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Enterprise Development in Natural Fibre-based Products

A Study of the Status and Potential in the Central Himalayan Region of India

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Preface

Development experiences in most of the mountain areas of the Hindu Kush-Himalayan Region, over the past decades, have shown that the prevailing predominant mode of their economies – subsistence agriculture – is becoming increasingly unsustainable both economically and ecologically. Diversification of economic activities into products and services, for which these areas offer a comparative advantage, through enterprise-based production for the market is considered necessary for sustaining livelihoods and alleviating the poverty of the rapidly increasing population. It is in this context that ICIMOD established a programme on 'Development of Micro-enterprises in Mountain Areas' with the objectives of identifying constraints and opportunities and developing policy, programme, and training guidelines for enterprise development in hill and mountain areas of the HKH region. As part of this programme, the Centre has commissioned a number of studies in different countries and areas of the HKH region with a view to documenting experiences of development and functioning of enterprises covering different aspects such as comparative advantage of products, processes, and factors in enterprise development, technology, credit, marketing, and development of entrepreneurial skills as well policies and programmes by government and non-government agencies for promotion of enterprises.

The present paper 'Enterprise Development in Natural Fibre-based Products: A Study of the Status and Potential in the Central Himalayan Region of India', by Lok Man S. Palni, Hem C. Rikhari, and Subrat Sharma, is one in a series of case studies. It is being published with the hope that it will be found useful by those engaged in research and development, policy-making, programme formulation, and implementation for the promotion of enterprises, as well as by present and potential entrepreneurs in their respective activities.

T. S. Papola
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Abstract

This study explores several aspects relating to a few important fibre-yielding plants (viz., *Agave* sp, *Cannabis sativa*, *Girardiana heterophylla*, *Grewia oppositifolia*, and *Daphne papyracea*) of the Central Himalayas and their fibre products. These traditional products are an integral part of the typical rural system because of their durability, flexibility, and ecofriendly nature. These fibre products not only fulfill rural needs and/or augment the economy, but are also of use in various household activities, including animal care. For example, ropes made from such fibres do not heat up under the sun and remain soft when animals move or shift postures. However, with some inputs, fibres of various species can be used for the preparation of non-traditional products in order to meet the ethnic choice/fashion of urban society.

Market indicators show that there is potential for enterprise development of various non-traditional fibre products, particularly in light of the growing preference for natural products rather than for synthetics. Furthermore, these products can compete in the market because they are unique. With this in mind, certain NGOs have begun to commercialise fibre-based products, although on a very limited scale because of the lack of infrastructure and of a marketing strategy. In order to increase the supply of raw materials, efforts have also been made to carry out large-scale plantation of *Agave* sp and other species. These are regenerated in nurseries through bulbils in order to support plantation work.

It has been observed that this document could serve as a useful basis for future research to develop appropriate strategies for achieving sustainable and feasible development of cottage industries based on fibre plants.

Acknowledgements

I am thankful to ICIMOD, Nepal, for funding this study. Special thanks are due to Dr. T.S. Papola, Head, MEI Division, ICIMOD, for making useful comments and suggestions on the earlier drafts of the report. Thanks are also due to Drs. S.S. Bisht, M. Joshi, and D.S. Rawat for their help in finalising it.

Lok Man S. Palni

Acronyms Used

CDS	-	Centre for Development Studies
CSIR	-	Council of Scientific and Industrial Research
DRDA	-	District Rural Development Agency
GBPIHED	-	Govind Ballabh Pant Institute of Himalayan Environment and Development
GMVN	-	Garhwal Mandal Vikas Nigam
HKH	-	Hindu Kush-Himalayas
HOPE	-	Himalayan Organization for Protecting Environment
IIFT	-	Indian Institute of Fashion Technology
INHERE	-	Institute of Himalayan Environmental Research and Education
KMVN	-	Kumaon Mandal Vikas Nigam
NGO	-	Non-governmental Organization
UNICEF	-	United Nations International Children's Education Fund
UPAA	-	Uttar Pradesh Academy of Administration

Contents

Chapter 1
Background

People living in rural India, a country with diverse soil, land, climatic features, and cultural features, are known for their unique ways of living in harmony with natural surroundings and for sustainable use of natural resources, including products of plant origin. Products of plant-based fibres are important examples of judicious use of natural resources for the essential requirements of daily life. This is so particularly in hill and mountain areas where alternative products are limited. Natural fibre-based products are both strong and flexible and have attracted attention from the earliest times (Forbes 1984). Domestication of animals led to the use of tough barks of various plants to obtain long, strong, and flexible tethers (Forbes 1984). Gradually, in its elaborated form, the fibre rope came into existence. Plant fibres are not only used to make ropes but are also used to produce a variety of other important items.

Natural (plant fibre-based) products play a key role in the day-to-day work in mountain villages as elsewhere. Fibre-yielding plants occupy an important position among different taxa that find direct use in our society. They contribute significantly to the economy through various uses in agricultural and allied activities as well as in many household operations.

Although fibre-based products and cultural manufacturing activities relating to these products constitute a key component of village culture, they provide only limited income-generating opportunities to local inhabitants or artisans. Nevertheless, natural fibre-based products have potential for commercial development of feasible cottage industries. Such products are also acceptable in wider markets as 'ethnic' items made from natural products; and this is because of their durability. Moreover, waste generated from these products is bio-degradable, thus is environmentally-friendly.

This report is based mainly on the work carried out in the Kumaon region of the

Central Himalayas in the state of Uttar Pradesh. The study area falls in the Lesser Himalayan zone, representing the most densely-populated mountain area in the region. The study was carried out in three districts, i.e., Almora, Bageshwar, and Pithoragarh.

Knowhow

The first phase of the study consisted of extensive surveys in the region in order to identify local pockets of indigenous knowhow about the extraction of fibres from 'target' plants; to document various uses associated with the products and by-products; and to examine the techniques of extraction and processing. Repeated visits and the use of a participatory approach helped to identify watersheds (Table 1.1) and some of the local pockets of specialised indigenous knowhow (Table 1.2).

It has been observed that the bark of *Grewia oppositifolia* (common names - *Bhimal*, *Bheku*, *Bhekua*, and *Bhimu*) is a widely used source of natural fibre in almost all villages in the Central Himalayan region. This tree has a common and essential presence in rural households where it is used for fodder, particularly during the winter months when green fodder is in short supply. In a sample study area in a remote watershed, i.e., in the Haigad watershed, this species was found to contribute a substantial portion of the total fodder obtained from agroforestry trees (Table 1.3). In the same watershed, in the village of Jyuna Estate, *Quercus leucotrichophora* (an important tree species growing naturally) is found in

Table 1.1: Fibre-yielding Plants and Locations of Field Surveys

Fibre-yielding Plants	Watersheds
Cannabis sativa	Kosi, Jataganga, Gomti, Haigad, Simgad
Girardiana heterophylla	East Ramganga
Grewia oppositifolia	Nana Kosi, Gomti, Haigad, Jataganga, Simgad, Gagas, Gaula, Khulgad, Kosi, West Ramganga
Agave sisalana	Pungar, Saryu
Daphne papyracea	Jataganga

Table 1.2: Local Pockets of Specialised Indigenous Knowhow

Fibre-yielding Plants	Main Product	Village(s)
Cannabis sativa	Cloth	Chamua,Bathal, Patgaon, Ganoli
Girardiana heterophylla	Fishing nets	Naugaon
Grewia oppositifolia	Rope	Basar, Kurchoona
Agave sisalana	Door mats	Kande-Kiroli
Daphne papyracea	Paper	Fulai Jageshwar

abundance, unlike in other places, and used as fodder; however, *G. oppositifolia* is still used a great deal.

Table 1.3: Average Tree Holdings of Fibre-yielding *Grewia Oppositifolia* per Household in the Haigad Watershed

Village	Altitude (m)	Households (No.)	No. of trees per household	Fodder contribution (% of total fodder from agroforestry trees)
Pinglon	1230	78	4.3	50.3
Laskarkhet	1500	27	3.8	33.1
Jyuna Estate	1700	106	1.8	6.3
Hawil Kulwan	1900	86	4.1	20.0

Another common plant fibre is obtained from *Cannabis sativa* (common name-*Bhang*). The plant occurs abundantly in the wild, generally in the vicinity of villages. The fibre, however, is extracted for the most part from cultivated plants. In recent times, the cultivation of this species has been legally restricted due to its use in the production of narcotics. In the detailed study of the Jataganga catchment area, it was observed that almost every village household still cultivates this crop to cater for fibre and/or seed as spices. The cultivated area per household varies between two *mutthi* to four *nali*.[1] No apparent use of the plant as a source of narcotics was observed.

The Jataganga catchment also happens to be the centre of local knowhow for making paper from *Daphne papyracea* bark. The *Daphne* plant is a small shrub usually found in the oak forests of the Central Himalayan region (Saxena and Singh 1982) and it occurs on slopes. The area is important among Hindus because of the famous Jageshwar temple situated there. In the past, the art of making paper out of *Daphne* was a common practice among the local inhabitants. It is the same as *Lokta* paper in Nepal; the paper popularised by UNICEF projects. This paper was used for writing traditional documents and for making horoscopes. The art of making paper has suffered badly in spite of the fact that interest in horoscopes has not declined, but, on the contrary, increased. This is attributed to the availability of commercially manufactured paper at cheap rates. The present state of affairs regarding *Daphne* paper is quite dismal and, in the study area, only one person knows how to make it: and that person too also does not make it any more.

The fibre obtained from *Girardiana heterophylla* (common name-*Sisun*), which grows commonly along water courses and on sites rich in nutrients, is used mainly to make fishing nets. This specialisation appears to be confined to one village (i.e., Naugaon) in the Saryu River catchment (Table 1.2).

[1] (*Mutthi* and *nali* are the local units for land measurement: 16 *mutthi* = 1 *nali*; 20 *nali* = 1 acre; 2.47 acre = 1 hectare).

Objectives and Approach

In the context of the background, the present study will document: (i) details of plant use and knowhow in respect of the five fibre-yielding plants selected, (ii) indigenous knowhow and processes involved in fibre extraction, (iii) role of fibre products and by-products in village and household economies, and (iv) the potential of enterprise development using these natural fibres at cottage industry level.

To achieve these objectives a two-fold approach was devised and various tools ranging from participatory approaches to questionnaire-based surveys were carried out in different villages and markets in Almora, Bageshwar, and Pithoragarh districts.

Approach 1

Detailed surveys were undertaken in households and shops in different villages. Questions were related to use of plants to make fibre products. An inventory was developed for households, e.g., (i) different fibre products in use, (ii) specific uses, if any, (iii) number of products, (iv) personal use by households and/or products marketed, and (v) the selling prices of fibre products. Similarly, another inventory was developed for villages and shops concerning the availability of products and the wholesale and retail prices of various items.

Studies were also carried out in specialised pockets where indigenous know-how (village level) prevailed to make inventories of: (i) the specific products and their uses, (ii) practices/techniques and tools used in fibre extraction, (iii) resource availability and future potential, and (iv) the existing marketing structure and possible expansion.

Approach 2

Some town markets were selected and surveyed, particularly those that were the main trading centres for surrounding villages. These towns were: Almora and Bageshwar (District Headquarters); Berinag, Takula, Bhainsiachana, and Dhaulchina (all block headquarters); and Jageshwar, Kotmanya, and Dharamghar (all small service centres). An inventory of each market was made on the following basis: (i) supply of fibre products from and to the villages, (ii) shops dealing in fibre products, (iii) purchase and supply, (iv) items kept in stock and sold, and (v) the demand and potential of various products.

The report is organized into three sections dealing with: (i) taxonomical descriptions of selected fibre-yielding plants and processes and knowhow of fibre extraction, (ii) role of fibre products in village and market economies, and (iii) the potential for enterprise development.

Chapter 2
Natural Sources of Fibre

Introduction

A detailed study of five fibre-yielding plants (Table 2.1) was undertaken. The observations dealing with the morphological and distributional features of various species, details of fibre and its extraction, and final products made out of different fibres have been described in the following sections.

