

Supply of Herbal Raw Drugs from Cultivation

Cultivation of medicinal plant species like Isabgol (*Plantago ovata*), Senna (*Senna alexandrina*), Ashwagandha (*Withania somnifera*), and Kuth (*Saussurea costus*) has since long established in the country with the entire commercial demand of these entities being met from cultivation. The dwindling wild populations of many wild collected medicinal plant species due to harvesting pressure has prompted the government agencies like NMPB and the domestic herbal industry to promote cultivation of these species. These promotional efforts have resulted in bringing many medicinal plant species under successful cultivation. Some of these species are *Piper longum* for fruiting spikes and roots; *Chrysopogon zizanioides* for vetiver roots; *Uraria picta* for roots called 'prshniparni'; *Acorus calamus* for 'bach'; *Phyllanthus amarus* for aerial parts called 'bhumiamla'; *Centella asiatica* for leaves called 'mandukparni'; etc. Whereas NMPB's subsidy scheme has played a definite role in promotion of cultivation of medicinal plants, it is the active part played by local CBOs/ NGOs in organizing farmer clusters and in providing technical and marketing support that has made cultivation of many medicinal plants a profitable venture. The role of the CBOs/ NGOs needs to be acknowledged for further promotion of the medicinal plants cultivation. It is also necessary to engage research organizations on long-term basis for development of high quality planting material of the prioritized medicinal plant species for cultivation. The complex and state-specific rule position related to cultivation of medicinal plants needs to be simplified. Appropriate modifications in the notifications issued under section 38 of the Biological Diversity Act, 2002 need to be brought in to promote cultivation of listed species.

6.1. INTRODUCTION

India has a long history of domestication and cultivation of medicinal plant species. Some of the important medicinal plant species under domestication and cultivation since long are Neem (*Azadirachta indica*), Gritkumari (*Aloe vera*), Tulasi (*Ocimum tenuiflorum*), Marua (*Ocimum basilicum*), Sehanjan (*Moringa oleifera*), Kari Patta (*Murraya koenigii*), Mehndi (*Lawsonia inermis*), etc. Such cultivation was, however, limited to a few species only and a large diversity of herbal raw drugs needed by the domestic herbal industry was being collected from the wild resources from different parts of the country. Ved and Goraya (2008) reported that out of the 178 herbal raw drugs being traded in large quantities, only 36 species were wholly or partially sourced from the cultivated sources and of these Isabgol (*Plantago ovata*) and Senna (*Senna alexandrina*) formed the major entities sourced entirely from cultivation.

It was in the early 1950s that concerns started to be expressed about the quality and decreasing availability of the wild collected medicinal herbs to the growing domestic herbal industry. Concerns were also being raised about some herbal raw drugs that were being regularly imported at an avoidable cost to the nation. It was to examine these issues that the Ministry of Commerce and Industry, Government of India in 1954 set up a Pharmaceutical Enquiry Committee. One of the key recommendations of this Committee was to initiate immediate steps to organize cultivation of medicinal plants in a scientific manner. The Committee further recommended designating and supporting nodal agencies for collection, storage and marketing of medicinal plants. The recommendations of the Pharmaceutical Enquiry Committee led to a joint meeting of the Medicinal Plants Committee of the ICAR, the Pharmaceutical and Drugs Committee of the CSIR and the Pharmacology Committee of the ICMR during February 1956 wherein need for bringing medicinal plants species under scientific cultivation was reiterated (Chopra *et al.*, 1957). A Central Indian Medicinal Plants Organisation (presently CIMAP, Lucknow) was thereafter established in 1959 under the auspices of CSIR to coordinate medicinal plants cultivation program in the country. Four regions i.e. Kashmir (Presently Jammu & Kashmir), Assam, Madras (presently Tamil Nadu) and Bengal (presently West Bengal) were identified to launch pilot programs for medicinal plants cultivation. These regional centres did undertake cultivation trials on a number of medicinal plant species that were either under import or were perceived to be under threat of extinction. Selection and development of germplasm with higher alkaloid content was also taken as one of the key research subjects during these cultivation trials.

Alongside these research efforts on cultivation of medicinal plants, consolidation of cultivation of some medicinal plant species was going on simultaneously which resulted in bringing under significant cultivation species like Isabgol (*Plantago ovata*), Ashwagandha (*Withania somnifera*), 'bach' (*Acorus calamus*), 'vasaka' (*Adhatoda zeylanica*), 'kuth' (*Saussurea costus*), 'vetiver' (*Chrysopogon zizanioides*), etc. However, despite these successful cultivation efforts, long drawn trials at standardizing agro-techniques of many medicinal plant species, the reliance upon wild resources did not reduce much. Ved and Goraya (2008), on the basis of comprehensive data analysis in respect of herbal raw drug entities consumed by domestic herbal industry in large quantities, reported that in the year 2005-06 more than 80% of the herbal raw drugs, both by species diversity and by volume, continued to be sourced from the wild.

6.2. RENEWED INTEREST IN CULTIVATION OF MEDICINAL PLANTS

The growing concerns and worries about the fast dwindling wild resources, increasing consciousness about the product quality, the ever increasing outflow of precious foreign exchange

to procure herbal raw drug entities from other countries, and non-acceptance of value added products in other countries unless certified as to the source and sustainable harvest regimes, have prompted a renewed interest in the cultivation of medicinal plants.

The continued medicinal plants related research and extension programs at CIMAP and other national organizations had resulted in developing high yielding cultivars in respect of species like 'amla', 'mentha', 'tulasi', etc. that helped in firmly establishing cultivation of these species in many parts of the country. Some of the medicinal plant species for which high yielding/ better quality varieties have been developed by selection, hybridization or mutations and released are as under:

S. No.	Name of Species	Variety	Released in	Developed by
1	<i>Plantago ovata</i>	Gujarat Isabgol-1 Gujarat Isabgol-2 Haryana Isabgol-5 Jawahar Isabgol-4 Neeharika	1976 1983 - 1996 1998	Gujarat Agricultural University, Anand Gujarat Agricultural University, Anand Haryana Agricultural University, Hisar College of Agriculture, Mandsaur CIMAP, Lucknow
2	<i>Withania somnifera</i>	Jawahar Asgandh-20 Jawahar Asgandh-134 Poshita CIM-Pratap	1989 1998 2001 2011	College of Agriculture, Mandsaur College of Agriculture, Mandsaur CIMAP, Lucknow CIMAP, Lucknow
3	<i>Senna alexandrina</i>	Anand Late Selection Sona	1989 1997	Gujarat Agricultural University, Anand CIMAP, Lucknow
4	<i>Chrysopogon zizanioides</i>	Hyb-8 Dharini Gulabi Kesari	- 1998 1998 1998	NBPGR, Pusa Campus, New Delhi CIMAP, Lucknow CIMAP, Lucknow CIMAP, Lucknow
5	<i>Bacopa monnieiri</i>	Subodhak Pragyashakti CIM-Jagriti	1999 1999 2007	CIMAP, Lucknow CIMAP, Lucknow CIMAP, Lucknow
6	<i>Centella asiatica</i>	Kayakrit Majjaposhak	1999 1999	CIMAP, Lucknow CIMAP, Lucknow
7	<i>Glycyrrhiza glabra</i>	Haryana Mulhatti-1 Mishree	1989 1997	Haryana Agricultural University, Hisar CIMAP, Lucknow
8	<i>Catharanthus roseus</i>	Nirmal Prabal	- 2001	Haryana Agricultural University, Hisar CIMAP, Lucknow
9	<i>Valeriana jatamansi</i>	Dalhousie clone Himbala	1994 2006	UHF, Nauni, HP IHBT, Palampur, HP
10	<i>Commiphora wightii</i>	Marusudha	1997	CIMAP, Lucknow
11	<i>Ocimum basilicum</i>	Vikarshudha Kusumohak CIM-Saumya CIMAP-Sharada	1999 1999 2003 2015	CIMAP, Lucknow CIMAP, Lucknow CIMAP, Lucknow CIMAP, Lucknow
12	<i>Hedychium spicatum</i>	Himkachri	2006	IHBT, Palampur, HP

S. No.	Name of Species	Variety	Released in	Developed by
13	<i>Acorus calamus</i>	CIM-Balya	2006	CIMAP, Lucknow
14	<i>Mentha arvensis</i>	Kosi	1999	CIMAP, Lucknow
		CIM-Kushal	2002	CIMAP, Lucknow
		CIM-Saryu	2010	CIMAP, Lucknow
		CIM-Kranti	2013	CIMAP, Lucknow
15	<i>Mentha piperata</i>	CIM-Madhuras	2004	CIMAP, Lucknow
		CIM-Indus	2005	CIMAP, Lucknow
		CIM-Patra	2010	CIMAP, Lucknow

Source: Maiti (2006) & intranet.cimap.res.in/cimvariety (accessed in July 2016)

However, these efforts somehow missed the wild collected species, availability of which was declining. The all important focus on the real time threat to wild collected native medicinal plant species was developed by the Foundation for Revitalisation of Local Health Traditions (FRLHT), a Bangalore based non-government organization working on medicinal plants since 1993. Lists of medicinal plant species under threat of extinction on account of unsustainable harvesting were developed using globally accepted threat assessment criteria. Many State Forest Departments, taking clue from the threat lists, initiated limited but sure programs to augment wild resources of medicinal plant species assessed threatened for their states. For example, the Andhra Pradesh Forest Department took up resource augmentation of 'magali' (*Decalepis hamiltonii*) in a big way, the Karnataka Forest Department initiated large scale plantations of 'ashoka' (*Saraca asoca*), and the Rajasthan Forest Department initiated nursery trials on 'guggul' (*Commiphora wightii*).

Cultivation of medicinal plant species got a national fillip with the setting up of a dedicated national body, the 'National Medicinal Plants Board' (NMPB) in November 2000, to address issues related to conservation and development of medicinal plants in the country. The NMPB has been promoting cultivation of medicinal plants under a subsidy scheme since its inception. Starting with a list of 32 medicinal plant species, notified under this scheme during 2006-07, the Board now supports cultivation of 116 species with three sets of subsidy regimes for three different sets of species (NMPB, 2012), which is 20% for 59 listed species, 50% for 38 listed species and 75% for 19 listed species. Most of these listed species are native to India and are either in high demand or are assessed as threatened. The Board is promoting cultivation of medicinal plants under a Centrally Sponsored Scheme, titled the 'National Mission on Medicinal Plants', which is being implemented through the National Horticulture Mission (NHM), Ministry of Agriculture. The Board is also promoting research on developing viable agro-forestry models for integrating medicinal plants with conventional agri-crops and horti-crops. Various research organizations have been involved in developing such models through establishing trials on farmers' fields for quick dissemination.

