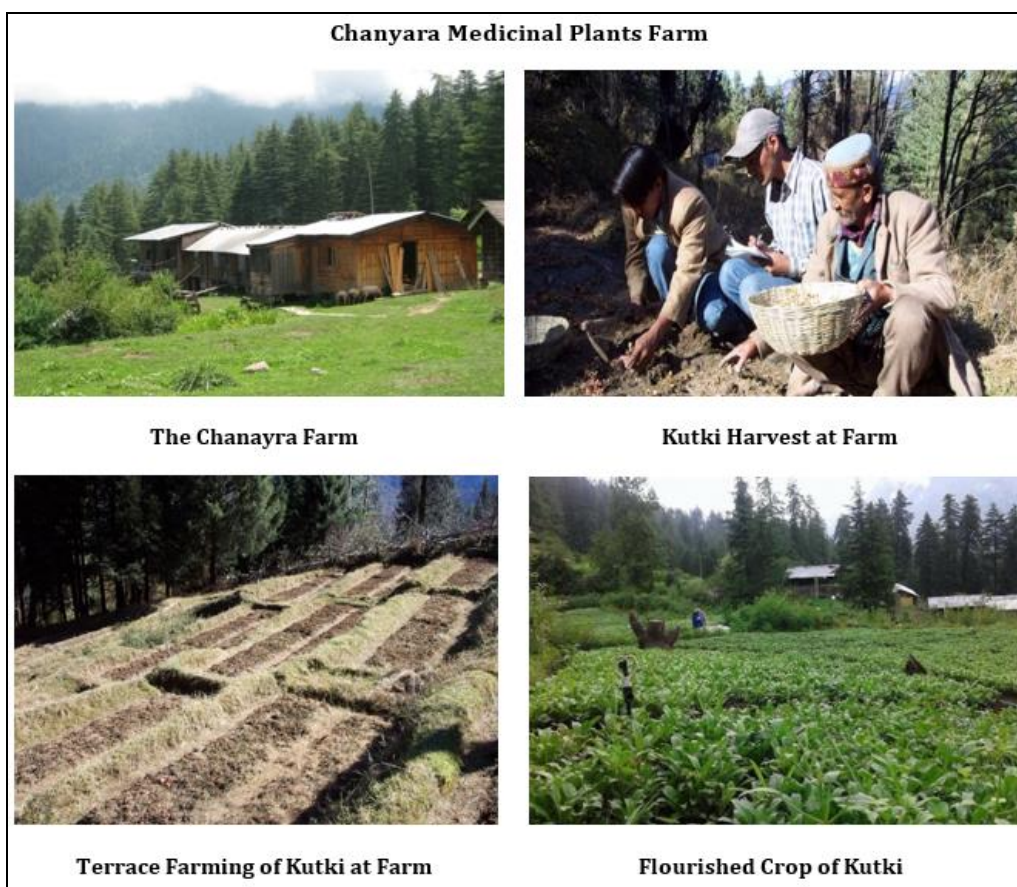


Fig 4: Per cent Share of Various Costs for the First Year of Cultivation



Conclusion

Keeping in view these backlogs, the study assessed the changes in prices of MAPs over the past twenty-two years and due to decrease in the collectors and farmers involved in cultivation of medicinal plants, the price of medicinal plants has increased hundred fold. The comparative analysis helped to assess various determinants of price and market value of each of the mentioned medicinal plant. The study makes certain recommendations for improving the market chain of MAPs, which include:

- Formation of cooperatives for the farmers engaged in the cultivation of MAPs so that the producers are aware of the market trends and conditions;
- The farmers and the local people must be made aware about the concept of “Access and Benefit sharing” so as to conserve the precious traditional knowledge about the plants and to protect this asset from being exploited;
- Involvement of various institutions and universities so as

to extend the extension programmes into the cultivation of the MAPs. This will help the producers in getting direct scientific help for their crops;

- Well-defined planning for the collection, cultivation and utilisation of the medicinal plants to conserve the genetic diversity; and
- Advancement of technologies for cost effective production of the MAPs, low cost post-harvest technologies and quality raw material production.

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