Description of Plants

The plant morphology of the selected species varies from trees to perennial succulents (Plates 2.1 and 2.2). The literature is full of detailed morphological and taxonomical features (Osmaston 1927, Naithani 1984, Samant 1987) and varied uses (Anonymous 1970, 1988). Thus, only a brief de-

Table 2.1: Some Features of Selected Fibre-yielding Plants

Plant species	Family	Growth form / Propagation / Parts Used for Fibre Extraction
Cannabis sativa Linn	*Cannabinaceae*	Tall annual herb/seed/ stem
Girardiana heterophylla Decne	*Urticaceae*	Annual herb/ seed and rhizome/stem
Grewia oppositifolia Roxb. ex Mast	*Tiliaceae*	Moderate semi-deciduous tree/seed/branch (bark)
Agave sisalana Perr	*Amaryllidaceae*	Perennial succulent/bulbils and suckers/leaves
Daphne papyracea Wall. ex Steud	*Thymelaeaceae*	Evergreen perennial shrub/seed/leaves and stem

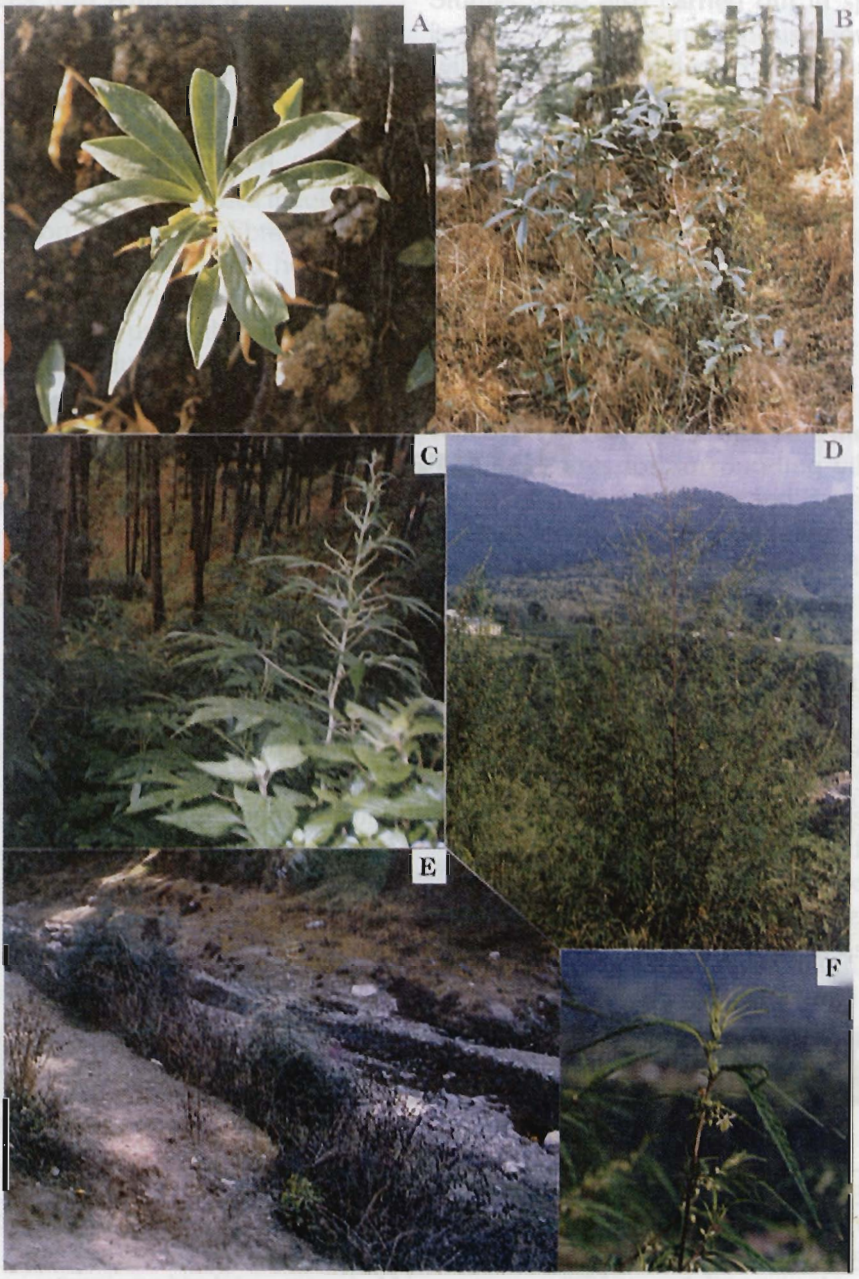


Plate 2.1: Fibre plants and their habitats
A) Close-up of *Daphne papyracea* with white flowers
B) *Daphne* in the understory of a *Cedrus deodara* forest
C) *Giraridana heterophylla* along water channels in a *Cedrus deodara* forest
D) Wild population of *Cannabis sativa*
E) *Girardiana* population along a stream channel and (F) A flowering shoot of *Cannabis*

Plate 2.2: A) Trees of *Grewia oppositifolia*
B) Drying of pooled stalks harvested from trees after fodder removal

scription has been presented in the following text as ready reference.

Cannabis sativa

This monotype genus is widely distributed (especially in the temperate and tropical countries) and is considered to be a native of Western and Central Asia. It is a tall herb, sometimes growing up to 4.88m. In the Jataganga catchment, shoot height and diameter (at base) of female plants vary from 275 to 305cm and 8.4 to 16.8mm, respectively. Twenty-day old seedlings attain a height of about 38cm with a 5mm diameter and about 10 leaves. The plant is dioecious in nature with a tap root system but occasionally monoecious plants have also been observed. The long stem is angular and bears divided palmate leaves. Flowers are usually yellowish cream in colour but have also been reported to be greenish. Male flowers are borne in long drooping panicles and female flowers in short axillary spikes. The fruit is an ovate seed-like achene.

Girardiana heterophylla

This is a perennial herb of temperate and subtropical Himalayan regions. It is a robust herb that grows to a height of up to nine feet. In the Jataganga catchment, shoot height and diameter at the base vary from 208 to 242cm and 15.5 to 21.2mm, respectively. The peculiar feature of this plant is that its stem is armed with stinging hairs that are present in abundance. The leaves are large-lobed and coarsely dentate or serrate. The plants are often found growing gregariously.

Grewia oppositifolia

This moderately-sized tree is widely distributed from the plains of Punjab to Bengal and up to an altitude of 2,134m in the Himalayas from Jammu and Kashmir to the Central Himalayas and Nepal (Brandis 1906). This tree is an essential component of age-old agroforestry practices of the Central Himalayan villages. Rough leaves are ovate, acuminate, and serrate. Pale yellow flowers occur in leaf cymes that are opposite the leaves. Fruits are black, drooping, and edible.

Agave sisalana

This genus is a native of Central America but is also found growing in East Africa and Asia. It was introduced in India during the 15th century but has become completely naturalised now. The plant has a short stem that bears a number of green, thick fleshy leaves. *Agave* flowers once during its lifetime. Its flowering stem arises from the centre of the plant as a thick pole that grows to a height of about six metres. The entire plant dies after bearing fruit.

Daphne papyracea

This plant is a common undergrowth in the broad-leaved forests that grow between 3,658 and 5,000m in the Central Himalayan region. The plant grows to a height of up to 2.44m. The leaves are obtuse.

Uses

These fibre-yielding plants also have various direct uses, other than providing raw material for fibre products. There are several by-products that are generated during the fibre extraction processes. Therefore, these plants play an important role in the functioning of village ecosystems. The various uses of the species have been summarised below.

Cannabis sativa

This plant is preferred by villagers for its multiple uses (Figure 2.1). However, cultivation of *Cannabis* is prohibited in many parts of India because of its abuse in the production of narcotic drugs. Uses of fibre, by-products, after fibre extraction, and the seed are summarised in Table 2.2. The woody portion that remains after the extraction of fibre is used to some extent as a fuel supplement in the kitchen (Plate 2.3). In February 1997, the market rate for seeds was Rs 18 per kg in Jataganga catchment. However, at district headquarters (e.g., Pithoragarh), it was Rs 30 per kg during November-December and Rs 25 per kg during January-February.

Girardiana heterophylla

This wild plant is only used for making ropes because of its stinging hair. However, sometimes the tender shoots and leaves have been used as vegetables by poor people. Contributions of fibre products in various aspects of village life are shown in Figure 2.2, and summarised in Table 2.3.

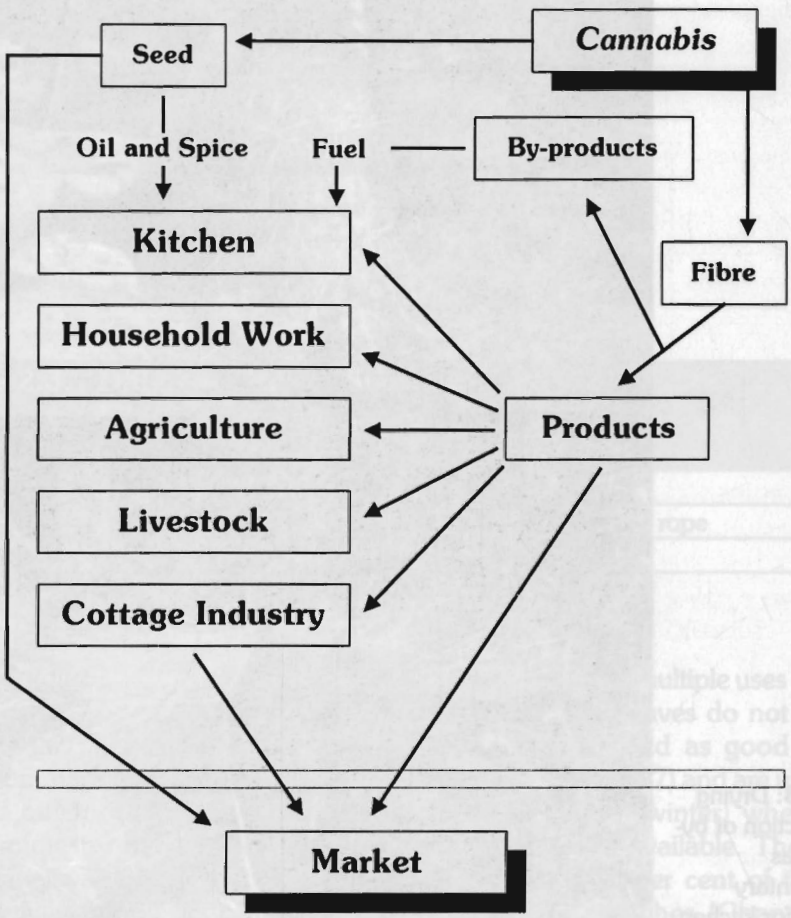


Figure 2.1: Different Uses of *Cannabis*

Table 2.2: Different Uses of the *Cannabis* Plant Seed, Fibre and Allied By-products		
Product	**Local name**	**Use**
1. Fibre	Taga	Binding material for a mat produced locally
2. Fibre	*Dhaga*	Weaving of local cloth
3. Fibre	*Dhaga*	Making different types of rope
4. Wood	*Laakar*	Firewood
5. Seed	*Bhang*	Spice, Dish (*Chutney*), Oil (also used to adulterate *Ghee)*

Plate 2.3: Drying and collection of by-products as supplementary firewood for kitchen activities

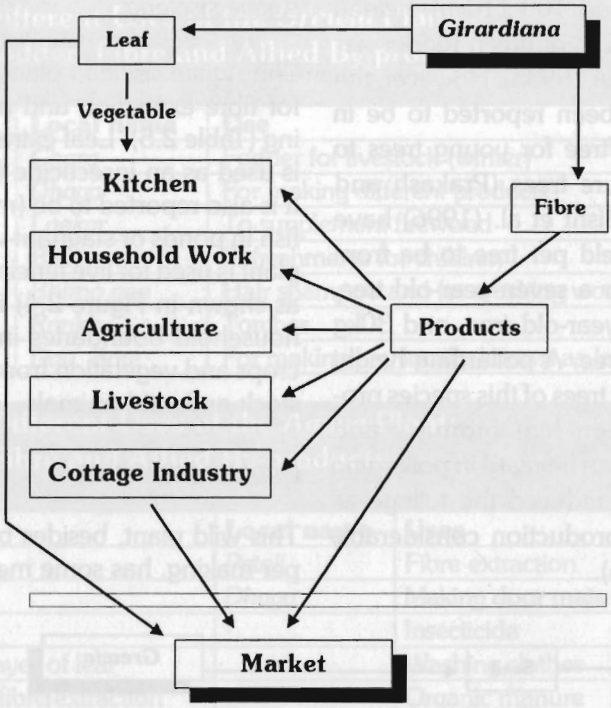


Figure 2.2: Different Uses of *Girardiana*

Table 2.3: Different Uses of the *Girardiana* Plant Fibre and Allied By-products

Product	Local name	Use
1. Fibre	*Dhaga*	For making different types of rope
2. Leaves	*Paat*	Used as vegetables

Grewia oppositifolia

Various uses of this plant are shown in Figure 2.3 and summarised in Table 2.4. In a study carried out to gauge the farmers' choice of agroforestry tree species in the subtropical Himalayas, 94 per cent of farmers in the low hills and 84 per cent in the mid-hills expressed the first preference for *Grewia* because of its multiple uses (Anonymous 1987). Since leaves do not contain tannin, they are rated as good fodder (Laurie 1945, Negi 1977) and are used during the lean period (winter) when other green fodder is not available. The leaves constitute about 70 per cent of the total fresh weight of branches (Chandra and Sharma 1977). Trees with girths of from 40-

50cm, 70-80cm, and 100-110cm yielded 3.5, 10.5, and 20.1kg of green fodder per tree (Lata and Verma 1993a). However, the general yield has been reported to be in the range of 12kg/tree for young trees to 30kg/tree for mature trees (Prakash and Hockking 1986). Bisht et al. (1996) have reported fodder yield per tree to be from five to seven kg for a seven-year-old tree, 11-15kg for a 15-year-old tree, and 30kg for a 25-year-old tree. A pollarding height of 0.5 and 1.5m for trees of this species produced higher green leaf biomass and fuelwood; a further an increase in pollarding height (i.e., 2.0m) reduced the foliage as well as fuelwood production considerably (Anonymous 1995).

Agave sisalana

The *Agave sisalana* plant is primarily used for fibre extraction and as biological fencing (Table 2.5). Leaf extract, in liquid form, is used as an insecticide (mainly for fleas). It is also reported to be (mis)used for killing fish in ponds or stagnant waters. The whole plant is used for live fencing (i.e., biofencing as shown in Figure 2.4) in crop fields and household boundaries in order to protect crops and vegetation from free grazing livestock and wild animals.