Domestic herbal industry also seems to have come to realize the importance and urgency of shifting their herbal raw drug procurement from wild to cultivated sources. Dabur India Ltd., Natural Remedies, Himalaya Drug Company, Sami Labs, Patanjali, Sri Baidyanath, Emami, and Ipca Laboratories are some of the companies that have already made a good beginning in this area and have created farmer clusters in different parts of the country for cultivation of medicinal plants according to their priority. The initiative by the domestic herbal industry has resulted in bringing an estimated 5000 ha of farm land under medicinal plant cultivation. The 'Gram Mooligai

Company Ltd.', a special community owned initiative, has also been promoting cultivation of selected medicinal plants and helping communities in their remunerative disposal over the past more than 15 years.

Some extraneous circumstances have also prompted a large number of farmers to opt for medicinal plant cultivation. Susceptibility of traditional agricultural crops to vagaries of nature and increasing vulnerability of these crops to damage by wild animals are some of these reasons.

6.3. CASE STUDIES OF MEDICINAL PLANTS UNDER CULTIVATION

Various sites under stabilized cultivation of medicinal plants were visited and first hand information about the experiences of farmers and the local level hand holding agencies gathered.

6.3.1. Cultivation of Kuth (*Saussurea costus*)

'Kuth' is dried roots of *Saussurea costus*, a plant assessed as Critically Endangered in its natural habitat and included in Schedule-VI of the Wildlife (Protection) Act, 1972. Reported to occur wild in India in small pockets only in Kashmir, the plant was taken up for cultivation in 1940s in Lahaul valley of Himachal Pradesh. The plant has ever since adapted well in the cold dry conditions of the Lahaul valley and has become a part of the local agricultural practices.

'Kuth' is a 3-year crop that is raised from seed. Seed is sown in the month of either November (more common) or May (less common) in rows in well ploughed fields having deep sandy loam soil. The farmers engaged in 'kuth' cultivation, maintain crops of one year, two year and three years on their fields to maintain the extraction cycle. The crop, depending upon the rainfall, requires 4-6 irrigations (1 each in June and September and 2 each in July and August).

Harvesting of 'kuth' is done during September-October. Leaves of the plants are cut 10-15 days before digging of roots is taken up. The cut leaves are collected and stored to be used as fodder during winters. Roots are dug up manually with the help of pickaxes. Average production per bigha is about 500 kg fresh weight and the farmers get about ₹ 10,000 per 'mand' (40 kg) of dried produce at the current prices. The dug up roots are usually put to drying immediately after harvest without any washing. However, now a trend of washing the roots before drying is also picking up. The washed roots are spread on roof tops, on sheets, or in the fields for drying and it takes between 20-30 days for complete drying of the produce. The larger roots are also cut into pieces to facilitate drying.



'Kuth' fields and 'Kuth' harvest



Cleaning, sizing and drying of 'Kuth' in Miar Valley, Lahaul, HP

The dried roots are transported to Kullu valley in November before the Rohtang Pass closes due to snowfall for 5-6 months. The material is cleaned, graded and packaged in jute bags @ 50 kg per bag (total bag weight = 51.100 kg to account for the weight of jute bag) in Kullu valley by the 'Kuth' dealers for domestic supplies. Total current annual production of 'Kuth' from the Lahaul valley is estimated to be about 60 MT of which about 3 MT of the graded material is said to be exported. Lahaul Kuth is considered to be better than the one cultivated in Kullu valley of Himachal Pradesh, Uttarakhand, or in China.

At present only about 150 ha area is under 'kuth' cultivation in Lahaul valley. The crop seems to have good potential demand for domestic consumption as well as for export. The farmers also expressed their interest in 'kuth' cultivation as it helps them in deep digging of soil and its periodic upturning to maintain productivity. Two issues, however, keep many farmers away from adopting 'kuth' for cultivation. The first is related to the procedural complexities involved in 'kuth' cultivation and trade due to its inclusion under the Wildlife (Protection) Act, 1972 and its inclusion in Appendix-I of the IUCN. The second issue is related to the transport of the dried material out of the valley before snowfall blocks Rohtang Pass. If the farmers fail to transport the material before snowfall, they have to keep the material with them over entire winter months, blocking payment to them. It was suggested during interaction with farmers and traders that some drying facility created in Kullu valley might help them in transporting fresh material out of Lahaul valley before snowfall.



Cleaning, grading and packaging of 'Kuth' in trader's godown

Cultivation of 'kuth' has also been promoted in Uttarakhand, where it is cultivated in about 100 ha with estimated annual production of about 40 MT per year. Pilot cultivation of 'kuth' has also been reported from Gonkhang area of Tawang in Arunachal Pradesh.

6.3.2. Cultivation of Pippal Mool (*Piper longum*) in Andhra Pradesh

Pippal Mool, the dried roots of *Piper longum*, form one of the important raw drugs used in Indian Systems of Medicine. Market survey and interaction with traders revealed that major supplies of 'pippal mool' are obtained from cultivation in Andhra Pradesh and Odisha. A field visit was undertaken to Vaddathi Madugula Mandal, known for cultivation of 'pippal mool', in Visakhapatnam district of Andhra Pradesh to understand the cultivation practices. The taluk is known to produce 75% of the 1000 MT of 'pippal mool' produced in the entire Vishakhapatnam district.

'Pipallu modi', as 'pippal mool' is popularly known in the local dialect, is cultivated largely by the tribal people inhabiting the hilly villages and tribal hamlets of Paderu, Hukumpetta, Pedha bayalu, Arakku, Gangaraju Madugula, Munchangi puttu, GK Veedi, Nakkalaput, Dumbri guda, Chintapalli and Sileru in Vishakhapatnam district. The area under 'pippal mool' cultivation in each of these villages varies from 10 to 200 acres (4 to 80 ha). Per farmer cultivation in the area varies from less than a bigha to 2 acres.



Cultivation of Pippal Mool around Madugula in Andhra Pradesh

The entire 'pippal mool' cultivation is organic, as only cow and buffalo dung is used as manure and no chemical fertilizer or pesticide is used. Cultivation practice involves cutting and storing the aerial portion of the plant as seedling for the next planting season. It is a 2-year crop. The farmers cut all the aerial portions comprising the stems and male spikes after one year to promote larger spread of roots and for better yield. The roots are dug up between November to January with agricultural implements for sale in the nearby Santha (local market). It is observed in the field that all the plants cultivated for 'pippal mool' are the male plants. It came as a surprise that none of the cultivators had seen the female plant or was aware of the female Pippali spikes. 1 acre of cultivation yields about 1500 kg of roots and the average sale rate of dried roots is ₹ 100 per kg in the local Santha. The whole sale local traders buy the material from the Santhas and process it further for sale to end users.

The procured 'pippal mool' is properly dried and broadly graded in to 3 quality classes by the local traders. The grade type-3 material, known as Nalaka and comprising of small thin adventitious roots, is priced at about ₹ 30 per kg. The grade type-2 material, known as Putras and comprising of small thick roots cut little away from the main roots, is sold for an average of ₹ 100 per kg. The grade type-1 material, known as Enchu and comprising of thick roots possessing strong taste and containing higher piperin content, is sold at ₹ 250 to ₹ 300 per kg. Shri Karnam Venkata Krishna Rao, popularly known as Madras Krishna Rao (mobile no.: 09491572699), Proprietor, Devi Prasad Industries, Vaddathi Madugula, Vishakhapatnam and in the business for 2 generations, trades

Pippal Mool in 17 different grades and exports about 100 MT of 'pippal mool' roots annually. In addition to Shri Rao, the village has many more 'pippal mool' traders with about 10 traders exporting between 50 to 100 MT of roots annually; about 10 traders selling about 10 MT of roots annually and 30 to 40 small traders selling about 500 kg of roots per year to meet mainly local supplies.



Sizing, grading and packaging of Pippal Mool

It came out from the traders that the produce from Andhra Pradesh accounted for only 30% supply of 'pippal mool' with the remaining 70% coming from Kanta, Vanakadilli, Kincharala, Taruva, Kiluva, Vuppapada, Koraput, Jaipur and Rayagada districts of Odisha. In all, 'pippal mool' was being cultivated over about 2000 ha in these two states.

6.3.3. Cultivation of Vetiver (*Chrysopogon zizanioides*) in Tamil Nadu

Some progressive farmers in Nochikadu, a coastal village located along the Coromandel Coast of India, 13 Km from Cuddalore, in Tamil Nadu have taken to 'vetiver' cultivation to offset their decreasing returns from the conventional agricultural crops like groundnut, cashew, onion, and paddy. Mr. R. Bhaskar, s/o Mr. Rathakrishna Padayachi of this village is one such farmer (mobile: 9751113931) who switched over 'vetiver' cultivation about 20 years back. 'Vetiver' is known locally as 'vilamichchi ver', and as 'ramachcham' in Kerala and 'lavachcham' in Karnataka. His success prompted other farmers in the village to adopt 'vetiver' as one of the crops in their regular agri-practices. Presently almost all farmers in the village cultivate 'vetiver' over a collective area of about 100 ha. Another about 100 ha of 'vetiver' cultivation is now taking place in the adjoining villages of Naduthittu (40 ha), Thiyagavalli (20 ha), Periyapattu (20 ha) and Aandikuzhi (20 ha). Major areas of 'vetiver' cultivation in southern India, however, is in Kerala where it is extensively cultivated in the coastal areas like Malappuram, Ponnani, Palapatti, Savakkadu, Guruvayur and Kozhikodu.

The original planting material for 'vetiver' cultivation in Nochikadu village was brought from Kerala. Now almost all farmers maintain their own seeding stock selected from the best rattans of each clump. For planting in 1 acre, 15 sacks of seedlings are required and 1 sack contains about 4500 seedlings. The separated seedlings can be stored up to 15 days. After planting, till harvesting period, daily irrigation is essential. As the fields are located chiefly along the coastal area, even 7 metre deep borewells are enough for such irrigation.

In a day, 3 acres of crop can be irrigated through sprinkler. No major insect/ pest attack has been reported except occasional mealy bug and white fly attacks and such attacks are addressed by spraying neem oil mixed with monocrotophos on leaves. The right season for new planting is between June to July. However, based on demand the planting can be done at any time of the year. The roots are usually harvested after one year of planting when good oil content gets accumulated in the roots. However, based on demand, harvest is sometimes done even after 8 months of planting.