Daphne papyracea

This wild plant, besides being used for paper-making, has some medicinal properties

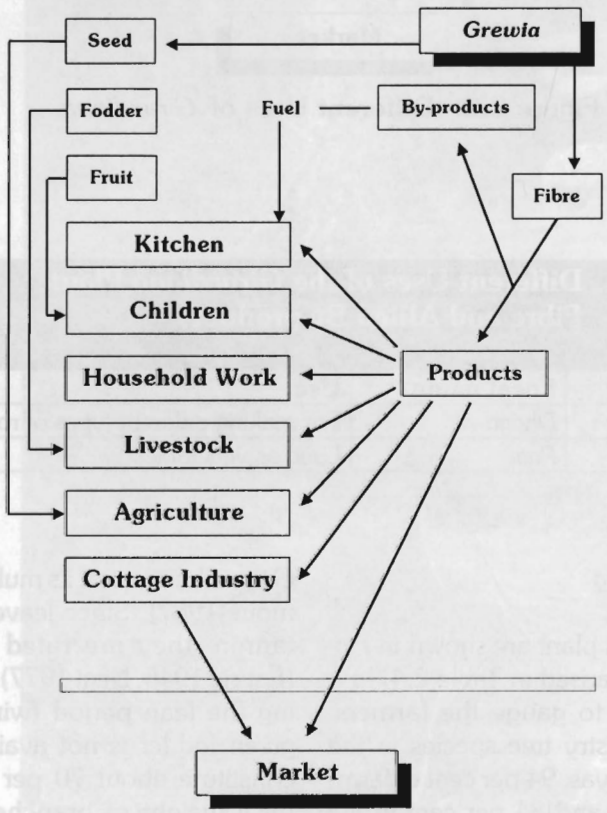


Figure 2.3: Different Uses of *Grewia*

Table 2.4: Different Uses of the *Grewia* Plant Fodder, Fibre and Allied By-products

Product	Local name	Use
1. Leaves	*Chara*	Fodder for livestock (winter)
2. Fibre	*Dhaga*	For making different products
3. Wood	*Laakar*	To supplement firewood
4. Seeds	*Bien*	Refreshments for children
5. Fresh bark	*Bhimo gao*	Hair shampoo and for washing woollen clothes
6. Dry sticks	*Rankh*	Torches
7. Tree	*Dau, Bote*	For making hay locally known as *loota*

Table 2.5: Different Uses of the *Agave* Plant: Fibre and Allied By-products

Product	Local name	Uses
1. Leaves	*Pateli*	Fibre extraction
2. Fibre	*Dhaga*	Making door mats and ropes
3. Leaf extract		Insecticide
4. Outer green layer of leaf		Washing clothes
5. Residue after fibre extraction		Organic manure
6. Flower stem	*Laakar*	Stakes for climbers
7. Whole plant	*Gher*	Biological fencing

that include bringing about relief from stomach-ache (root extract in water) and for healing fractured bones (bark) (Table 2.6).

Fibres and Their Extraction

The fibrous properties and extraction methods have been compiled from various sources, and these include secondary literature and methods adopted by village practitioners.

Table 2.6: Uses of *Daphne* Plant

Product	Local name	Uses
1. Bark	*Chhao*	Fibre extraction
2. Bark	-do-	Treatment of bone fractures
3. Root	*Jar*	Treatment of stomach-ache

Cannabis sativa

In the Central Himalayan region, *Cannabis* occurs abundantly in the wild during the rainy season; however, only cultivated plants are used for fibre extraction. Preparation of crop fields begins before the rainy season sets in (May-June) and the fields being ploughed twice. Sowing is carried out after mid-June and is followed by levelling the crop fields. The weight of 10 seeds stored at room temperature for eight months was 0.23g $\pm$ 0.01 and the rate of germination was almost 100 per cent. The crop requires intensive weeding between July and August. The vegetative growth occurs up to August followed by flowering and fruiting in September. Male plants flower a little earlier than the female plants

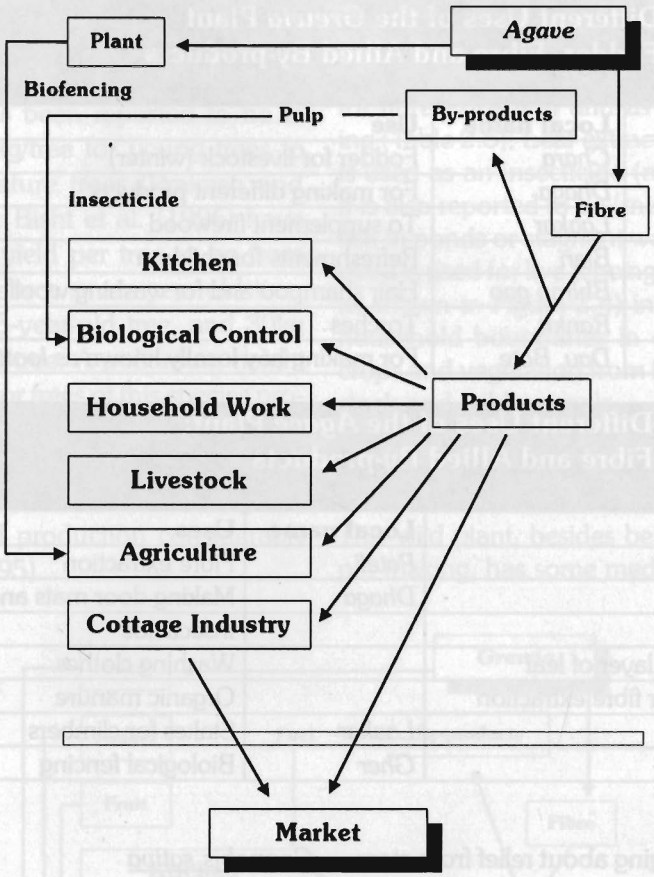


Figure 2.4: Different Uses of *Agave*

and their contribution to total plants in a unit area is about 50 per cent (according to the villagers). Male plants are easily distinguishable and only these are harvested.

The harvested male plants are spread on roof tops and allowed to ret in rain water; they require only a small quantity of water for the process. If the rain is irregular, the harvested plants are processed with surface water. The plants are subjected to retting for three to four days, followed by the extraction of fibre and drying.

The female plants stand in the fields until the seeds mature, up to about the end of October. Seeds are collected after harvesting the plants and the stems are left in the field for 15-20 days to dry in the sun. The stems are then stacked in bundles of 60 to 120 plants (Plate 2.4). The bundles are submerged in running water channels or *khal*(s) or moistened with tap water and left for retting (Plate 2.5) depending on the availability of time between various agricultural activities. The duration of retting depends upon the climate of the place. It normally takes three-four days to complete the process. The fibre is then separated from the retted stalks by hand. The scutched fibre is finally cleaned and separated into finer strands.

Plate 2.4: Use of solar energy for drying
A) *Cannabis* stems before retting
B) Extracted fibre (hanging) and by-products (on the ground)

Plate 2.5: Different methods of retting for *Cannabis* fibre
A) In running water
B) In *khal*
C) With tap water

The fibre is strong, lustrous, and durable. Commercial fibre is 40-80 inches long. The fineness of its staple is less than that of linen, though its tensile strength is appreciably greater. The fibre is made up of a mixture of cellulose and ligno-cellulose. Chemical analysis indicates that the cellulose content is about 78 per cent. The tips of the fibre are bluntly rounded. The fibre is usually straw-white but can vary in colour from pale yellow to deep grey. It is strong and the villagers consider it to be the most durable among all the natural fibres that are of plant origin. Notably, the fibre from female plants is stronger and longer than that from male plants (298cm *vs* 132cm, respectively). The fibre obtained from five stalks of different lengths (90-282cm) yielded 31.4g of dry fibre and the time for extraction was about two minutes. The diameter of single thread obtained from fibre is recorded to be about five mm.

Girardiana heterophylla

Three species of genus *Girardiana* are found in India and only one of them, *G. palmata,* is systematically cultivated in the Nilgiri hills in the Western Ghats. No systematic cultivation (such as that of hemp) of the species exists in the Central Himalayan region and fibre is extracted only from naturally growing plants of *G. heterophylla*. The plant occurs abundantly in the wild, over the moist areas along water channels, and on nutrient rich soils in the vicinity of human habitations. The shoots appear during April from underground rhizomes. Vegetative growth occurs up until August, followed by flowering and fruiting in August-September. The plant above ground perishes in December-January. Seed collection is carried out from December-February. In an experiment performed at the G.B. Pant Institute of Himalayan Environment and Development's Katarmal Nursery in Kosi, the seed germination rate (seeds sown 6 months after collection) was only about 17 per cent.

The fibre lies in the inner bark of the stalk, and fibre extraction is not a common practice among the villagers because of the stinging hair on its leaves and stem. The artisans of a particular caste within the village extract fibre from this species. The stem yields a fibre, which is said to rival the best fibres in strength. Harvesting of stems is carried out from September through February according to the time available, but mostly just after the rains are over. The main process involved in the extraction of the fibre is retting in water as in the case of *Cannabis*. The harvested stems are submerged in running water channels for two to three days for retting and then the fibre is peeled away (Plate 2.6).

The fibres contain about 90 per cent cellulose and resemble flax in length and firmness but are softer, more open, and downy. The density and tensile strength of the fibre are higher than those of flax, but the resistance to slipping is lower. Tests carried out in Darjeeling show that the fibre can be spun into long filaments. The strength of wet specimens of bleached filament is higher than that of air-dried specimens. The fibre is soft and flexible. The colour is usually straw-white but may vary from pale brown to pale yellow.

Grewia oppositifolia

The density of seedlings in an area is subject to thinning and depends on local needs/ requirements. The young shoots, i.e, current year's growth, appear in April and the vegetative growth continues up to the month of August. The leaves fall in March-

Plate 2.6: Fibre extraction from *Girardiana*
A) Retting in a running water channel
B) Collection of retted stalks

April. The blossoms and fruit appear along with the vegetative growth.

The species is propagated by seeds that are collected in the period from October to January and the number of seeds per kg varies between 10,000-15,000 (Lata and Verma 1993a). The seeds exhibit dormancy due to the hard seed coat. Seeds sown in July (eight months after collection) took longer (19 days) to begin germinating. Further, the germination percentage is often unsatisfactory (only about 28%) (Lata and Verma 1993b). However, quick (nine days) and better (about 50%) germination takes place when seeds are soaked in hot water for 24 hours. In an experiment at the GBPIHED nursery at Kosi, seeds sown in the first week of August (about eight months after collection) had slightly higher germination rates than (50%) those collected in Kullu (46%); especially when the seeds were soaked in cold water for 24 hours and rubbed with wire mesh for 10 minutes. Commencement of germination was also fast (only eight days). The height

(based on 36 seedlings) of a two-month old seedling was slightly lower for those seeds collected from Kullu provenance (7.5cm with 5.2 leaves per seedling) than for those from the Kosi provenance (7.7cm with 5.1 leaves per seedling). Lata (1996) has reported 82.7g per seedling dry matter production for a one-year old seedling, of which the root accounted for about 38 per cent, and leaves and stem for about 31 per cent each. Seven-year old trees of *Grewia* growing at the institute's nursery in Kosi, grew to a height of 7.5±1m and a girth of 47±7cm (based on 5 plants). Further, this tree is a strong light demander and requires full sunlight for optimal growth. Species can also withstand frost and this has further increased the importance of this species for farmers.

During winter (November to February), the current years' shoots are harvested to obtain leaves as green fodder. The sticks (after leaf collection) are left out for shade drying until the second week of March. Shade dried sticks are then spread in the open for sun drying for two to three days. These sticks are then pooled into bundles of 30-40 sticks per bundle. The bundles are kept submerged under water for about four to six weeks in a channel by making a pool (locally known as *khal)*. Stones are kept on each bundle to keep the bundles submerged. The retting time depends on the thickness of sticks and the prevailing temperature in the area. The *Grewia* sticks take the longest to ret in water than any other species. A sort of slimy microbial growth seems to be necessary for the process of retting to be complete (Bisht et al. 1996). The fibre is extracted from retted stalks manually by peeling off the bark gently and pounding it with a mallet to remove the dead outer bark. Finally, it is washed in water. The fibre is usually white or light brown in colour. The newly extracted fibre is dried in the sun. Using local skills and a combination of various 'ties and knots', different products are fabricated to meet the domestic and market demands.

The bark yields a fibre that contains 72 per cent cellulose. In an experiment, five stalks (with minimum diameters of 2.5cm and of different lengths - 55, 90, 101, 106, 125cm) yielded a total of about 48g dry weight of fibre. The time taken to extract fibre was about 2.5 minutes. The fibre was pounded by a mallet for 7.5 minutes in order to dislodge the outer bark and then washed with water for about one minute.

Agave sisalana

By and large, cultivation practices have not been observed in the case of this species in the Central Himalayan region except in a few locations near Dehradun in Garhwal region and near Bhowali and Bageshwar in Kumaon region by voluntary organizations. The mature leaves are scraped by hand to remove the green matter from the fibrous layer.

The fibre consists of strands or filaments usually three to five inches long. The fibrous substance consists of 73-78 per cent of a lignified form of cellulose. The fibre is white or pale yellowish in colour; it is strong and coarse.

Daphne papyracea

This is an evergreen shrub with continued leaf drop (multiple events). Leaf drop takes place throughout the year, whereas leaf flushing occurs during February-March and September-October (multiple events) (Singh and Singh 1984). The plant bears white odourless flowers from December to February and fruit maturation occurs from April to June. The fleshy fruits are brown-

ish red in colour. The number of individual plants per ha varied in different *Quercus* forests (2,134 plants/ha in *Quercus floribunda*, 33 plants/ha in *Q. lanuginosa*, 1,455 plants/ha in *Q. leucotrichophora*, 6,875 plants/ha in mixed *Quercus* forests) (Saxena and Singh 1982). Its bark is the source of commercial cellulose, but it is found in only small quantities (about 22%).

The bark can be peeled off easily. The bark is sun dried and, after scraping off the epidermis, it is cooked in water that has been rendered alkaline with wood ash. The inner fibrous parts are softened by this treatment. The cooked parts are beaten into a pulp and cast out on perforated sheets to make paper.

Fibre Products

The fibre obtained from different species is spun manually into threads using various tools (Plates 2.7 and 2.8). Use of hands and feet is essential because the tools of the trade are incomplete. A description of various fibre products of different species has been presented below.

Cannabis sativa

The fibre of this plant is primarily used for making different types of rope for household activities and/or in cottage industries. The various products that are prepared with different combinations of fibre threads are shown in Table 2.7 and Plate 2.9.

Girardiana heterophylla

In the Himalayas, unlike in other places, the fibre is extracted for local use and is used mainly for household work, usually for making various ropes (particularly for livestock related jobs). At the level of small cottage industries, it is used for making fishing nets (presently confined to one location only, Plate 2.10). Different types of ropes, identical to those made of the *Cannabis* fibre, are made using various combinations of threads (Table 2.8).

Grewia oppositifolia

This fibre is used mainly for making ropes for household activities. The method of making ropes (varying combinations of threads) depends on the specific purpose for which the rope is to be used. Ropes are used for livestock care, to a great extent, and are available in the local markets of the region (Table 2.9).

Agave sisalana

The various products traditionally made of *agave* fibre and their specific use in village life are shown in Table 2.10 and Plate 2.10. Other commercial products have also been tried out by some organizations.

Daphne papyracea

In this region, this plant fibre was earlier used to make paper (locally known as *Kagaj*) and for preparing horoscopes.

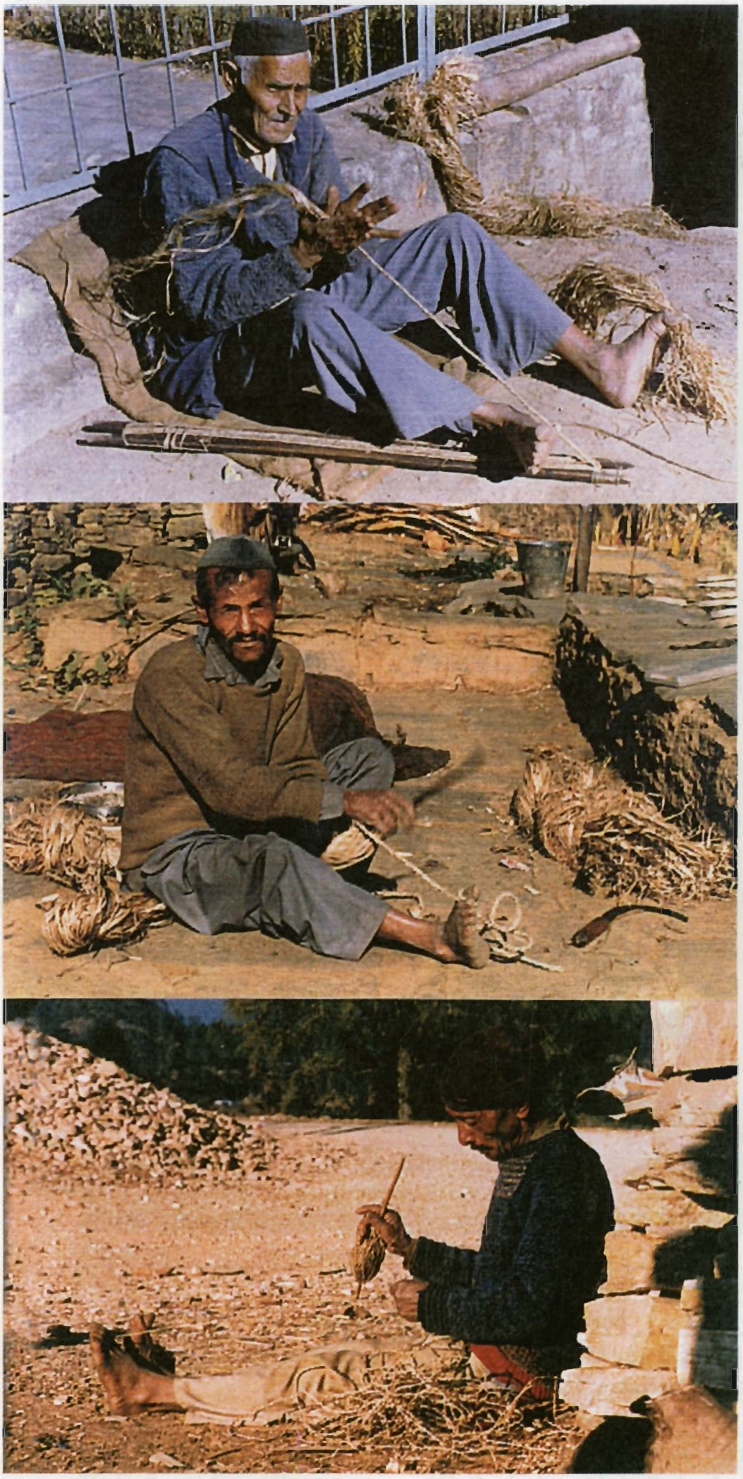


Plate 2.7: Spinning fibre threads with various tools — a special feature is the use of feet and hands

Plate 2.8: Fibre, various tools and usage for spinning fibre threads and weaving cloth

Table 2.7: Final Products of *Cannabis* Fibre

Product	Local name	Specific Use
1. Net	*Jao*	To collect fodder and leaf litter
2. Rope	*Jyor*	To carry firewood and fodder
3. Rope	*Gayan*	To tether animals
4. Rope	*Barr*	To pluck firewood
5. Rope	*Jutora, Haroon, Nara*	To yoke bullocks to the plough
6. Carry bag	*Seenk*	To carry utensils
7. Cloth	*Kuthla*	To carry and store food grain
8. Cloth	*Budla*	To carry fodder and matting
9. Mask	*Muhao*	Masks for cattle while performing agricultural work
10. Collar Belt	*Daon*	To tie collar bells on bullocks
11. Basket	*Jali*	To pick mangoes and other fruit

Table 2.8: Final Products of *Girardiana* Fibre

Product	Local name	Specific use
1. Net	*Fatyao*	Small fishing nets
2. Net	*Jal*	Large fishing nets
3. Rope	*Jyor*	To carry firewood
4. Rope	*Gayan*	To tether animals in cattle sheds
5. Rope	*Jutora*	To yoke bullocks to the plough

Table 2.9: Final Products of *Grewia* Fibre

Product	Local name	Specific Use
1. Rope	*Jyor*	To carry firewood
2. Rope	*Gayan*	To tether animals in cattle sheds
3. Rope	*Jutora*	To yoke bullocks to the plough
4. Mask	*Muhao*	Masks for cattle during agricultural activities
5. Net	*Jao*	To store vegetables and carry utensils
6. Carrier bag	*Seenk*	To store vegetables and carry utensils

Table 2.10: Final Products of *Agave* Fibre

Product	Local name	Specific Use
1. Rope	*Jyor*	To carry firewood and fodder
2. Rope	*Gayan*	To tether animals
3. Rope	*Haroon*	To yoke bullocks to the plough
4. Mask	*Muhao*	Masks for cattle during agricultural activities
5. Net	*Jal*	To carry fodder
6. Carry bag	*Seenk*	To store vegetables and carry utensils
7. Collar belt	*Daon*	Collar belts with bells for bullocks

Plate 2.9: Various ropes and their usage
A) *Seenk* B) *Jutora* C) *Muhao* and thread D) *Jao* E) *Jyora*

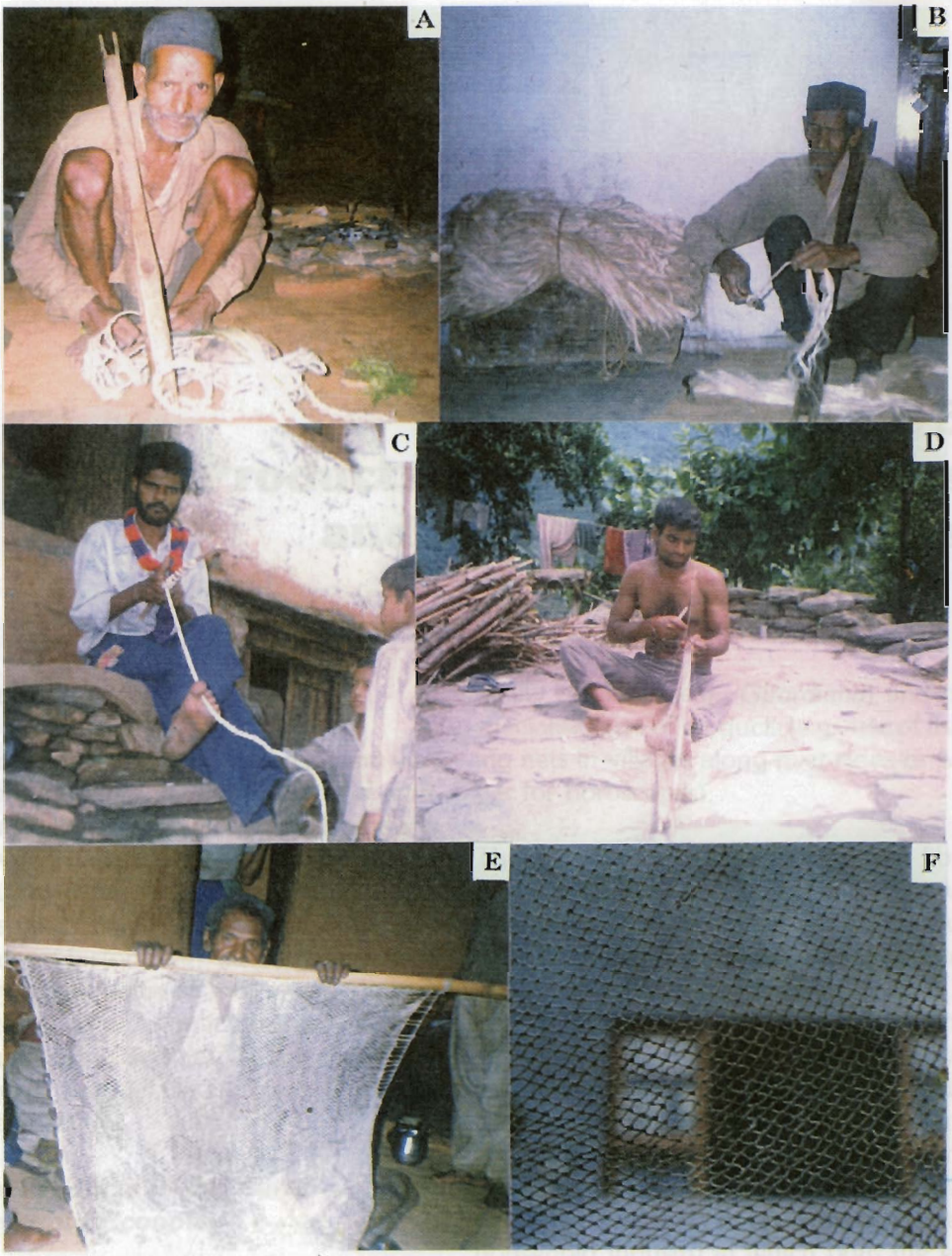


Plate 2.10: Ropes and fibres of *Agave*
A,B,C) Artisans with scutched fibre, ropes, and tools
D) An artisan making a fishing net from Girardiana fibre
E) A ready-made fishing net
F) Close-up of net

Chapter 3
Fibre Products in Village Activities and the Role of Markets

Introduction

Natural fibres and their products were very important before the introduction of artificially synthesised polymer-based products. However, natural fibre-based products are still used extensively in mountainous regions (as described in Chapter 2) because of various factors, e.g., free and easy availability of raw materials and cheap, durable products. Several mechanisms exist for manufacturing and distributing these fibre products. The details are given in the following sections.

Fibre Products in the Rural Household Economy

Village communities, irrespective of geographic locations, have widespread working knowledge of fibre extraction and of making products from plant fibres. However, specialised or skilled knowledge is sometimes confined to a particular caste in localised pockets because of: (i) the availability of plants (e.g., *Girardiana*) and (ii) specialised use of products (e.g., use of fishing nets in villages along river sides or paper for horoscopes).

The artisans specialised in common fibre products (*Grewia* and *Cannabis*) are known as *khokhee*. As mentioned earlier, the skill of a *khokhee* is confined to a particular group (caste). Several methods (Figure 3.1) can be identified for manufacturing and distributing products within a village system. Making various fibre products for daily use has played a key role in strengthening the symbiosis between various communities within a village. This activity is carried out in two ways: (i) in the form of a small household industry in which both the extraction of fibre and the making of products are carried out by an artisan, and (ii) raw plant fibre is provided to an artisan to make one particular product. Irrespective of the approach, the artisan receives food in lieu of his services. Sharing of outputs (food grain by farmers and fibre products

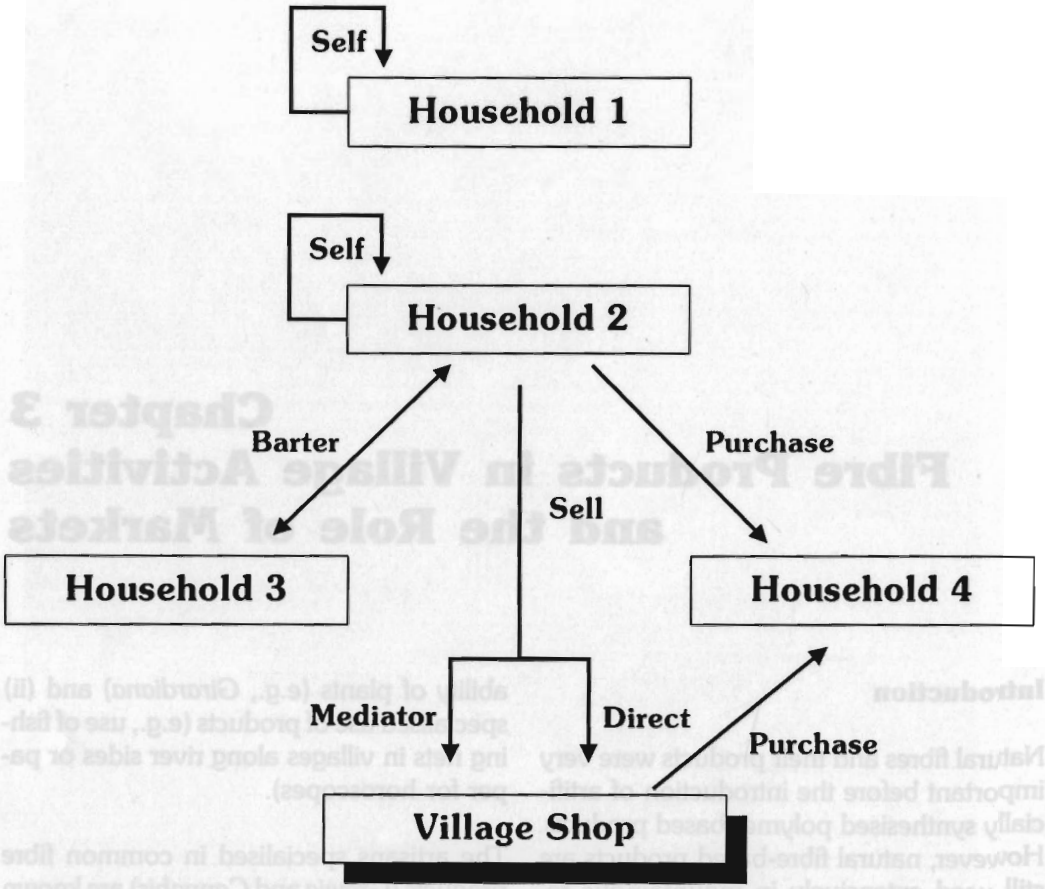


Figure 3.1: Trade Linkages between Different Households and/or the Village

by artisans through a barter system) within a village community is a common practice throughout the Central Himalayan mountains.