Cultivation, Harvesting & Post-Harvest Handling of Vetiver

Harvesting of the roots is now done with Hitachi Buckling, a hydraulic excavator, as it takes much less time for harvesting, and saves the farmers from the labour problems. It is also believed that damage to the roots is less if harvesting is done with machine. Roots of different maturity, cleanliness and colour fetch different prices. The roots harvested between 6 to 8 months of planting are usually white in colour and sell for about ₹ 90 per kg, whereas the ashy-white to reddish tinged roots harvested after 10-12 months of planting sell for ₹ 100-110 per kg. The washed and cleaned roots sell for still higher prices of about ₹ 125 per kg. Well dried material can be safely stored for one year without any loss in quality. The dried roots are bundled in pressing machines, each bundle weighing 45-50 kg. The bundles are usually sold through herbal mandis located in Tamil Nadu, Pondicherry, Kerala and Karnataka. An average annual quantity of about 500 MT is traded from this village cluster only.

As an average yield of 2-2.5 MT of roots is obtained per hectare of 'vetiver' cultivation. 10% wastage on account of incomplete digging and loss during cleaning and bundling is considered acceptable. The crop is considered profitable if produce sells at prices above ₹ 90 per kg.

Pilot cultivation of 'vetiver' has also been reported from Assam. Dabur Herbal Farm, Sandila, Uttar Pradesh has successfully culminated trials on 'vetiver' cultivation under alkaline (pH 9-10) and water logged conditions. The pilot experiment carried out on 10 ha land has resulted in a yield of 2-2.5 MT of dried roots. Asha Gramodyog Sansthan, Lucknow has also promoted Vetiver cultivation in Uttar Pradesh over about 50 ha. The farmers here add value to the produce before selling. The dug up roots are washed and taken to distillation units set up primarily for Mentha, subjected to distillation and oil extracted. An average of 16 kg (12-20 kg) of Vetiver oil is recovered per ha. The current sale price of Vetiver oil is about ₹ 14,000 per kg.

6.3.4. Cultivation of Vettiver Coleus (*Plectranthus vettiveroides*) in Tamil Nadu

Vettiver Coleus (*Plectranthus vettiveroides*), locally known as 'vettiver' or 'black iribeli' and called 'harivera' in Sanskrit, has been under cultivation in the sandy-loam soils along river Cauvery in some villages of Sirkali Taluka in Nagapattinam district of Tamil Nadu for long for its dried aromatic roots, that have been traditionally used to make garland to decorate deities in temples in the state. The roots also form key ingredient of many Ayurveda and Siddha formulations. The long, fibrous roots are straw coloured with light fragrance when fresh, but turn blackish with strong aroma on drying. Extensively cultivated in the erstwhile North Arcot, Coimbatore, Madurai, Thanjavur, Tirunelveli and Chengalpet districts of Tamil Nadu, and Palakkad district of Kerala at the turn of the 20th century, cultivation of this species is now limited to a few villages in Nagapattinam and Thanjavur districts over a total area of just about 10 hectare (Murugan *et al.*, 2015).

Mr. S. Sekar, S/o Mr. M. Chellakannu Padayachi, Thillaimangalam Village, Aanaikaaran Chathiram PO., Kollidam Via, Sirkali Taluka, Nagapattinam District (Moblie: 95850 15310) is one of the few farmers who is continuing with the cultivation of Vettiver (Coleus). His family has cultivated 'vettiver' for three generations. Most of other farmers have stopped cultivating this species over



Cultivation, Harvesting & Post-Harvest Handling of Vetiver

the last ten years due to poor returns. As a standard practice, 6 twigs of 10" length and having 3-4 pairs of leaves are planted together on ridges in well ploughed sandy land. The plants need daily watering in the morning hours. Groundnut oil cake powder is sprayed on the roots after 20 days of planting for which soil is loosened on both sides of the planting ridge. 'Vettiver' is a 3 months crop, but can also be harvested after 80 days of planting. Harvesting requires special attention. Roots have to be washed free of sand through continuous pouring water at the base of the plants. Despite such care, some delicate roots still remain in the soil.

The freshly harvested roots are sold to temples (Nataraja temple at Chidambaram; Murugan temple at Palani; Balaji temple at Tirupathi; Karaikkal Ammaiyar temple at Karaikkal, etc.) in bundles of 12 individual stems (one muttu), where these are used for decorating the idols, added in making of garlands and thatches. About a third of the produce is dried and sold to herbal shops locally and at Chennai for use as herbal medicine at ₹ 150 per kg. The stem portions of the plant are chopped, dried and sold to the small scale cottage industry making Agarbathi (incense sticks). With investment of ₹ 25,000 per acre, a good crop can yield ₹ 75,000 worth of roots after 3 months. Even though cultivation seems to be good economics, the crop needs a lot of labour inputs and therefore its cultivation is being continued by only the passionate farmers. This species, with no known wild populations, has been assessed as 'Extinct in the Wild', is presently known from only its cultivated source. The species is under real time threat of extinction even from cultivation, if the pace at which its cultivation is reducing continues.

The species shares its Tamil name 'vettiver' with the roots of *Chrysopogon zizanioides* (= *Vetiveria zizanioides*) belonging to the grass family and sometimes confused with the same. Thus, with reference to Tamil Nadu, the name 'vettiver' should be attributed only to *Plectranthus vettiveroides*. *Chrysopogon zizanioides*, in Tamil Nadu is known as 'vilamichchiver'.

3.5. Cultivation of Agar (*Aquilaria malaccensis*) in Tamil Nadu

Agar (*Aquilaria malaccensis* = *A. agallocha*), locally known as Sanchi or Sasi in Assam, is a tree native to north-eastern States in India and is known for yielding very high value oil from its fungal infested wood. In nature, the wood of mature trees is infested by fungus through the tunnels made by the larvae of a stem borer insect (*Zeuzera conferta*). With its natural populations having come under severe threat of extinction due to over exploitation, the species has been listed under the IUCN Red-List, being assessed as 'Vulnerable' globally and 'Critically Endangered' in India. It is now enlisted in Appendix II of the CITES and also in the Negative List of Exports issued by the Ministry of Commerce in India.

The wild populations of the species having been severely depleted, the species has come under extensive cultivation in Assam and other north-eastern states. As per one survey carried out by the Assam Forest Department in 2003, there exist about 9-10 million trees of Agar on private lands. These private plantations have kept the Agar trade live with Hojai (District Nagaon, Assam) being the major hub of Agar trade in India. An estimated more than nine thousand agar distillation units of various sizes are in operation in Assam alone, a very large proportion of these being operated without license.

The lucrative price of agar oil has prompted farmers from other states also to take up Agar plantation. Mr. K. Jothimani, s/o Mr. D. Krishnaswamy Padayachi, Keezhakuppam Village, Nadukuppam PO., Kadampuliyur Via, Panruti Taluka, Cuddalore District of Tamil Nadu has taken initiative to take the plant out of its natural habitat and try it in Tamil Nadu. Based on a newspaper

advertisement, this agriculturist along with his 2 partners, invested ₹ 3 lakhs for procuring 1000 Agar seedlings from Northeast India and planting these over 4 acres of land. He also experimented with intercropping with banana and ground nut (1 time harvest only). He also introduced Pathimugam (*Caesalpinia sappan*), Jack fruit (*Artocarpus heterophyllus*), Teak (*Tectona grandis*), Coconut (*Cocos nucifera*), Mango (*Mangifera indica*), Drumstick (*Moringa oleifera*), Portia (*Thespesia populnea*) and Guava (*Psidium guajava*) trees on his remaining land.



Agar wood cultivation in Tamil Nadu

After 4 years of planting, about 900 trees of Agar plant have survived and established. All the trees were found to have attained an average height of 6 m and each tree has 3-7 individual poles/trunks. The average girth of each tree is about 50 cm. They shed the leaves during the months of June-July. The soil type of the field is red sandy and the plants are irrigated once in a week. Once in a year Panchakavya (five products from cow i.e. milk, curd, ghee, urine and dung) solution is applied on the roots of the plants. Over the past four years, the fertilization regime followed includes one-time application of 30 sacks (@50 kg. per sack, and ₹ 500 per sack) of natural fertilizer from Idea company, burnt ash of groundnut plants, and 48 tonnes of cow dung. Application of goat dung and urea was noticed to be not suitable, as post this application about 70 trees died.

The farmer informed that he was getting ready to inject the specific fungus to each tree in order to

develop the brown-black coloured wood at the rate of ₹ 4 per pole/ trunk. M/s Kanagaraj, Agarwood Development, Cheyyar, Tiruvannamalai District, Tamil Nadu has been advising the farmer in respect of this plantation. The farmer has been assured that the wood can be harvested after 6 months of injecting the fungus. However, the farmer has spent close to ₹ 8 lakh on this venture and is now calling upon experts to guide him for harvesting and marketing of the produce.

6.3.6. Cultivation of Prshniparni (*Uraria picta*)

Prshniparni, an important constituent of Dashamoola, has been assessed as a threatened medicinal plant species due to massive decline in its wild populations. The FRLHT and the Forest Departments of Gujarat, Uttarakhand, and Maharashtra have been making good efforts for the last more than ten years at locating wild populations of this species, gathering its germplasm and at raising it in their nurseries. Gujarat Forest Department has also initiated a project to augment wild populations of Dashamoola species, including Prshniparni. Organisations like the Forest Research Institute, Dehradun have worked on developing its agro-techniques and plantation models. It was, however, the concerted efforts by the Bio Resources Development Group (BRDG) of Dabur Research & Development Centre that made the journey of this species from forest to farm possible.

The BRDG, with financial support from the NMPB, initiated research on sodium tolerance, phytochemical profile and genetic stability of the 'prshniparni' germplasm collected from different populations in Uttarakhand and Gujarat. The plants were subjected to graded dosing of sodium in the nutrient medium and the tolerant plants were taken up for mass multiplication. Technique for *in vitro* multiplication of the plants with multiplication ratio of 1:5 and survivability of 80% was also standardized. Method for growing plants from seeds giving 85% germination was also standardized. This was followed by developing commercially viable agronomic package that was duly demonstrated to the farmers. The cultivation trials recorded substantial high yields of aerial parts for UP-3 accession over other accessions.

The average first year yield of the aerial parts is recorded as about 1.2 MT per ha. However, the yield of the ratoon crop is five times higher than the first crop. BRDG has, in collaboration with Asha Garmudyog Sansthan, Lucknow, has promoted its cultivation and presently some 60 farmers in Kushinagar district in Uttar Pradesh are growing 'prshniparni' over about 20 hectares of their land. Trials to introduce its cultivation in Lucknow district have also been initiated by the Asha Garmudyog Sansthan.



Photo : Sitaram Kushwaha



Photo : Sitaram Kushwaha

Prishiniparni cultivation in U.P.

6.3.7. Cultivation of Bach/ Sweet flag (*Acorus calamus*)

“The roots (harvested produce) from the 'sweet flag' fields irrigated with underground water are more aromatic than the ones irrigated with sewage water...”, says Mr. Rajanna, a farmer from Kuntamma Thota near Bheemasandra village in Tumkur district of Karnataka, showing the long flagellate roots of Sweet flag freshly harvested from his field. He further explained that the 'sweet flag' required year round irrigation and copious green manure to ensure good quality produce having thick white pith and good returns. Sweet flag is cultivated over 125 ha in Tumkur and Koratgere taluks in Tumkur district of Karnataka. The 'sweet flag' cultivated in this region is traditionally known to be of high quality and much sought after by the Ayurveda physicians and domestic herbal industry. The produce from this region is believed to meet significant part of the domestic herbal industry's annual requirement of this commodity.



'Sweet flag'/ 'bach' cultivation

Sweet flag is grown in wet fields with puddles, which are prepared much similar to the traditional paddy fields. Regular irrigation is derived from either irrigation tanks/ underground water lifted from open wells/ bore wells, or urban sewage water directed into the fields. Every farmer of Sweet flag maintains his own planting material in the form of apical shoot pieces with growing meristem extracted from the harvested plants of the previous crop. These apical pieces are planted in the sunken nursery beds where they grow to about 12" in about 30 days. These are then transplanted onto the prepared main field (land is thoroughly ploughed, clods crushed, weeds removed, land flooded, puddles prepared, planting furrows opened to make the field ready for planting) at a spacing of 4" between the plants and 18" between the rows. The field is irrigated with tank water or well water. Fertilizer is applied as required. The crop comes to yield in about 10-12 months, when the leaves start turning yellowish. At this time the irrigation is stopped and the fields are

allowed to dry. The land is then dug and the plants along with subterranean roots are pulled out. The greenish tops with the growing tips are severed and kept aside as the planting material for subsequent crop. The pinkish, stout, flagellate rhizomatous roots with multiple internodes are the raw form of 'sweet flag' produce.

The 'sweet flag' roots are then thoroughly washed to remove dirt, soil and coarse leaf scales from the nodes. The cleaned roots are then heaped in open threshing yards, chopped into finger long pieces, spread and allowed to dry for about 3-5 days. The rhizome pieces are frequently turned over to facilitate uniform drying and to prevent mold growth. The dried pieces are then thrashed thoroughly with wooden mallet followed by vigorous rubbing against an abrasive surface (usually gunny sacks) so as to separate the dried fibrous roots from the nodes. The thrashed pieces are then dusted and spread in shade before they are finally filled into sacks. The sacks are temporarily stacked in a local warehouse and later transported to Sweet flag traders in Tumkur market from where it is eventually transported largely to Mumbai and to mandis in Tamil Nadu.

Rhizomes from the field irrigated with tank/ borewell water are brighter in color than those from the field irrigated with sewage water, which are darker in color. The produce is further segregated into two grades based on the size i.e. well grown healthy stout pieces constitute the first grade, while the lanky and shriveled pieces the second grade. On an average, a sack of rhizome pieces weighs between 36-40 kg, while the yield varies from 4 to 4.5 MT (dry weight) per ha. An average of 500 MT of dried 'sweet flag' roots are traded from the area every year.



Fresh and dried rhizomes of 'Sweet flag' / 'bach'

Mr. Padmarajaiah, a leading 'sweet flag' trader in Tumkur informed that the Tumkur Traders' Guild announces in advance the approximate demand for the next year and the prices to enable farmers to decide upon the extent of cultivation to be taken up. The prices of the commodity have been very variable over the past decade or so and varied from ₹ 2700 per quintal during 2000 to a high of ₹ 23,000 per quintal in the year 2013, before settling to ₹ 8000 per quintal during 2014-15.

The difficulty in getting labour for harvesting and post harvest handling, promotion of newer and more remunerative cash crops, failure of monsoon, and drying of aquifers have contributed to drastic reduction of area under Sweet flag in Koratagere. In case of Tumkur, however, the area under Sweet flag has shown a significant increase. Special gains in Sweet flag cultivation have been noticed in Bheemasandra, Dibbur and Gubbi Gate Palya villages beyond the urban fringes of Tumkur, where the total area under sweet flag cultivation has risen from about 35-40 hectare till some years back to more than 100 hectare. Much of this increase in area under Sweet flag in these

villages has happened in the catchment area of the river Shimsha, a tributary of river Cauvery, where traditionally paddy was grown. One of the reasons cited by the farmers for this shift to 'sweet flag' is availability of perennial source of irrigation water on account of extension of Hemavathi river irrigation canal network to the area. They also cited non-susceptibility of 'sweet flag' to insect pests and diseases, and assured minimum returns as other reasons for this shift.

Trial cultivation of 'sweet flag' has also been initiated at Dabur Herbal Farm, Sandila, Uttar Pradesh under alkaline (pH 9-10) and water logged conditions. The pilot experiment carried out on 4 ha of alkaline land has resulted in a yield of 2.5-3 MT of dried roots per ha and opened possibility of its cultivation on a larger scale in such lands. As against the going market rate of ₹ 60-80 per kg of dried roots, Dabur has offered a rate of ₹ 115-120 per kg of cultivated dried roots to promote its cultivation. Cultivation of 'sweet flag' over 30 acres in Uttarakhand (Sitarganj, Shaktifarm, and Kiccha near Rudarpur in Uddham Singh Nagar and Tharali in Chamoli) is also being promoted by Dabur India Ltd.

6.3.8. Cultivation of Ashwagandha (*Withania somnifera*)

Ashwagandha, used in large quantities in Indian Systems of Medicine, is a species of choice for cultivation in dried parts of the country with the largest cultivation clusters located in Neemuch district of Madhya Pradesh. Presently, an area of about 1000 ha is reported to be under 'ashwagandha' cultivation in the village cluster of Piplia Raoji, Uched, and Jamniya Raoji in this district. The 'ashwagandha' roots of Ratitala are, however, considered to be the most prized.

Mr. Ram Singh and Mr. Surendra Singh Shekhavat of village Piplia Rao have been cultivating 'ashwagandha' for many years. They shared that 'ashwagandha' cultivation has been a good source of cash income for them. Sown in the month of July, this crop they said does not need much care and becomes ready for harvest by December-January. On full maturity, the plants are uprooted, shoot portion severed while the root stumps are retained. The stumps are spread in open and allowed to dry for 7 days. Roots are then thrashed and cleaned of all foreign particles and the remnants of clumps, and then chopped into pieces. A fully mature crop yields an average of 4.4 MT of fresh roots, that on drying come to about 1.5 MT per ha. The dried roots are graded and index finger thickness roots are segregated being of the best quality and these fetch the highest prices. The remaining 40-50% of the material of lesser thickness is called 'taar' and is sold at lower prices. Prices also varied depending upon the quantity of starch in the roots. The fibrous roots are priced low as compared to the roots with higher starch content.



'Ashwagandha' cultivation

The farmers informed that the crop during the year 2015-16 was not good as the area received deficit rains and that there was little provision of irrigation. It also came out that over the years, the leaf and seeds of the species have also found good market.

In addition to cultivation of 'ashwagandha' in Neemuch and surrounding areas of Madhya Pradesh and Rajasthan, extensive areas have been brought under 'ashwagandha' cultivation in Guntakul and Kurnool area of Andhra Pradesh. Similarly, its cultivation has also been initiated over about 100 ha in Gadag, Hospet, Bellary region of north Karnataka.

6.3.9. Cultivation of Bhumi amla (*Phyllanthus amarus*)

The market samples of herbal raw drug 'bhumi amla', correlated to *Phyllanthus amarus* in India, consist of material from many commonly found and similar looking species of this genus posing a question about the uniformity and authenticity of the material used. It is to address this issue that efforts at cultivation of authentic 'bhumi amla' have been initiated.



Dried 'Bhumi amla'

Mr. Sunder Lal of village Parora in Tehsil Hasanganj of district Unnao in Uttar Pradesh and cultivating 'bhumi amla' for the last five years, while showing the team the field where he had grown 'bhumi amla', reverently removed his foot wear before entering the field. He informed that Asha Gramudyog Sansthan, Lucknow provided him the initial seed stock and was also providing technical support for raising and marketing of this crop. The crop, he informed, was usually sown during February, needed 8-10 irrigations and the plants grow to about 1.5 m tall in 60-70 days, when these were ready for harvest. Most of the farmers take two harvests, the second on the onset of rainy season. With an average annual yield of 6 MT per ha, and much less cost of inputs than conventional crops, cultivation of 'bhumi amla' is seen as profitable by the farmers. They, however, informed that the second harvest plants usually get fungal infested affecting the quality and the rates. The harvested produce is dried and chopped by the farmers before selling. The current farm gate price for the dried and chopped produce was reported to be ₹ 35 per kg.



'Bhumi amla' cultivation

Mr. Dileep Rai, Director, Asha Gramudyog Sansthan informed that 15 families were cultivating 'bhumi amla' in this village over about 10 ha of land. His organization, he informed, was supporting about 120 farmers in 40 villages to grow 'bhumi amla'. It was the result of these efforts that bhumi amla has presently come to be cultivated over 80 ha farm land in the area with current annual

consolidated output of 150 MT. M/s Natural Remedies, with annual purchase order of 100 MT, was reported to be the major buyer of the produce. M/s Dabur India Ltd. and M/s AIMIL Pharmaceuticals were the other major buyers of the produce.

6.3.10. Cultivation of Mandukparni (*Centella asiatica*)

Mandukparni, known more popularly as Brahmi, is used extensively in the Indian Systems of Medicine both for making commercial formulations by the industry and at household levels for primary health care needs. The plant commonly grows in moist niches along the banks of canals, ponds, lakes, etc., farm bunds, and in regularly watered lawns. Wild collected material is however susceptible to admixture of other similar looking species of genus *Hydrocotyle*. Cultivation of this species is therefore catching up to get regular supplies of authentic material from known sources. It is a one step towards getting the material certified.



'Mandukparni' cultivation

Asha Gramudyog Sansthan, Lucknow is spearheading cultivation of 'mandukparni' through its farmer clusters in district Barabanki and Sitapur. Interactions with farmers in Hakkabad Khinjana village in this cluster revealed that the seed source for its cultivation was of Sri Lankan origin, having bigger plants, larger leaves, higher yield and alkaloid content equal to that of Indian varieties. The farmers informed that they had already taken five cuttings in two years of planting. The plants are known to continuously provide 3-5 cuttings per year for 3-4 years. The fresh harvest is completely dried before selling. Annual yield is estimated to be 7-8 MT per ha and the current farm gate price of the dried produce was informed to be about ₹ 80 per kg. With a total of about 8 ha area currently under 'mandukparni' cultivation, Asha Gramudyog Sansthan is able to collect and sell an average of 2.5-3.0 MT of dried 'mandukparni' leaves every month.