The pattern of exchange and distribution of fibre products of three main species (*Grewia, Cannabis,* and *Agave*) is significantly diverse among species as well as in different villages for a given species (Figure 3.2). These diverse patterns depend upon: (i) access by road to the main service centres (e.g., Almora and Bageshwar), (ii) demand within the village, and (iii) one's own requirements. An analysis of proportional distribution of different products made by an average household or artisan (Table 3.1) indicates that most products, particularly those related to livestock and daily household operations, is used within the village.

Manufacturing of these natural fibre products did not appear to be the main occupation of villagers; rather, it was observed to

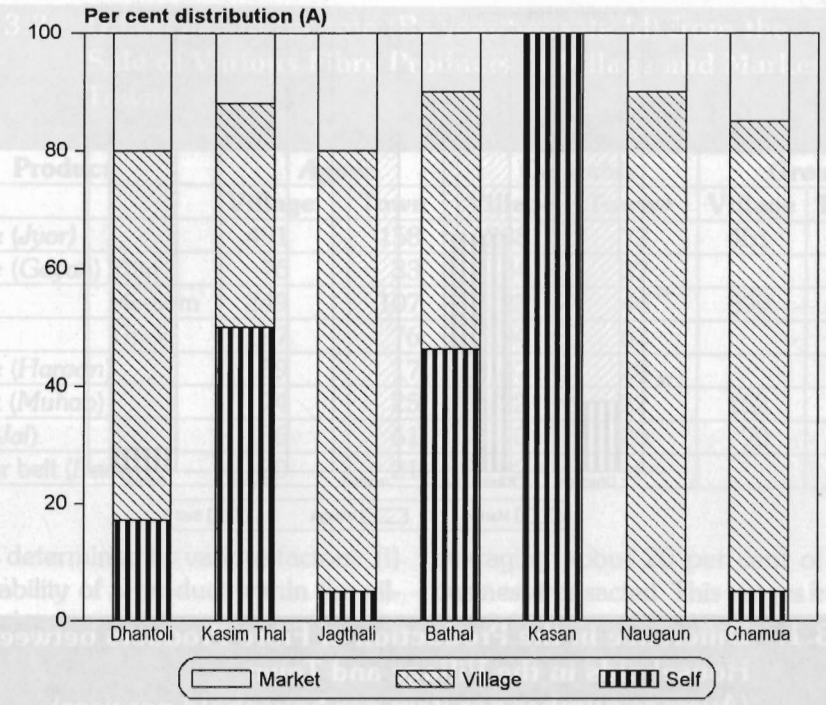
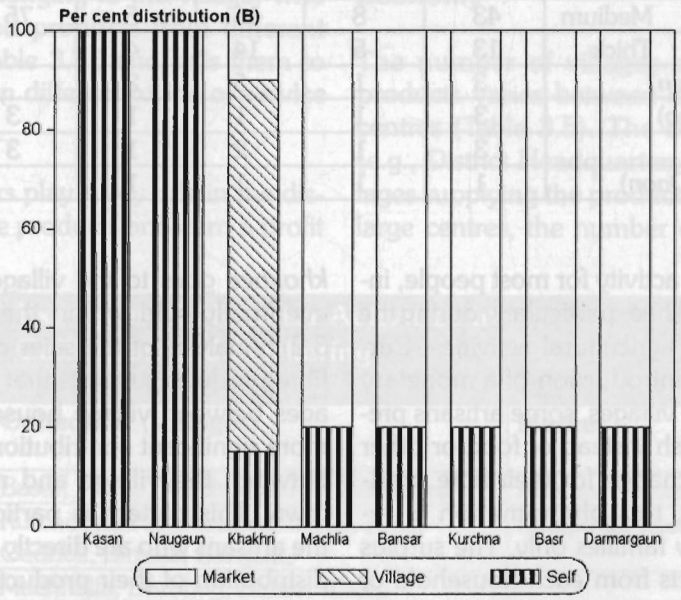


Figure 3.2: Distribution of Fibre Products (A) *Cannabis*, (B) *Grewia*, and (C) *Agave* for Personal Use, within the Village and Market Trade



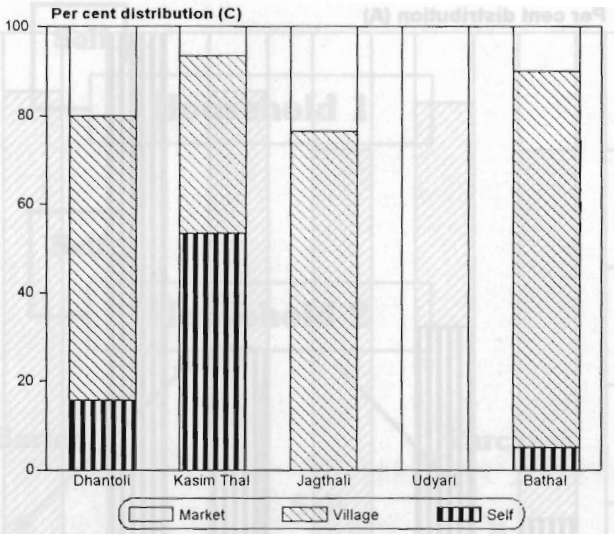


Table 3.1: Difference in the Production of Fibre Products between Households in the Village and Town (Average number per item per household per year)

Product	*Agave*		*Cannabis*		*Grewia*	
	Village	Town	Village	Town	Village	Town
1. Rope (*Jyor*)	49	15	29	8	58	43
2. Rope (*Gayan*) Thin	23	10	27	11		
Medium	43	8	16	5	75	45
Thick	13	5	14	4		
3. Rope (*Haroon*)	3	1	5	2		
4. Mask (*Muhao*)	3	1	1	1	3	4
5. Net (*Jal*)	3	1	2	1	3	4
6. Collar belt (*Daon*)	1	1	1	1		

be a secondary activity for most people, including the *khokhee*, particularly during the lean period for agricultural activities. Currently, with the introduction of a monetary economy in the villages, some artisans prefer to accept cash instead of food or other materials in exchange for their fibre products. However, this phenomenon is restricted to a few families only. The surplus of these products from each household or *khokhee* goes to the village shops and is eventually sold within the village (Table 3.2) Analysis of the sales of village-made fibre products suggests that economic linkages between village households make a more significant contribution than linkages between the village and markets in the town. This pattern is particularly true for the artisans who are directly engaged in the distribution of their products.

Table 3.2: Difference in Income (Rs/year/household) from the Sale of Various Fibre Products in Village and Market Towns

Product	*Agave*		*Cannabis*		*Grewia*	
	Village	Town	Village	Town	Village	Town
1. Rope (*Jyor*)	491	158	238	73	451	209
2. Rope (*Gayan*) Thin	76	33	84	37		
Medium	249	107	123	44	899	265
Thick	197	76	194	63		
3. Rope (*Haroon*)	39	17	47	20		
4. Mask (*Muhao*)	74	25	22	22	152	190
5. Net (*Jal*)	136	61	70	20	70	75
6. Collar belt (*Daon*)	20	21	22	16		

Pricing is determined by various factors: (i) the availability of a product within the village and the demand for a product and its availability in the village market; (ii) time available to visit markets in town, particularly when the markets are at a distance from the village; and (iii) cash needed to buy the items needed.

Fibre products are also marketed through a mediator (belonging to the village) who collects finished products from different households (Table 3.3.) and sells them to various shops in different towns or service centres.

These mediators play a key role in the distribution of fibre products and earn a profit averaging about 20 per cent of the total business transacted. This ranges from about Rs 20,000 to Rs 75,000 per annum (Table 3.4). A higher profit margin was observed in the sale of ropes and *Gayan* (20-40%) than in the products that involve complex weaving, i.e., masks and nets (e.g., *Muhao* and *Jao*).

Role of Market Towns in the Rural Economy

The number of villages supplying fibre products varies between different service centres (Table 3.5). The bigger the town (e.g., District Headquarters), the more villages supplying the products. In the case of large centres, the number of villages sup-

Table 3.3: Examples of Mediator Activities in Collection and Marketing

Village of Mediator	Collection (Villages)	Market
Basar	Basar, Thaily, Kurchoona Aar, Kaulipara	Almora, Someshwar
Kurchoona	Kurchoona Par, Kafalkot, Naula, Jyoli, Gadholi, Bimola, Bangsar,	Kathpuria, Kosi, Bageshwar
Machhalia	Machhalia, Darbhag, Babur *Khola*	

Table 3.4: Business, Profit Margins of Mediators and Individual Profit from Products in Percentages

Mediator	Total business transacted (Rs per year)	Total profit share (%)	Individual profit share of products				
			Rope	Gayan	Gayan	Muhao	Jao
Mr. N. Kandpal	75,000	22.6	30	20	25	14	11
Mr. K. Kandpal	74,750	19.4	30	20	26	14	10
Mr. Prem Ram	36,700	22.6	22	25	27	16	10
Mr. Jashod Ram	19,850	16.5	34	25	20	10	11

Table 3.5: Statistics of Supplier Village and Purchaser Village from Various Market Towns and Service Centres

Market	Villages		Ratio	Supply to the same villages
	Supplier	Purchaser		
District Headquarters				
Almora	23	8	0.34	0
Bageshwar	23	12	0.52	12
Block Headquarters				
Berinag	15	12	0.8	10
Dhaulchina	2	3	1.5	1
Bhainsiachana	2	5	2.5	2
Takula	6	5	0.8	4
Service Centres				
Kotmanya	4	6	1.5	4
Dharamghar	3	4	1.3	1
Jageshwar	2	5	2.5	0
Bitholi	3	4	1.3	0

plying products exceeded those buying; in small centres, the number of villages buying products was more.

The commerce in fibre products from and to market towns overlaps between: (i) supply from and to the same village, and (ii) linkages between two villages (Figure 3.3). One interesting observation was that the mechanism was common at all service centres, except at the District Headquarters and the small service centre of Jageshwar (Table 3.5).

The marketing mechanism also varies with the method of payment to an artisan. Some artisans prefer the barter system and take food or other subsistence items in lieu of their products and, therefore, sell their products within the village. Others prefer cash and, therefore, mostly sell in the market or to middlemen.

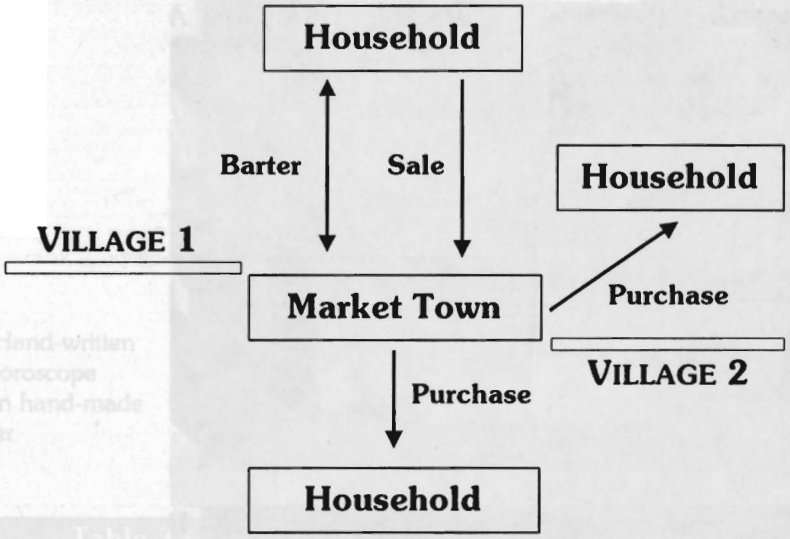


Figure 3.3: Trade Linkages between Two Villages and a Common Market

The cost of fibre products varies with the plant species used. This is dealt with in later sections. The term 'selling price' stands for the price paid by the shopkeeper to an artisan.

Cannabis sativa

The range of prices for various hemp products is given in Table 3.6. These give an average picture of the various markets located in villages and towns. However, products such as *Budla* or *Kuthla* (Plate 3.1) seldom come to the market because too much time is required to prepare these items and returns are not satisfactory. In addition there are cheaper and better substitutes for these in the market.

Girardiana heterophylla

Only one product (small or large fishing nets) of this species has cash value.

Grewia oppositifolia

Fibre products from this plant are easily available in different markets in the region.

Agave sisalana

The products of this species are not common in all markets but are considered to be superior to the same products made from other fibres.

Daphne papyracea

The only known fibre product, paper (Plate 3.2), is not available in the market any more.