6.3.11. Cultivation of Mentha (*Mentha arvensis*)

'Mentha' is under cultivation in Hakkabad Khinjana and surrounding villages in Barabanki district of Uttar Pradesh for the past about 20 years, where it is cultivated over 50 ha of land by about 150 farmers. Planted in the month of February, this crop, after 7-8 irrigations and 2-3 light pest sprays, becomes ready for harvesting of the first cut in about 60 days and after another 5-6 irrigations for the second cut in another 50-60 days. The harvested shoots are air dried for 10-12 hours and subjected to distillation to extract 'mentha' oil. Many large farmers have also installed their own distillation units and these units were also being made available to smaller farmers for distillation of their produce. At present 10 distillation units were reported to be functional in the village cluster. Once the crop comes to harvesting, the distillation units are run round the clock. One distillation cycle takes 60 qtl of fresh cut 'mentha' (air dried for 10-12 hours) and it takes about 6



'Mentha' cultivation

hours to complete the cycle. With fresh cut from one bigha being about 18-20 qtl, produce from at least three bigha is needed to run one cycle of distillation unit. The dried herbage after distillation forms the bulk of fuel to run the distillation units. The total average annual yield of oil from both the cuts is about 200 litres per ha. Mr. Raj Kumar, a local farmer cultivating 'mentha' over 4 ha since 1995-96, expressed that banks might sometimes delay the payments, but no such delay in payment has ever been experienced in case of 'mentha' oil as this oil finds ready sale and gets immediate cash payment.



'Mentha' harvest and distillation unit

Every farmer in the area maintains his own nursery for planting during the next year. For this purpose, the rootstock is planted at close spacing in a shaded area after the second cut at the onset of monsoons. This plot is maintained through regular irrigation for the next 5-6 months. The tillers from this rootstock are used for 'mentha' plantation during the next year.

In the State of Uttar Pradesh alone, 'mentha' is cultivated over more than 30,000 ha in various parts of the state, with the prominent clusters being in Rohilkhand and in Barabanki-Lakhimpur-Faizabad. Interaction with farmers of Budaun area of Uttar Pradesh revealed that the area under 'mentha' cultivation had drastically decreased over the past 2-3 years, with some respondents reporting such reduction to be more than 80%. The major reasons cited for such decline in 'mentha' cultivation were increasing input costs, especially labour wages and irrigation cost, and decreasing prices of 'mentha' oil that have decreased from ₹ 2200 per kg to just about ₹ 900 per kg over the past 2-3 years.

'Mentha' cultivation over about 400 hectares has also come to notice from Hoshiarpur and Nawanshahar districts of Punjab, and its cultivation is picking up as an alternative cash crop.

6.3.12. Cultivation of Tulasi (*Ocimum tenuiflorum* & *Ocimum gratissimum*)

'Tulasi' is perhaps the most important plant of the country from religio-cultural and therapeutic point of view. It is extensively used as offering to the deities, as a household remedy for various ailments, and as an important ingredient of many commercial formulations. Large traditional cultivation of this plant is known from around Mathura to cater to the need of Vrindavan temple where the stems of this plant are used to make garlands. Similar cultivation clusters to meet the need for offerings to the deities are also known from around temples in southern India.



Cultivation and harvest of 'Tulasi'

Of late, 'tulasi' cultivation for therapeutic purposes has also caught the attention of farmers. Visit to the Mahmudabad village cluster spanning Sitapur and Barabanki districts revealed that 'tulasi' is being cultivated by about 60 farmers in 15 villages over about 20 ha of land. This village cluster produces about 20-25 MT of dried 'tulasi' leaves and about 35-40 MT of dried 'tulasi' stems from two cuttings every year. Whereas the dried 'tulasi' leaves fetch a price of ₹ 80-100 per kg to the farmers, the 'tulasi' stems sell for about ₹ 40 per kg. The domestic herbal industry is the major buyer of dried 'tulasi' leaves and the dried 'tulasi' stems are generally used in making veterinary medicines.

Organic India Ltd. is also reported to support organic cultivation of 'tulasi' over an area of about 1000 ha in Rath tehsil of Hamirpur district in Bundelkhand, Uttar Pradesh for use in their herbal tea. Two varieties of *Ocimum tenuiflorum* i.e. Rama Tulasi and Shama Tulasi are grown under this program for which the company is paying a rate of about ₹ 90 per kg of graded 'tulasi' leaves. There is another attempt at 'tulasi' cultivation under federated farming in Gadag tehsil in Karnataka. Farmers of six villages in this area, under leadership of Mr. Mahadeva Pawar, an enterprising farmer from Kalasapur village of Gadag tehsil, have come together and have taken up cultivation of various species of medicinal and aromatic plants with 'tulasi' cultivation over 4 ha of land. The farmers here are obtaining an average yield of 3 MT per ha of dried 'tulasi' leaves. The minimum assured farm gate price committed by the pharma companies is ₹ 120 per kg.

The company is also promoting the cultivation of Vana Tulasi (*Ocimum gratissimum*) that fetches a little lower price. Vana Tulasi is also being cultivated over about 8 ha in Barabanki district of Uttar Pradesh. Mr. Alok Kumar, a farmer of village Tigayian in this district shared that if planted in July, this species gets ready for first harvest in September and for second harvest in December. The crop needs irrigation for 2-3 times in between. The species, if planted in March, needs 4-5 rounds of irrigation. The annual production of leaf is about 2500 kg per ha and that of stems about 4000 kg per ha.

Vana Tulasi (*Ocimum gratissimum*), known locally as Tulsa, has also come to be a choice medicinal plant for cultivation in areas around Neemuch in Madhya Pradesh and Udaipur in Rajasthan, where it is grown for its seed. Visit to the fields of Mr. Ashok Kumar Sharma and Mr. Shyam Sunder Sharma of village Dholakhari in Udaipur district brought to notice the various difficulties associated with cultivation of Tulsa. The crop is usually sown during late June to take benefit of the first monsoon showers. However, if the monsoon fails to arrive in time, all the seeds are eaten up by ants, requiring re-sowing and adversely affecting the yield. The crop sown during June becomes ready for harvest by the first week of December. The plants are thrashed and winnowed to get seeds that are sold in the Neemuch mandi. The annual production of Tulasi seed from this area is estimated to be more than 1000 MT, major part of which is sold at Neemuch mandi. The crop was reported to be susceptible to damage by Neelgai, herds of which run through the standing crop badly trampling the plants. No report of Neelgai eating this crop, however, came to notice.

6.3.13. Cultivation of Makoi (*Solanum nigrum*)

Makoi is a natural grown medicinal plant species commonly found on waste lands and as a farm side weed, from where an estimated 2000 MT of its aerial parts are harvested every year. Of this,



'Makoi' cultivation in Uttar Pradesh

about one third i.e. about 600 MT is collected from Hasanganj tehsil of Uttar Pradesh only. In addition, about 10-15 MT of its fruits are also collected from the wild. The major buyer of this species is the herbal industry making extracts (viz. Natural Remedies and Indian Herbs) and veterinary medicines (viz. Ayurved Ltd.).

The quality considerations have brought this otherwise fairly common species under cultivation. As at present, an area of about 80 ha is under its cultivation in Uttar Pradesh. An estimated annual production of aerial parts from this cultivation is about 100 MT and that of fruits is of about 25 MT. Whereas the dried aerial parts fetch a price of ₹ 12-15 per kg at the farm gate, the dried fruits sell at ₹ 100-110 per kg.

6.3.14. Cultivation of Isabgol (*Plantago ovata*)

Isabgol or Psyllium, with annual trade of more than 60,000 MT, is entirely sourced from cultivation done in the States of Rajasthan, Gujarat and Madhya Pradesh. In western Rajasthan, it is cultivated over about 2400 ha land around Jaisalmer. Sowing of seeds @ 4 kg/ ha is done during November-December. A spacing of 30 x 45 cm is considered ideal for higher seed yield. The crop requires 4-6 irrigations over the period it becomes ready for harvesting in 110-130 days i.e. during March-April. The harvested plants are spread for about two days for air drying, after which they are threshed with tractor/ bullocks. A good crop yields 800-900 kg of seeds per hectare.

Isabgol cultivation has also been started in the areas of Rajasthan adjoining Neemuch in Madhya Pradesh over the last about 6-7 years. Interaction with Mr. Goverdhan Lal Sharma of village Kedariya, tehsil Vallabhnagar, district Udaipur, Rajasthan provided good insights in to the issues



'Isabgol' cultivation in Rajasthan

related to Isabgol cultivation in the area. It was informed that Isabgol cultivation was presently being done on about 10 ha land in the village. The major reason for this shift from wheat was lesser irrigation required for Isabgol vis-à-vis wheat and high susceptibility of wheat to damage by Neelgai, locally called 'Rozda'. It was, however, informed that Rozda has started nibbling the flowers and browsing whole plants also. The crop has also become susceptible to aphid (Mola) attacks. The crop needs 3-4 irrigations and two sprays, one for killing weeds like 'bathua' (*Chenopodium* spp.) and the other to kill 'mola' (aphids). Sh. Goverdhan Lal informed that he has to perform night vigil at his farm located about one kilometer away from the village proper to shoo away the raiding herds of Rozda. The crop is also highly vulnerable to untimely rains, especially after seed setting, when even a little rain can cause the seeds to shed and the entire soil becomes mucilaginous and hard. The crop in this area yields about 1200 kg seeds per ha. The produce from this village is usually sold at Fatehpur, Nimbaheda or Neemuch mandis that are respectively 30 km, 100 km and 130 km from the village. Mr. Goverdhan informed that he got ₹ 12000 per qtl during 2015-16 at farm gate for his entire produce of Isabgol seeds.

The area under isabgol cultivation is registering a decline in some areas due to climatic adversaries and farmers are shifting to other crops like jeera and fennel seeds or saunf. Isabgol is a risky crop as a little unseasonal rain can ruin the whole crops.

6.3.15. Cultivation of Rosemary (*Rosemarinus officinalis*)

Rosemary, a European aromatic herb, known for its essential oil used in pharmaceutical, cosmetic and food flavouring industry, has been brought under viable cultivation in Gadag and Shirahatti



'Rosemary' cultivation in Karnataka

taluks of Gadag district, Bellary taluk of Bellary district and Gundlupet and Chamarajanagar taluks of Chamarajanagar district in Karnataka under a federated farming initiative being spearheaded by Mr. Mahadeva Pawar, an enterprising farmer from Kalasapur village of Gadag tehsil. At present, it is cultivated over about 10 ha of land.

Rosemary is propagated through softwood stem cuttings. About 6-inch long cuttings are prepared from the previous crop and are planted at close distance in the nursery beds and allowed to root. During early rains, the land is ploughed, leveled, weeds removed, and furrows opened. Rooted cuttings are planted in the main field at a spacing of 60 cm between the plants and rows. Fields are irrigated once in 8-10 days. Standard dose of fertilizer (DAP) is given during the fourth month. Occasional weeding and soil raking is done, while the crop is maintained for one year. Crop is generally free from any major pests, however, occasional root wilt and root grub infestation is noticed.

Harvesting is done during October and March. Plants are uprooted and spread in open for 7 days, with frequent turning over to ensure uniform drying. Dried plants are subsequently thrashed with

wooden clubs, to separate the leaves. The small needle like leaves, constitute the raw drug material. This dried leaf mass is cleaned to remove shoot pieces and other extraneous material. An average yield of 3 MT per ha is expected from a well maintained field. The produce is then filled into sacks, with each bag containing an average weight of 35 kg. The current assured farm-gate price was reported to be ₹ 100 per kg of dried leaves. It came out that the dried leaf mass first enters the raw drug mandis in Mumbai and Delhi, from where it is distributed to different essential oil extraction units.

6.3.16. Cultivation of Chiretta (*Swertia cordata*)

Chiretta is an important herbal raw drug used in Indian Systems of Medicine. Excessive exploitation of its wild resources has brought this group of species (*Swertia chirayita*, as well as its equivalents like *Swertia cordata*, *Swertia angustifolia*, etc.) under threat of extinction. These days, Chiretta of trade is mainly sourced from Nepal with a part of the material that is traded as Chiretta actually being Kalmegh (*Andrographis paniculata*), which is known in trade as 'Tikt chirata'. Many



'Chiretta' cultivation and harvest

previous efforts at cultivation of Chiretta at commercial scale did not yield desired results. Dr. Lal Singh, Director, Himalayan Research Group (HRG), Shimla, identified *Swertia cordata* as a potential Chiretta species for commercial cultivation in Chachiot tehsil in Mandi district of Himachal Pradesh and started agro-techniques standardisation work in 2002 with support from Department of Science and Technology, Government of India. With initial financial help from the NMPB, he enrolled 507 farmers for cultivation of Chiretta, out of which a group of 55 master growers was trained to maintain the first crop on their fields for producing seed. A total of 11.415 kg seed was recovered from these fields during October 2009. He enrolled another set of 487 farmers to initiate Chiretta cultivation in February-March 2010. Most of these farmers are women and the fields used are the ones that were once under Hemp. By the end of 2010, total number of farmers enrolled for Chiretta cultivation in this cluster was about 1000 and total area under Chiretta cultivation was about 70 ha making it the largest cluster of farmers growing medicinal plant of wild origin in the Indian Himalayan region.

Marketing of the produce, the first commercial lot of 5 MT became available in 2011, became an issue with traders and herbal companies coming up with offers of very low prices. The HRG held its nerve, got itself registered for VAT and CST to be able to transport the material on behalf of the farmers and helped farmers in selling the first commercial consignment of 2.5 MT to M/s Dabur India Limited. The farmers had to pay export permit fee of ₹ 7 per kg to the State Forest Department for the entire produce sold to M/s Dabur India Ltd. This came as dampener, as such levy was originally meant for wild collected produce only.

With the hand holding provided by the HRG, the farmers are showing more interest in cultivation of other high value Himalayan medicinal plants also. Marketing remains an issue and HRG has taken up this matter with the government to simplify the procedures for marketing and develop effective strategy and framework for marketing of farmers produce. [Text and Photos by Dr. Lal Singh, HRG]

6.3.17. Cultivation of Karu/ Kutki (*Picrorhiza kurroa*)

Karu/ Kutki is a very important Himalayan herb that is extensively used in Indian Systems of Medicine. Ruthless harvest from wild has brought this species under threat of extinction and the species is now listed in the CITES. The efforts by High Altitude Plant Physiology Research Centre (HAPPRC) in Uttarakhand to develop agro-techniques of this plant have culminated in the form successful commercial cultivation of this species in Gheshe, a remote village located at 2500 m altitude in Chamoli district of Garhwal. The cultivation started with a tripartite agreement between HAPPRC, Dhawan international, a herbal unit, and the Gheshe villagers on August 9, 2002. This document laid the basis of the cultivation of the aforementioned species and the buy-back guarantee for harvested produce.



'Kutki' cultivation and harvest

Pursuant to the signing of this agreement, 32 farmers registered for Kutki cultivation and assigned 5 ha of total area for the purpose. With the limited germplasm of the high yielding broad leaf (BL) variant of the species, cultivation could, however, be started with only five farmers. The first harvest was reaped during October 2005. Dhawan International procured all the 200 kg of dried material. The farmers of the village have now organised themselves into a society and have got it registered under the name 'Gheshe Kishan Samiti' with the State Bhasaj Sangh, mainly to acquire permit for commercial cultivation of Kutki. Presently, after 13 years of its initiation, Kutki is now

cultivated by 35 farmers over 4.5 ha land in this village in small scattered fields.

The present annual production from this area is about 1 MT of dried roots of very high quality and M/s Dhawan International is procuring part of the produce at the farm gate price of ₹ 800 per kg. Since 2011, M/s Dabur India Ltd. has also been making purchases of a major part of the produce from this area

Large scale cultivation of *Picrorhiza kurroa* will be helpful to provide the pure drug to the pharmaceutical industries and can also reduce the exploitation pressure on the natural population, thus helping to conserve the species in its natural habitat. [Text and Photos by Prof. M. C. Nautiyal, HAPPRC]

6.3.18. Cultivation of Senna (*Senna alexandrina*)

Senna has long been under cultivation in Tirunelveli, Madurai, and Tiruchirapalli districts of Tamil Nadu. In areas with dry, gravelly, and red-loamy soils, it has naturalized and comes up as self grown crop also. Popularly known as Tirunelveli Senna in trade, the annual production of its leaves in 1955 was nearly 500 MT and that of its pods was about 80 MT. 'Senna' is still being extensively cultivated in these areas and forms a good source of cash income to the local farmers.



'Senna' cultivation in Rajasthan

During the 1950s, the plant was introduced to Mysore and Jammu, where its cultivation trials were laid. Even as the cultivation of the species was found to be viable, it has not picked up in these areas. Its introduction in Rajasthan for cultivation about 20 years back has been very successful. The species, known as 'Sonamukhi' in Rajasthan, has become a crop of choice in the state. It is cultivated under typical rainfed situations and grows best in newly cultivated areas, where it requires neither any fertilizers nor any pesticide etc., thus, making all 'senna' cultivation as 'organic'. A total of about 10,000 MT of 'senna' was processed in 2014-15 in the 50 odd processing units located in Rajasthan. The processed 'senna' is largely exported to Japan, Germany, USA and China. An estimated area of about 5,000 hectares is under 'senna' cultivation in the districts of Jalore, Jodhpur, Pali and Barmer. A hectare of well cultivated 'senna' yields about 1.5 MT of 'farmer grade' dried matter (leaflets, pods and leaf rachis/ branchlets). The current procurement price of farmer grade 'senna' leaves is ₹ 10-12/- per kg. The farmer grade 'senna' contains about 30% leaf rachis/ branchlets.

6.3.19. Cultivation of Tejpatta (*Cinnamomum tamala*)

Tejpatta or Indian Bay Leaf has hitherto been largely collected from the wild, with some collection being made from the self grown trees on farm bunds. The demand and trade of this produce has,

however, been picking up over the years. This prompted the farmers, especially in Uttarakhand, to maintain the self grown trees on their farms and also plant more trees towards getting ready cash income from the sale of leaves. An ICIMOD sponsored intervention some ten years back trained the farmers and wild collectors in sustainable harvest and value addition techniques. This intervention resulted not only in many-fold increase in the price of graded leaves, but also in taking up of 'tejpatta' cultivation by many farmers. Presently, an estimated 10000 farmers in both Garhwal and Kumaon regions of Uttarakhand are involved in planting of 'tejpatta' on their fields.



'Tejpatta' plant

The cultivation and trade of 'tejpatta' in Uttarakhand has got a boost in the form of its getting GI (geographical Indicator) tag with a name 'Uttarakhand Tejpat'. The Uttarakhand 'tejpatta' has been GI registered (No. 520 dated 31 May 2016) for having 'cinnamaldehyde' that accords sweetness to the leaves. The 'tejpatta' for Uttarakhand is, therefore, also called 'meetha tejpat'.

The harvesting of leaves is done from October-November to February-March depending upon the elevation and precipitation. For harvesting the leaves, the branches are usually lopped to encourage new branches during the next year. An average yield of 15-20 kg of dried 'tejpatta' is obtained per mature tree per year. Presently, graded leaves are fetching a sale price of ₹ 50-60 per kg. The total trade volume of 'tejpatta' from Uttarakhand is estimated to be 1000 MT per annum.



Photo : Dr. Rajiv Pandey

Farmer engaged in 'Tejpatta' harvesting, and a harvested tree

Trade of about 25 MT of bark of this tree per year from Kumaon region of Uttarakhand has also come to notice.

6.3.20. Cultivation of Other Species

In addition, cultivation of the following species was also come across, but could not be studied in detail due to the growing and harvesting cycle of these not commensurate with the visits of field teams to the cultivation area:

Artemisia (*Artemisia annua*): This species is under organized cultivation over about 400 ha in the districts of Lucknow, Sitapur, Hardoi and Lakhimpur in Uttar Pradesh. The yield of aerial parts is about 50-60 MT per ha. The species is reported to be used for making anti-malaria vaccine. The



'Pippali' cultivation in Maharashtra

plant material for this purpose needs to have artemisin content of 0.5-0.7%. Ipca Laboratories, with annual procurement of more than 1000 MT, is the single largest buyer of the produce. M/s Samut Products and M/s Ayurved are other major buyers of this species.