It appears from Tables 3.6 to 3.9 that fibre products of each plant species have a certain market value. However, in any market, plant products of all or a particular species may not necessarily be available in shops dealing in fibre products (Figure 3.4). An analysis of the availability of products

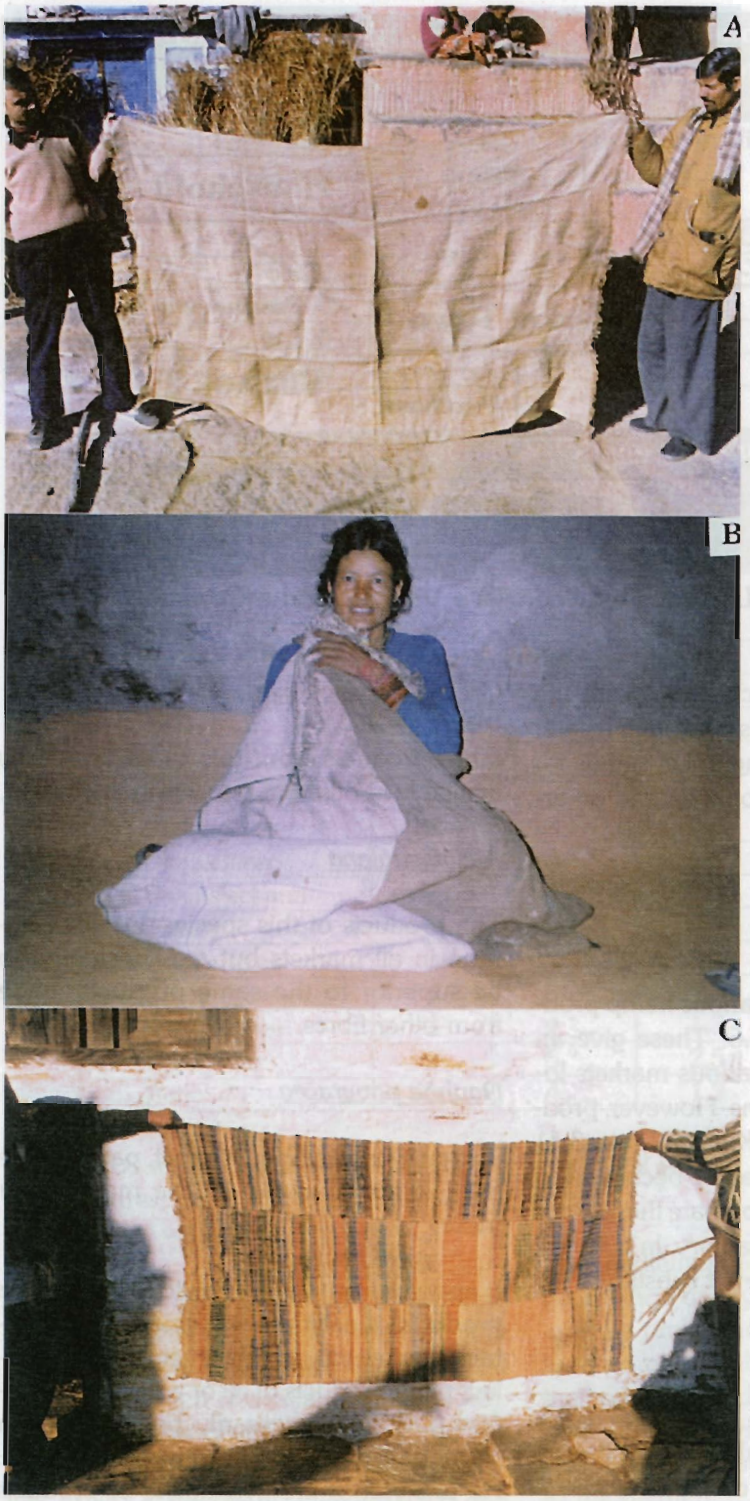


Plate 3.1: Various types of cloth made of *Cannabis* fibre

A) Full length *Kuthla* for fodder collection and carriage

B) A new and old piece of *Kuthla*

C) A full mat

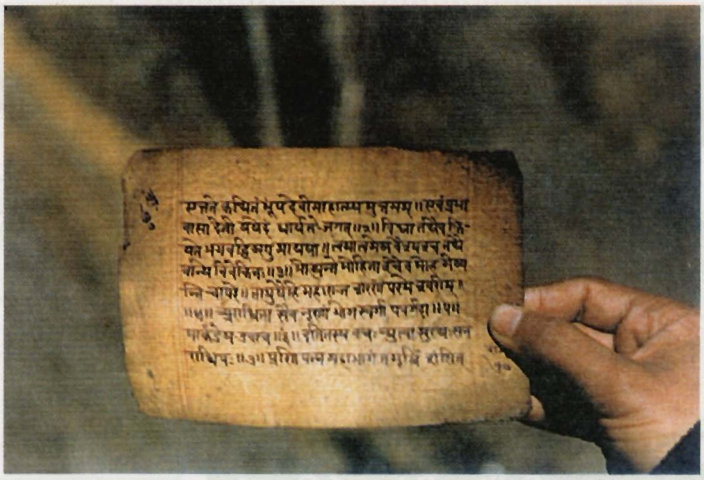


Plate 3.2: Hand-written (traditional horoscope document) on hand-made *Daphne* paper

Table 3.6: Selling Price of Finished Products made of *Cannabis* Fibre

Product	Local name	Selling Price Range (Rs per piece)
1. Net	*Jao*	20 - 40
2. Rope	*Jyor*	6 - 8
3. Rope (Thin)	*Gayan*	2 - 4
4. Rope (Medium)	*Gayan*	4 - 12
5. Rope (Thick)	*Gaya*	12 - 18
6. Rope	*Barr*	20
7. Rope	*Jutora, Haroon, Nara*	6 - 14
8. Carrier bag	*Seenk*	10 - 30
9. Cloth	*Kuthla*	100 - 150
10. Cloth	*Budla, Badar*	100 - 200
11. Mask	*Muhao*	15 - 25
12. Collar Belt	*Daon*	12 - 20
13. Basket	*Jali*	20

of different species at a shop shows a diverse pattern within a market and among various markets. Products of three plant species (*Cannabis*, *Grewia*, and *Agave*) were available in all the shops at Bhainsiachana and Takula, however, shops at Jageshwar deal in products made from *Cannabis* fibre only.

Further analysis of availability of a particular product in different markets indicates that products related to livestock (*Gayan* and *Muhao*), household activities (ropes), and fodder collection (*Jao*) are frequently available in different markets; other specialised products (e.g., cloth) are available in one or two markets only (Table 3.10)

An important observation regarding the availability of these products in all markets was that none of the shops dealt exclusively in fibre products (Plate 3.3). Usually, one

Table 3.7: Selling Price of Fishing Nets made of *Girardiana* Fibre

Product	Local name	Price range (Rs per piece)
1. Net (small)	*Fatyao*	500
2. Net (big)	*Jal*	700 - 1,000

Table 3.8: Final Products and Selling Price of *Grewia* Fibre

Product	Local name	Price range (Rs per piece)
1. Rope	*Jyor*	15
2. Rope	*Gayan*	10 - 14
3. Rope	*Jutora*	6 - 14
4. Mask	*Muhao*	25
5. Net	*Jao*	40 - 50
6. Carry bag	*Seenk*	15 - 20

Table 3.9: Products and Selling Price of *Agave* Fibre

Product	Local name	Price range (Rs per piece)
1. Rope (Small)	*Jyor*	8 -12
2. Rope (Long)	*Jyor*	20 - 22
3. Rope (Thin)	*Gayan*	3 - 5
4. Rope (Medium)	*Gayan*	10 - 12
5. Rope (Thick)	*Gayan*	8 - 20
6. Rope	*Haroon*	10 - 14
7. Mask	*Muhao*	15 - 25
8. Net	*Jal*	30 - 40
9. Carrier bag	*Seenk*	15 - 25
10.Collar belt	*Daon*	15 - 25

Table 3.10: Product Availability in Percentage of Total Shops Dealing in Each Product in a Market

Market	Products									
	Rope	Gayan	Muhao	Jao	Haroon	Dao	Kuthala	Budla	Seenk	Jali
Almora	74	100	58	53	-	-	-	-	-	-
Bageshwar	73	100	64	64	9	-	27	27	18	9
Berinag	82	100	36	18	9	18	-	-	-	-
Dhaulchina	100	100	33	-	-	-	-	-	-	-
Bhainsachhena	100	100	-	-	-	-	-	-	-	-
Takula	75	100	75	50	-	-	-	-	25	-
Kotmanya	100	100	90	-	-	-	-	-	-	-
Dharamghar	100	100	33	33	-	-	-	-	-	-
Jageshwar	67	100	-	33	-	-	-	-	-	-
Bitholi	100	100	90	90	-	-	-	-	-	-

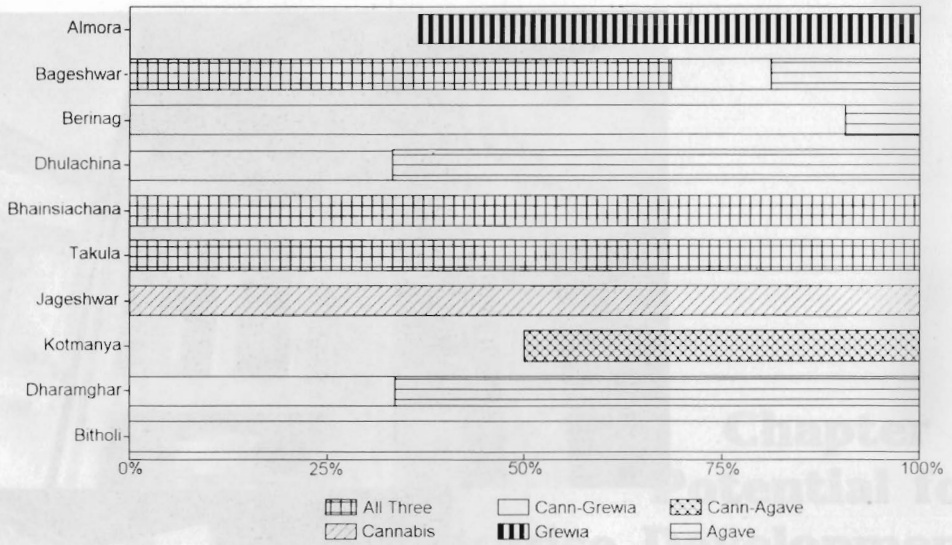


Figure 3.4: Distribution pattern of various fibre products available in different markets

or two shops in small service centres or villages served as small 'super markets' where villagers buy many different products for daily use. In the market towns, these items are available in a variety of shops, e.g., grocery stores, vegetable and tea stalls, etc. Fibre products are considered of secondary importance by shop owners. This can be seen from the annual business transactions (Table 3.11). However, fibre products play an important role in influencing the total business (including other items in the shop) as they help to develop a relationship with customers from the villages.

Table 3.11: Business in Fibre Products in the Markets under Study

Market	Income from selling (Rs per year)	
	Range	Average
Almora	160 – 2,220	1,064
Bageshwar	1,008 – 4,500	2,231
Berinag	660 – 2,280	1,214
Dhaulchina	480 – 1,260	752
Bhainsiachana	1,080	1,080
Takula1	1,020 – 2,520	1,540
Kotmanya	96 – 1,776	936
Dharamghar	732 – 1,056	864
Jageshwar	660 – 1,140	702
Bitholi	1,716 – 1,916	1,816

Plate 3.3: Display of different fibre products in shops

Chapter 4
Potential for Enterprise Development

Introduction

Studies carried out on fibre-yielding plants so far reveal that these plants and their products play a significant role in the different activities in a village system. In spite of the increase in awareness about the market potential of modified products and the support extended by non-government and government agencies, few people have taken the initiative to revive these practices and processes with the intention of developing them into cottage industries. The present set up should be used and strengthened as far as possible by providing modern, scientific, and technical knowhow (as in the case of *Agave*) and management inputs.

Status of Plant Species

There is ample scope for research and development on the fibre of *Grewia*, a tree recognised for the quality of its fibre. Products, such as hats, wall hangings, shoes, etc (Plate 4.1), have been made from this fibre and successfully tested in the market. Recently, a new herbal shampoo has been developed from the *Grewia* plant (Plate 4.2).

Cannabis fibre is considered to be superior to that of *Grewia* by the villagers. It is available in the rural or market towns but, because of its narcotic properties, there have been restrictions on commercial cultivation and use. Hence, any large-scale production of raw material (*Cannabis* fibre) for developing a cottage industry would have to receive permission from the government (Plate 4.3).

Recently, the use of *Agave* has been promoted in this area in order to develop household-based industries. Plantations have been established in a few locations with the help of many organizations. A mechanised process has also been developed for the extraction of fibre by using diesel engines (Plate 4.4). The main emphasis, so far, in terms of product develop-

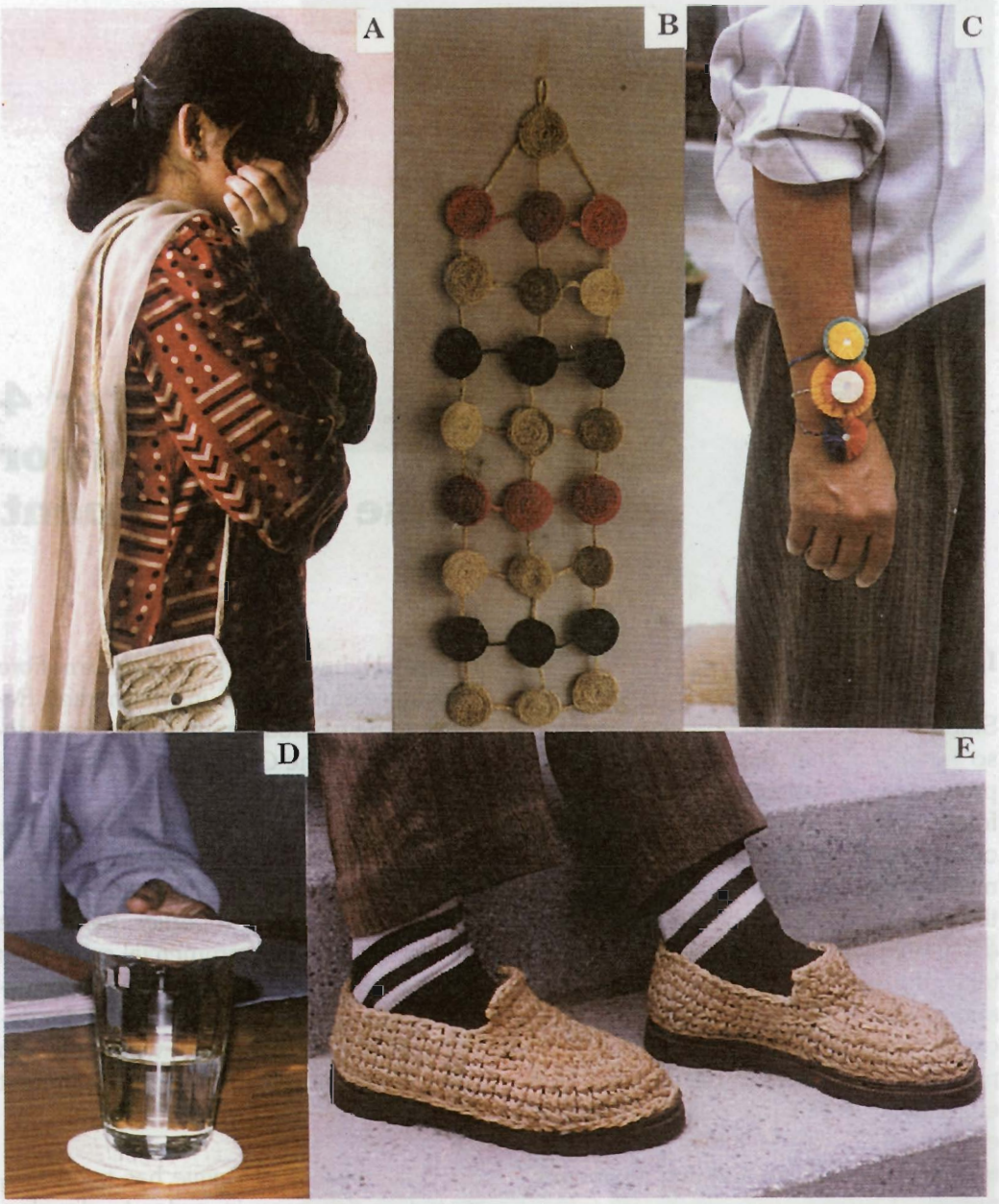


Plate 4.1: The fibre from plants used for making
A) ladies' purses
B) wall hangings
C) *rakhee*
D) glass covers (all from *Agave* fibre)
E) shoes from *Grewia* fibre

Plate 4.2: A herbal shampoo made with *Grewia* as the main component

ment has been on the consumer needs of urban settlements. Further, fibre from the *Agave* plant has attracted special attention from creative artists. Various products, viz., decoration pieces, table mats, shoes, handle covers, wallets, ladies' purses, tea coasters, garlands, shaving and painting brushes, etc (Plates 4.1, 4.5 and 4.6) have been developed from it in collaboration with local artisans. An outlet run by a voluntary organization that is working on the development of these products has also helped promote the sales.

Girardiana and *Daphne* plants, being a part of the natural vegetation, form an easily available source of fibre, but, in the case of the former, its stinging bristles restrict its wide use. Special use of *Girardiana* fibre, e.g., to make fishing nets that are durable, makes this plant important among the fibre-yielding plants of the region. Introduction of synthetic fibre-based fishing nets is hampering the use of *Giradiana* and indigenous skills. Similarly, indigenous knowhow in making paper with bark from the *Daphne* plant has practically vanished from this region as a consequence of the availability of modern mill-made paper. There is potential for developing enterprises and generating employment because this shrub is an important raw material for making paper commercially also. The *Daphne* plant can be harvested in abundance for this purpose and/or cultivated in wastelands to provide additional raw material for the commercial manufacturing of paper at cottage industry level. A mill for this purpose could be located in the foothills.

Acceptability of Products

It appears from the analysis that various traditional products developed out of these plants, and the relevant practices have so far been centred on their local use within villages. However, attempts are being undertaken to develop non-traditional products for revenue generation and to provide job opportunities. Traditional products from natural fibre, such as nets, *jutora*, carrier bags, masks, collar belts, baskets, and baskets for collecting grass and for use in various agricultural and household activities, cannot be substituted by any other product. Where substitutes (synthetic polymer)

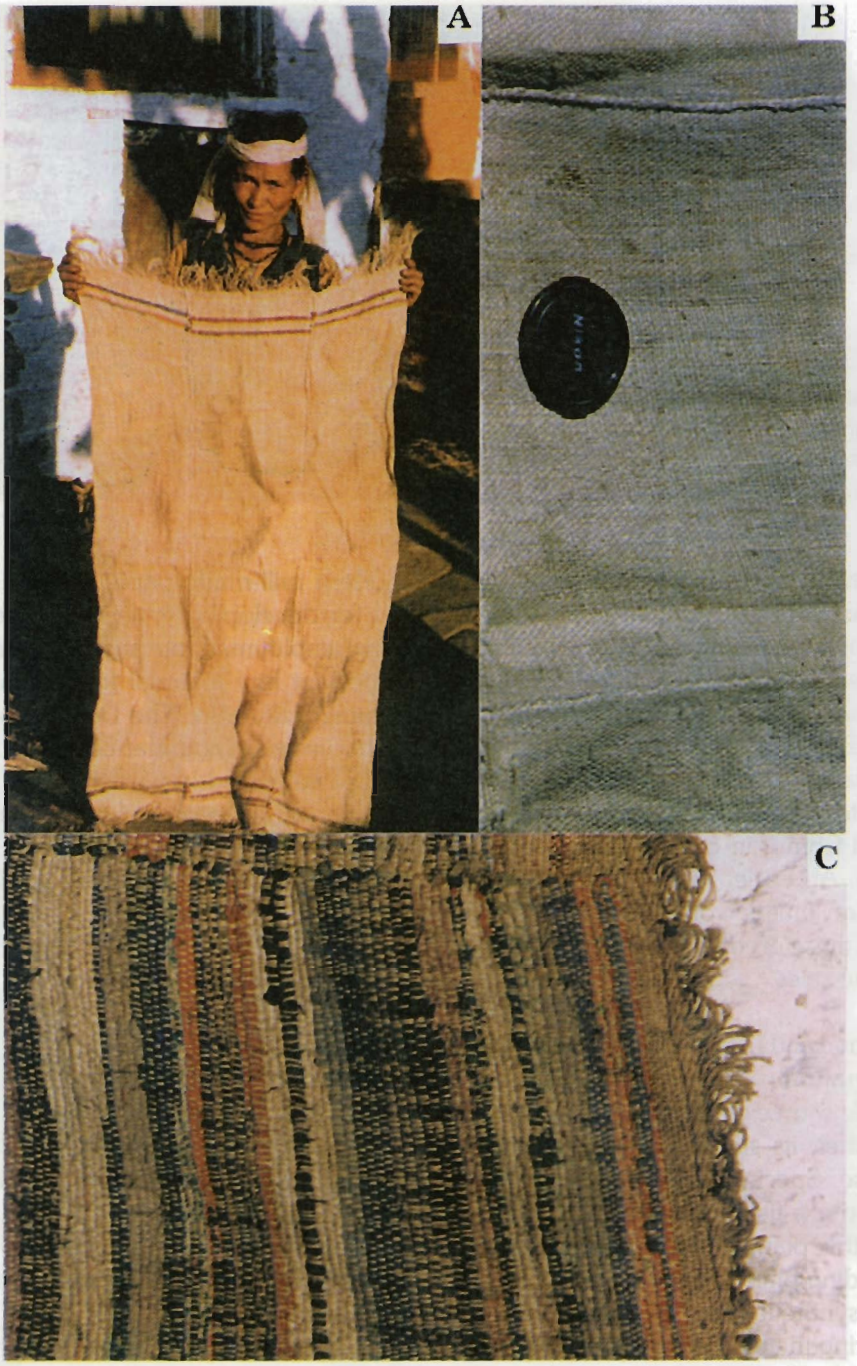


Plate 4.3: Various cloth pieces made of *Cannabis* fibre
A) *Budla* mat
B) Close-up of *Kuthla*
C) Close-up of a mat

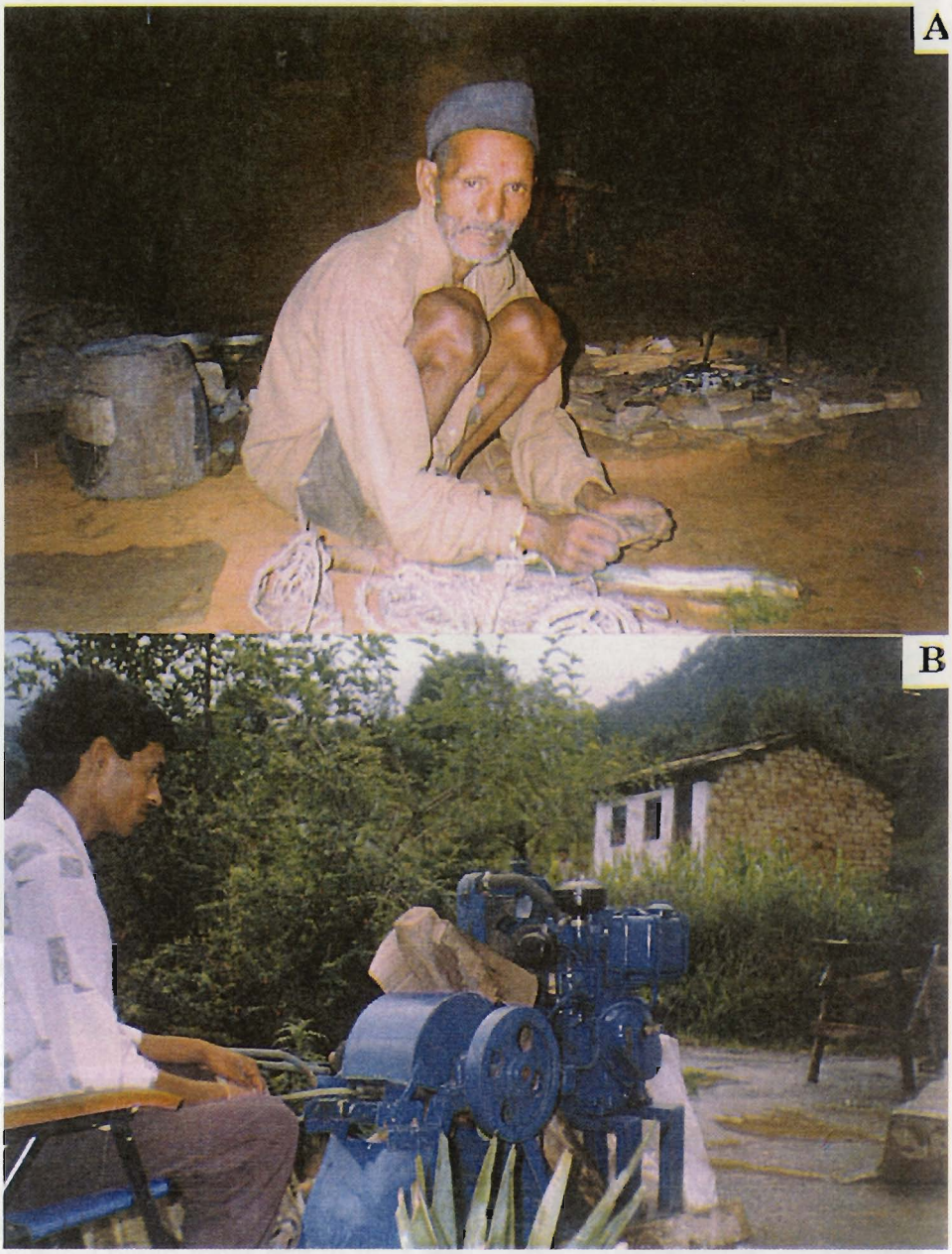


Plate 4.4: Development of Technology
A) Primitive, manual method of scutching *Agave* fibre
B) Modern machine developed for the extraction of fibre

Plate 4.5: Fancy articles made out of *Agave* fibre
A) Decoration piece B) Table mats
C) Shoes D) Handle cover
E) Wallets and ladies' purses

Plate 4.6: Use of *Agave* fibre to make
A) garlands,
B) tea coasters,
C) decoration pieces, and
D) shaving and painting brushes

are available, as in the case of ropes for livestock-related activities, villagers prefer natural fibre-based ropes due to their remarkable advantages. Ropes made of natural fibre do not heat up even under direct sunlight. Further, they remain soft when animals move or change posture. Therefore, use of natural fibre does not harm animals or cause rashes and wounds on the neck, while polymer-based ropes cause bruising and uneasiness.