Pippali (*Piper longum*): Pippali, the dried fruiting spike, is extensively used both as a spice and as a herbal drug and forms an important constituent of Ayurvedic formulation 'Trikatu'. A part of the annual demand is met from the wild populations of this plant that grows naturally in the rain forests. Major supply

of the Pippali is, however, met from cultivation in different parts of the country. One such Pippali cultivation cluster, under active technical and marketing support from Mr. V. B. Ladole, Chief Functionary, CARD, a local NGO, is located in Anjangaon Surji of Amravati district in Maharashtra where about 1000 farmers cultivate Pippali over about 600 ha and produce an average of 400 MT of Pippli every year. Many of these cultivators are landless farmers who take land on lease for this cultivation. The crop saw a drastic drop in prices in 2014-15, with farm gate prices crashing to just about ₹ 350 per kg, making it difficult for the farmers to even recover their cost of cultivation. The prices have, however, recovered to about ₹ 700 per kg over the last year. The area has a long history of intercropping Pippali with betel vines. However, cultivation of Pippali as single crop started only during the 1960s. Sh. Ladole, associated with Pippali cultivation for about 45 years, has made it into a commercial venture. The usual trade chain involves selling the produce to the local trader who then sends it to Delhi or Mumbai herbal raw drug mandis. Some farmers have also started dealing directly with the terminal mandis.

Pippali is also reported to be under cultivation over about 800 ha as an intercrop in oil palm orchards at Jangareddyguddam in West Godavari district of Andhra Pradesh, under an initiative by M/s Dabur India Ltd.



'Castor' cultivation in Rajasthan

Castor (*Ricinus communis*): Castor is an important medicinal plant of which seed oil, roots and leaves are used as herbal raw drugs. The duration of traditional castor crop is 7-8 months. The farmers in Rajasthan

have now taken to cultivating high yielding castor varieties like NPH-1 (Aruna), GAUCH-4, and TMVCH that mature in about 150 to 180 days. Harvesting is generally done when one or two capsules in a bunch show signs of drying. However, it is advisable to harvest only the fully ripe capsules to get oil of better quality. Castor is cultivated both as rain-fed and as irrigated crop and as pure or mixed crop. During the year 2014-15, a total of 1.49 lakh hectare area was recorded to be cultivated with castor in Rajasthan with the total production of castor seeds recorded at 1.56 lakh MT. The average yield for the year 2014-15 was, therefore, 1,050 kg/ ha. The area under castor cultivation in Gujarat was recorded as nearly 7.33 lakh hectare. Castor is also cultivated in Karnataka and Tamil Nadu.

Chiretta (*Swertia chirayita*): As per API, 'Chiretta' is correlated to *Swertia chirayita*, a species the availability of which from the wild has drastically reduced. Efforts at its cultivation, going on for quite some time, are reported to have borne fruit in the form of bringing about 2 hectares in Uttarakhand and about 10 hectares in Nepal under its cultivation through promotion by Dabur India Ltd.

Ghritkumari (*Aloe vera*): Cultivation of 'ghritkumari' has increased many fold over the past 4-5 years. The major reason for this increase in area under cultivation is successful positioning of the *Aloe* products as over the counter health food items. Ghritkumari is a perennial plant that yields first flush of leaves after one year of planting, with subsequent flush of leaves getting ready for harvest every three months. This is one of the few herbal raw drugs that sells in fresh form. The crop yields an average of 700 quintal of fresh leaves per hectare per year. The sale price of the fresh leaves varies from ₹ 5 to ₹ 7 per kg. An area of about 115 ha was recorded to be under *Aloe* cultivation in Jodhpur division alone during 2014-15.

Mehndi/ Henna (*Lawsonia inermis*): Mehndi is grown over more than 40,000 hectare in Sojat tehsil of Pali district in Rajasthan, where the limestone parent rock is believed to enrich the



Henna (*Lawsonia inermis*) cultivation in Rajasthan

produce with deep colour. Mehndi is a perennial crop with the plants known to continue producing leaves for 70-80 years, with annual harvest of about 600 kg per hectare. For harvesting the leaves, the branches are cut about 3" above the ground to promote bushy growth for better yield. The cut branches are dried for 2-3 days and then leaves are separated by light thrashing. The produce is taken to special Mehndi Yard of the Sojat Krishi Upaj Mandi where the produce is put to open auction. During the year 2014-15, the sale rate of dried 'mehandi' leaves varied from ₹ 30-40 per kg.

Kavach Beej/ Velvet Bean (*Mucuna pruriens*): It is popular as 'Nasugunni' in Kannada and is



'Kavach' cultivation in Karnataka

another herbal plant in demand, amenable for cultivation with least inputs. It is seen in about 5 acres in Gadag region. Planting is done, similar to the planting of French beans. After proper tilling, the field is made ready by opening alternate ridges and furrows. Seeds are individually sown in the ridges at a distance of 2 feet. Spot irrigation is given immediately after planting. Despite being a vine, Velvet bean plants here, are however encouraged to come up as solitary bushes. Wooden stakes, props or pandals as support for the growing vines are not encouraged as it would incur additional cost, which the traders are not willing to pay, the farmers assert. Plants are maintained for 9 months while there will be profuse flowering and fruit set.

Mature pods are harvested and dried in open. They are then thrashed; chaff and pod crusts are removed to separate the seeds. Seeds, which look like French bean seeds constitute the traded material. Seeds of all size are seen, but are not graded. Ungraded and assorted seeds are then filled into sacs for shipment.

Other Cultivation Initiatives: Cultivation of medicinal and aromatic plant species like Kulanjan (*Alpinia galanga*), Lemon grass (*Cymbopogon flexuosus*), Kachur (*Curcuma zerumbet*), Gunja (*Abrus precatorius*), Kalihari (*Gloriosa superba*), Pushkarmool (*Inula racemosa*), etc. has already stabilized in different parts of the country.



Photo: S. P. Subramani



Photo: S. P. Subramani

Kalihari (*Gloriosa superba*) cultivation in Tamilnadu

Akarkara (*Anacyclus pyrethrum*), previously imported from Morocco, has been brought under cultivation in Bareilly, Rampur and Lucknow in Uttar Pradesh. This area has also come to be known for fairly large-scale cultivation of Tukhm-e-Kahoo (*Lactuca sativa*) and Pili Shatavar (*Asparagus*



Pushkarmool (*Inula racemosa*) cultivation in Lahaul, Himachal Pradesh



Atis (*Aconitum heterophyllum*) cultivation in Himachal Pradesh

racemosus). Similarly, cultivation of Kasni (*Cicorium intybus*) has also come to notice from Gurgaon and Rewari districts of Haryana.

Cultivation of some other species like *Acorus calamus*, *Berberis aristata*, *Hedychium spicatum*, *Phyllanthus emblica*, *Sapindus mukorossi*, *Taxus wallichiana*, etc. has come to notice from Uttarakhand. These cultivation initiatives in the State are being spearheaded by the Herbal Research and Development Institute (HRDI) NMPB sponsorship. Additionally, cultivation of species like Chhipri (*Pleurospermum angelicoides*) and Archa (*Rheum australe*) in Uttarakhand has also come to notice. However, these cultivations are too small and too scattered and, thus, data on the total area under their cultivation could not be compiled.

Cultivation of 'shankhapushapi' (*Convolvulus prostratus*) under a collective initiative of ICRISAT and Dabur India Ltd. in Barmer district of Rajasthan has also come to notice. This initiative is reported to have resulted in production of about 40 MT of dried produce during 2014-15.

Contractual cultivation of *Coleus forskohlii* over more than 1000 hectares and involving about 1500 farmers under Sami Labs initiative has also come to notice. This cultivation is under buy-back agreement. The Sami Labs, in addition to providing technical support to the farmers, also provides them with interest free credit in the form of quality seeds, fertilizers and pesticides.

Small scale cultivation of species like 'Bankakri' (*Podophyllum hexandrum*) in Himachal Pradesh;

Table 6.1. Major Medicinal Plant Species under Cultivation with Area

S. No.	Trade Entity	Plant Species	Estimated area under Cultivation & Production		Region/ States
			Area (in ha)	Annual Production (Dry. Wt. in MT)	
1	Isabgol	<i>Plantago ovata</i>	80000	45000	Gujarat, Rajasthan & MP
2	Mentha oil	<i>Mentha arvensis</i>	40000	8 lakh ltr	UP, Uttarakhand, Bihar, Punjab
3	Henna	<i>Lawsonia inermis</i>	40000	25000	Rajasthan
4	Senna	<i>Senna alexandrina</i>	22000	20000	Rajasthan, Tamil Nadu
5	Aswagandha Roots	<i>Withania somnifera</i>	6000	5000	MP, Rajasthan, Andhra Pradesh
6	Tulsi	<i>Ocimum tenuiflorum</i>	5000	5000	UP, Karnataka, Tamil Nadu
7	Pippal Mool	<i>Piper longum</i>	4000	2000	Andhra Pradesh, Odisha
8	Pippali	<i>Piper longum</i>	1500	2000	Maharashtra, Andhra Pradesh
9	Kuth	<i>Saussurea costus</i>	250	120	Himachal Pradesh, Uttarakhand
10	Bach	<i>Acorus calamus</i>	400	3500	Karnataka, Uttar Pradesh
11	Vetiver	<i>Cymbopogon vetiveroides</i>	1500	500	Tamil Nadu, Kerala, Chhatisgarh
12	Artemisia	<i>Artemisia annua</i>	400	2000	Uttar Pradesh,
13	Ghritkumari	<i>Aloe vera</i>	1000	15000	Rajasthan, Gujarat, Madhya Pradesh, Karnataka, Haryana
14	Other Species	-	5000	-	Chhatisgarh, Uttar Pradesh, Kerala, North East States, Uttarakhand, Karnataka, Tamilnadu,
Total			207050		

'Ginseng' (*Panax sikkimensis*), 'Jatamansi' (*Nardostachys jatamansi*), and 'Chokpa' (*Angelica glauca*) in North-eastern States, and 'Ratnapurush' (*Hybanthus enneaspermus*) in Tamilnadu has also come to notice.

6.4. SPECIES PHASED OUT FROM UNDER CULTIVATION

During the late 1990s, a lot of effort was made to promote cultivation of Jojoba (*Simmondsia chinensis*), an exotic species, the seeds of which were supposed to have a great export market. A special farm for its cultivation was established at Dhand (Rajasthan) over 37 ha and plantations were raised over about 200 ha in other parts of Rajasthan and Gujarat. Jojoba Seeds were also recorded as a noticeable commodity in foreign trade with export of 867 MT of its seeds during 2004-05 (Ved and Goraya, 2008). However, export of Jojoba seeds continuously declined thereafter and came to just 3 MT during 2009-10 and has been almost nil from 2010-11 to 2014-15. During the field visit to Rajasthan, our teams noted that the Jojoba farms were now under conversion to some other crops.

A similar case of phasing out from cultivation has happened with another exotic species Milk Thistle (*Silybum marianum*), believed to have a great potential of export. Cultivation of Milk

Thistle was promoted over 400 ha in the drier parts of Rajasthan and an estimated annual production of 500 MT was reported for the year 2004-05 (Ved and Goraya, 2008). The species seems to have got almost phased out from cultivation over the years with only negligible trade of this species having been recorded during the year 2014-15.

Stevia (*Stevia rebaudiana*) is another exotic species that was tried to be promoted for large scale cultivation during 1990s. Cultivation of the species has failed to stabilize and no significant cultivation of this species has come to notice during 2014-15.

The above examples go on to show that the process from introduction of a medicinal plant species under cultivation to its final incorporation in the established agri-practices of the area is long-drawn and beset with challenges including chances of failure. It is, therefore, very necessary that adequate research at choice of species, introduction trials and marketing tie up is carried out before promoting any medicinal plant species for cultivation.

6.5. EMERGING TRENDS IN CULTIVATION OF MEDICINAL PLANTS

Cultivation of medicinal plants seems to have come to be accepted by farmers as a viable option for crop diversification and cash income, and by the herbal industry as a source of assured certified material in required quantities.

6.5.1. Developing Models for Intercropping

The Forest Research Institute, Dehradun has developed various models of successful integration of various medicinal plants with agri-crops. Some of these commercially viable agri-models successfully demonstrated include for *Rauvolfia serpentina*, *Uraria picta*, *Asparagus racemosus*, and *Piper longum*. Similarly, the Himalayan Forest Research Institute, Shimla has long been working on developing commercially viable models of integration of medicinal plants with horticulture and have standardized models for integration of *Valeriana jatamansi* and *Picrorhiza kurroa* with apple.

Development of intercropping models is now no more limited to the Research Institutes alone. The farmers, seeing good prospects of the medicinal plant cultivation, have started experimenting with their own intercropping models. Farmers in the Gadag area of Karnataka, who have taken to federated farming of medicinal plants, have started employing innovative methods like introduction of an important medicinal plant *Salacia chinensis* as an intercrop in Rosemary plots, usually taken up on dry, parched fields. Likewise, they have also started growing Shatavar (*Asparagus racemosus*) climbers along the bunds. Farmers in Gujarat have perfected the technique of integrating climbers of *Leptadenia reticulata* in their agricultural fields.

Whereas the intercropping models are likely to stay, the research institutes need to work out modalities for application of insecticide/ fungicides and fertilizers required for the primary agriculture or horticulture crop, to ensure that application of chemicals does not impact the quality of medicinal plants.

6.5.2. Hand holding Role of Local NGOs/ Progressive Farmers in Medicinal Plant Cultivation

Almost all case studies of successful cultivation of medicinal plants have at least one thing in common. And that is all such cultivations are steered by some local NGO or a Progressive Farmer. Some examples are given below to highlight the point:

Dr. Lal Singh, Director, Himalayan Research Group, Shimla took upon himself the challenge of

cultivating Chiretta in Himachal Pradesh and organized a cluster of about 500 farmers in more than 20 villages of Jeoni Valley in Mandi district of the state, for this cultivation. Today, after initial hiccups running over more than 10 years, his cluster produces more than 50 MT of Chiretta every year. Dr. Lal Singh continues to provide technical guidance and marketing support to the farmers. Senna/ Sonamukhi cultivation in Rajasthan has now come to stay as a very profitable venture, especially in newly cultivated lands under rainfed conditions. It is successful even today as its propounder, Mr. N D Prajapati, a progressive farmer and entrepreneur from Jodhpur, continues to do hand holding of farmers for the past more than 20 years.

Mr. Dileep Rai, Director, Asha Gramudyog Sansthan, a Lucknow based NGO, has been organizing farmers in Lucknow, Sitapur, Barabamki and Unnao districts of Uttar Pradesh for cultivation of various medicinal plant species like Tulasi, Bhumi amla, Makoi, Mandukparni, Prshniparni, Vetiver, Mentha, etc., and providing them technical and marketing support. As on date, more than 1000 farmers from about 100 villages are successfully cultivating medicinal plants in his organized group.

Kuth cultivation in trans-Himalayan valley of Lahaul in Himachal Pradesh was on the decline, when Mr. Nand Lal Sharma of Nanda Medicinal Plants Exports, Mansari village in Kullu district took up the challenge of reviving this cultivation. He explored global markets for sale of the produce and is providing technical inputs to Kuth farmers to add value and to prepare Kuth for export. He has been successful in his efforts and Kuth cultivation is looking up again. Mr. Nand Lal has also organized the farmers for cultivation of Karu and Atees, two other very important high value Himalayan medicinal plants.

Mr. Pranab Ranjan Choudhury of Baitarani Initiatives, Bhubaneswar has joined hands with Dabur India Ltd. and local farmers in collecting and processing herbal raw drugs collected from forests in Phulbani and Bolangir districts of Odisha. He has also now organized farmers to undertake cultivation of medicinal plants and for this purpose has already set up a nursery-cum-demonstration plot for cultivation of Briht Panchmool species for training of local farmers.

Mr. Shahandaaz Hussain, Managing Director of Agri Vista Tech, a Guwahati based company is promoting medicinal plant cultivation by organizing farmer groups in the north-eastern states of the country. He has been successful with *Alpinia galanga* cultivation in Arunachal Pradesh, Nagaland, Mizoram and Meghalaya and his cultivation clusters produce more than 300 MT of galangal roots every year. He is also using these cultivation clusters to promote cultivation of species like *Acorus calamus*, *Saussurea costus*, *Inula racemosa*, *Panax sikkimensis*, *Dactylorhiza hatageria*, *Angelica glauca*, *Aconitum heterophyllum*, *Nardostachys jatamansi*, and *Valeriana* spp., the field trials of which have been already completed.

Mr. V. B. Ladole, Chief Functionary, CARD, a local NGO located in Anjangaon Surji of Amravati district in Maharashtra, has, as a part of his mission of rural development through community action, organized more than 1000 farmers to cultivate medicinal herbs, the prominent of these being Pippali. The cluster has also initiated cultivation of Musli (*Chlorophytum borivillianum*) and presently about 200 farmers of this cluster are growing it over about 150 hectares.

In case of adoption of medicinal plant cultivation in Gadag tehsil of Karnataka, efforts by Mr. Mahadeva Pawar, an enterprising farmer from Kalasapur village of the same tehsil need to be appreciated. He organized the farmers and interacted with herbal industries and local traders for

remunerative marketing of the produce before choosing species for cultivation. His efforts have not only made medicinal plant cultivation a profitable venture for the farmers, but also helped in bringing many parched fields under vegetation.

It is clear from the above examples that any new initiative at promoting cultivation of medicinal plants requires hand holding by some local agency over long periods. The farmers need technical inputs in the form of advice about choice of species, initial germplasm, tending of crops, post



Interaction with medicinal plant farmers (01. Tulsi farmers in U.P.; 02. Mandukparni farmers in U.P.; 03. BhumiAmpla farmers in U.P.; 04. Farmers in Odisha; 05. Isbagnol farmers in Rajasthan; 06. Tulsa farmers in M.P.)

harvest handling and marketing. The efforts of the various NGOs and progressive farmers to lead consistent production of large volumes of good quality produce over years has brought these clusters in lime light with many herbal industries now ready to strike deals with these clusters for long term supplies of the material.

6.6. ISSUES IN PROMOTING CULTIVATION OF MEDICINAL PLANTS

The medicinal plants cultivation, with all the efforts at its promotion, has not yet attained the size and scale it has the potential to achieve. Some key reasons for this slow progress in the sector are as follows:

(i) There is no good mechanism to announce demand of the produce for the next 2-3 years in respect of different species. This lack of knowledge usually results in either over production causing crash in prices or under production causing rise in prices. Many of the high value medicinal plants, especially the shrubs and climbers and the Himalayan herbs, need 2-3 years to become harvestable and such knowledge about the demand at the time of harvesting of produce would save them from losses.

(ii) There still is inadequate acceptability of cultivated produce of some species. For example, the cultivated Atees is not finding favour with the buyers and fetches lower price than the wild harvested one.

(iii) There are issues with dispensation of subsidy. The farmers, many of them not educated enough, are required to prepare cases for seeking subsidy. On approval of the cases, they get first installment of subsidy also. However, the process of getting the second installment released is rather complex. It involves getting the farm inspected and verified by the designated officers, which many a times gets much delayed. Many of the farmers tend to lose their interest in the medicinal plant cultivation during this period.

(iv) Most of the farmers take to medicinal plant cultivation for cash income. However, with payments increasingly being made through Rural Cooperative Banks, there is usually a long delay between deposition of cheques and their clearing for payments.

(v) Adequate availability of good quality planting material remains an issue.

(vi) At many places the farmers get lower than agreed prices as their produce gets reported by the terminal buyer as containing lower percentage of alkaloids or being of lower quality. This is due to non availability of laboratories in the vicinity of the cultivation centres.

(vii) Many states like Himachal Pradesh and Uttarakhand require farmers, desirous of cultivating medicinal plants, to register with the authorized offices under Transit of Forest Produce (Land Route) Rules. The process does not end with registration alone. The farms are required to be inspected by different levels of officials till the crop is harvested and made ready for transportation. It causes inordinate delays, many a times causing damage to the product quality.

(viii) Many medicinal plant species have been notified under Section 38 of the National Biological Diversity Act, 2002 with strict regulations on their trade. The regulations while notifying the species under this section need to be reviewed and made supportive of cultivation of the notified species.

(ix) Much of the cultivated medicinal plant produce gets damaged during post harvest handling due to want of necessary infrastructure to dry, clean, chop, grade and package it. Many farmers during interactions desired creation of such facilities at community level to help them undertake post harvest handling of the produce in a more efficient way. Setting up of drying platforms and drying kilns is of utmost importance at or near Manali to enable taking out and handling fresh and semi dry consignments of Kuth before snowfall blocks the only road link to the Lahaul valley.

(x) Cultivation can get the farmers better dividends if the farms are certified as organic.

6.7. DISCUSSION

Unregulated harvest of many of the naturally growing medicinal plants has resulted in serious decline of their wild populations and thus pushed these wild species towards extinction. Cultivation of such species seems to have become a necessity for meeting the consistent demand for their use and not just a choice. From the above, it is clear that there is a new genre of entrepreneurs in the form of NGOs on one hand and farmers in search of crop diversification on the other hand to give medicinal plant cultivation a serious try. Industry also seems to have realized the inevitability of encouraging cultivation. The need now is to create a facilitating environment for this purpose. For one, the policy and legal framework, especially for the Himalayan states, would need to be revisited and made conducive for cultivation of Red-Listed Himalayan herbs. The system of Transit Pass/ Export Permit under Transit Rules of different states also need to be reviewed and made easier to facilitate trade of cultivated medicinal plant produce. There is a need to develop infrastructure for post harvest handling with associated capacity building training programs for the farmers and the supporting NGOs. The research Institutes would need to be supported for developing large scale planting material for production of high quality material.