Despite consumer preferences and availability of substitute products, natural fibre-based products have the potential of being used in cottage industries because of the availability of raw material within accessible distances. In addition products can be

Plate 4.5: Fancy articles made out of *Agave* fibre
A) Decoration piece B) Table mats
C) Shoes D) Handle cover
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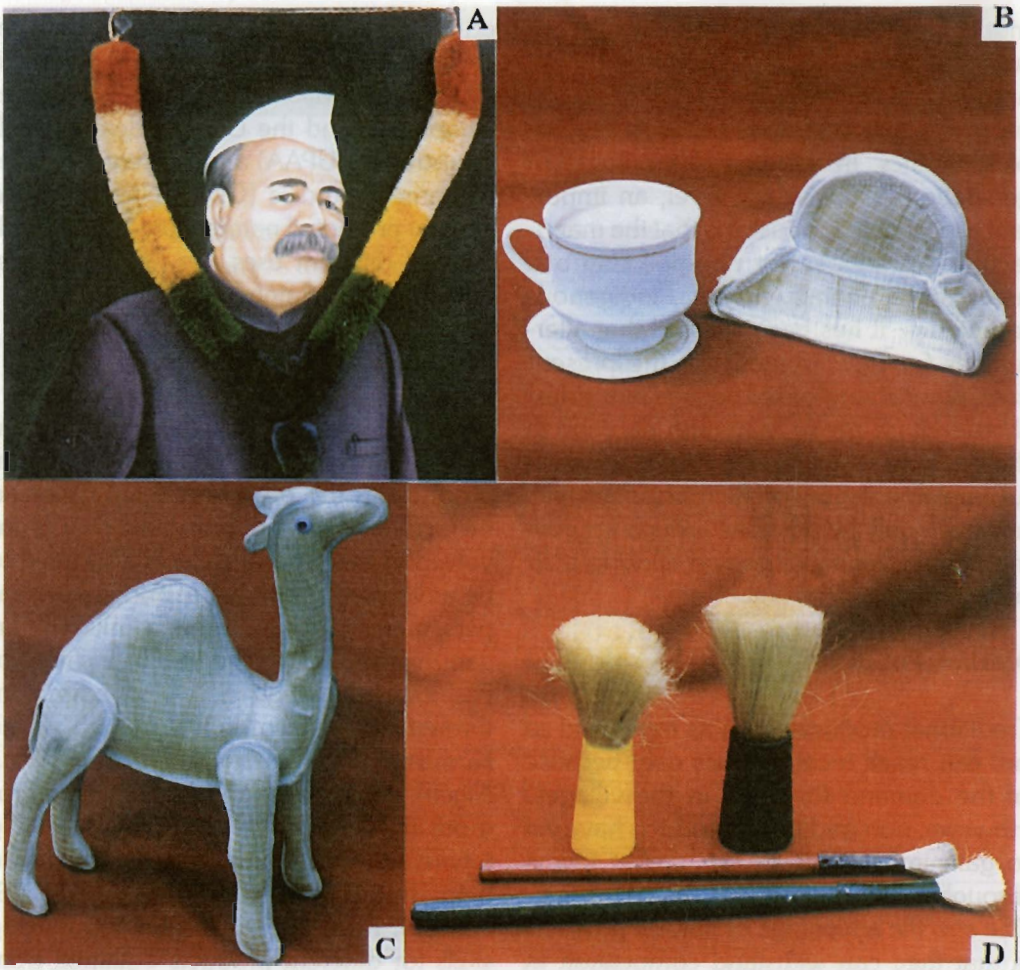

Plate 4.6: Use of *Agave* fibre to make
A) garlands,
B) tea coasters,
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Despite consumer preferences and availability of substitute products, natural fibre-based products have the potential of being used in cottage industries because of the availability of raw material within accessible distances. In addition products can be

modified/altered to some extent to suit consumers without too much technical input and equipment. There is also a growing global preference for natural products in place of synthetics. In addition to employment generation at the village level, an important aspect of this industry is that the manufacturing processes are non-polluting and use environmentally-friendly, indigenous techniques. It has been stressed that alternatives for development (in the present case, natural fibre-based cottage industries) should cause no or minimum damage to the environment (Papola 1996). Successful implementation of such activities will, however, only be possible through improving people's capabilities and eliciting their participation.

Market Potential

Traditional products, such as ropes and so on, can reach local markets only because of the demand for them in the villages. However, non-traditional products have yet to gain importance in the market towns through value adding and advertisement. The specific advantage of natural products is that they can withstand competition in the market due to their uniqueness.

Various traditional and non-traditional fibre-based products have been listed in Table 4.1. The cost of traditional products varies between Rs two to 1,000, whereas for non-traditional products the range is from Rs 15 - 1,300. Non-traditional products have potential to create a demand in urban markets in spite of the use of synthetic materials. Nonetheless, there is an increasing awareness in the urban community and a growing global preference for natural rather than synthetic products. Further, natural fibre products attract tourists to local markets. They have also been adopted by many organizations. In this regard, institutes such as the G.B. Pant Institute of Himalayan Environment and Development, and the U.P. Academy of Administration (UPAA) and its Centre for Development Studies (CDS), Nainital, have already promoted natural fibre-based products for different uses, e.g., bags, folders, and so on at seminars and workshops.

Strategies for Promotion

Market promotion will play an important role in making room for non-traditional products in the outside market. This can be achieved by encouraging NGOs involved in this work. Products also need to be advertised properly in various newspapers, magazines, and through links with organizations such as the Indian Institute of Fashion Technology (IIFT). Advertisement through the tourism industry, such as the Kumaon and Garhwal *Mandal Vikas Nigam*, could be among the means to promote these products. Exhibitions in big towns and in historical places could also help. In this connection, UPAA and CDS, Nainital, have already begun introducing stalls for different products obtained from various NGOs. Producers' cooperatives should be established to organize, manufacture, and sell fibre-based products.

A few NGOs are already active in the promotion of natural fibre-based products in the study region. The idea of developing non-traditional products for commercial purposes was launched by the *Griha Udyog* and *Resha Utpadan Samiti* (Plate 4.7). At present, other NGOs (Himalayan *Gram Vikas Samiti*, *Mahila Vikas Sangathan*, HOPE, Pithoragarh, *Sanskrit Parishad*, etc) in the Central Himalayas are engaged in preparation of various fibre-based products, although on a very limited scale. The scale

Table 4.1: Cost of Various Traditional and Non-traditional Fibre Products

Products	Preparation time (hours)	Appr. Cost (Rs)
Traditional Products		
Ropes of various lengths and thicknesses	0.5-3.5	2-22
Ropes (Haroon, Jutora, Nara)	0.5-1	6-14
Carrier bags for carrying curd	1-2	10-30
Cloth for making mats, coats and bags	30-48	100-200
Masks for bullocks' mouths	1-2	15-25
Collar belts	1	12-25
Baskets	6-10	20
Fishing nets	60-70	700-1000
Nets	40-50	20-50
Non-traditional Products		
Jackets	80-110	158
Ladies' bags (based on size)	2-24	30-260
Ladies' purses (based on size)	2-24	18-100
Gents purses	2-4	20-25
Floor mats	96-190	720-900
Belts	4-9	67
Table cloths	6-48	85-760
File covers (folder)	12-22	50-200
Bags (based on size)	50-110	80-250
Wall hangers	8-10	50-105
Door mats	2-24	20-250
Hats	2-8	40-65
Himachali caps	2-8	45
Toys	6-48	45
Photo frames	18-30	15-250
Cushions	20-40	40-200
Telephone mats	2-24	15-100
Small mats (like *kaleen**)	50-80	50-315
Cradles	90-130	1300
Tea set mats	1-2	45-65
Tea cosy	2-8	45
Chair mats	6-24	40-150
Shoes and sleepers	2-4	Not fixed

* *kaleen* = carpet

Plate 4.7: *Agave* sp
A) A close-up of a large-scale plantation
B) Transportation of fibre
C,D) Finished fancy products
E) Mr. Girish Kandwal who runs an NGO working for the commercialisation of fibre products
F) A skilled woman trained by Mr. Girish Kandwal, now working independently

is small because of the lack of markets, marketing skills, and the limited supply of raw materials. These organizations sell their products in local markets through exhibitions. They also receive some financial support from the Hill Development Department of the Government of U.P. and the District Rural Development Agency (DRDA).

The *Griha Udyog* and *Resha Utpadan Samiti* have taken a lead in developing various fibre-based products for commercial purposes. The organization, at present, receives orders for fibre-based products from IIFT; the UP Academy of Administration, Nainital; Kumaon *Mandal Vikas Nigam*; the G.B. Pant Institute of Himalayan Environment and Development; Kosi-Katarmal; Delhi Exports; and so on. Various products have also been commended by importers and consumers from Canada, the USA, and Mexico. They have placed orders for these products in bulk but, due to shortage of raw materials, the consignment could not be met.

NGOs such as HOPE and *Paryavaran Sansthan* (GBPIHED) have also taken a lead in Human Resource Development by training farmers on fibre extraction. The extracted fibre is sold to the NGOs who carry out the training. *Griha Udhyog* and *Resha Utpadan Samiti* have also trained two women, and they have set up their own businesses. Moreover, this organization has also given employment to about 30 persons (about 12 in the nursery and 18 in the office) for preparation of finished products.

Resource Development

Griha Udhyog and *Resha Utpadan Samiti* and *Mahila Vikas Sangathan* have developed their own nursery of *Agave* sisal hybrid. The nursery of these organizations is spread over an area of five to six ha. Plantation work has also been carried out on an area of 30 to 70 ha, in order to support production on a commercial scale.

Intensive research and development programmes are still essential in order to make raw materials available for commercial production of fibre products. To obtain raw materials, more nurseries, particularly of *Agave* spp, need to be established to support large-scale plantation of the species (Plate 4.8). This species is regenerated through bulbils and is well adapted to nutrient poor and xeric sites. The species can be cultivated on wastelands that comprise about 5.5 per cent of the total area of the Central Himalayas. In addition, plants used for biofencing and slope stabilisation can also be used for fibre extraction by plantation at regular intervals. Fibres extracted at village level can be collected through cooperatives and made available to NGOs and others. Some NGOs have also begun to purchase extracted fibre from villagers at the rate of Rs 20.00 per kg.

Similarly, research and development work needs to be carried out on seed germination, cultivation practices, and coppicing of *Daphne* before recommending the species for commercial use in paper-making. In order to obtain more fibre from *Cannabis*, traditional methods of cultivation need to be improved through further research and development, especially in the field of biotechnology. This would also help to develop plants free of narcotics.

In conclusion, it is clear that fibre-based (both traditional and non-traditional) products have considerable potential to sustain the rural system, generate revenue, and provide job opportunities. If non-traditional

products are launched in the outside market properly, it will contribute significantly to the sustainability of many households in the Himalayan region. Further, as the techniques involved in extraction of fibre and preparation of products are ecofriendly, it will help preserve the Himalayan ecosystem.

Plate 4.8: *Agave* sp
A) Large-scale plantation and
B) regeneration through bulbils in a nursery

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ICIMOD serves as a multidisciplinary documentation centre on integrated mountain development; a focal point for the mobilisation, conduct, and coordination of applied and problem-solving research activities; a focal point for training on integrated mountain development, with special emphasis on the assessment of training needs and the development of relevant training materials based directly on field case studies; and a consultative centre providing expert services on mountain development and resource management.

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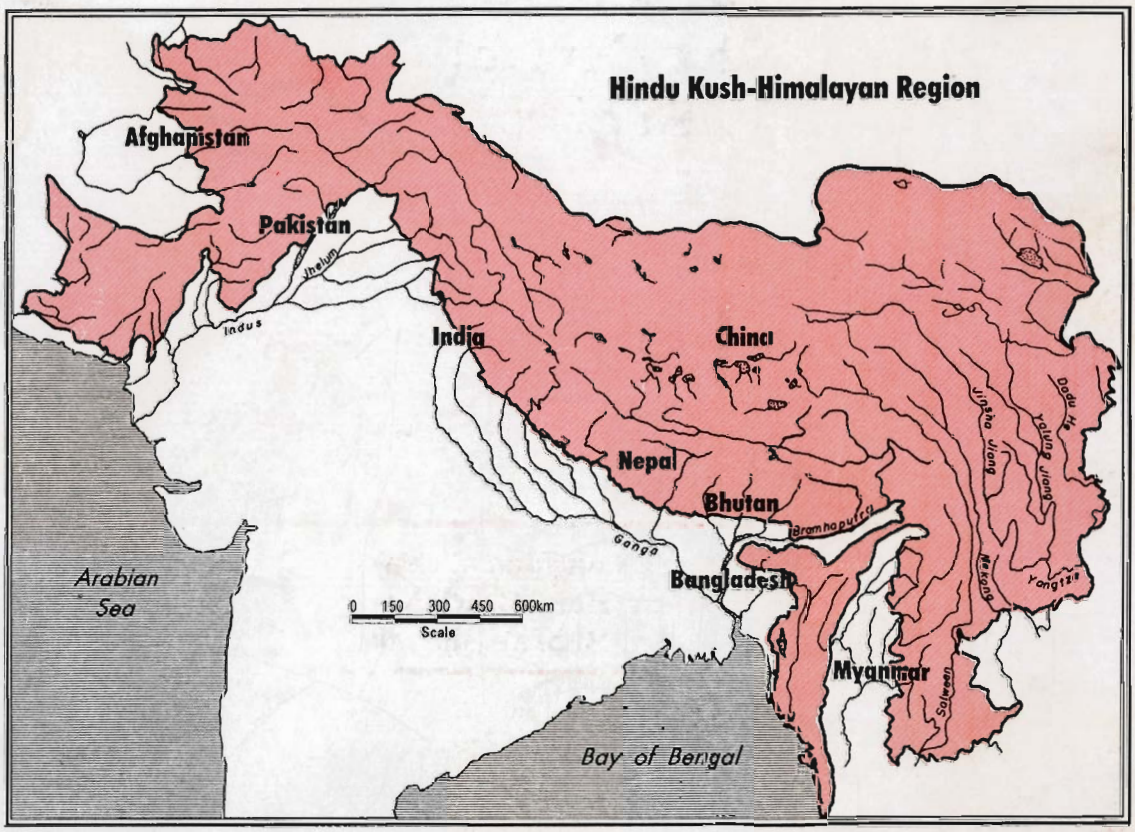
Participating Countries of the Hindu Kush-Himalayan Region

Afghanistan
Bangladesh
Bhutan
China
India
Myanmar
Nepal
Pakistan



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