

**Medicinal and Aromatic Plant Production Technologies**  
*a step towards farmwomen prosperity*

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**Introduction:** Medicinal and aromatic plants occupy an important position in the socio-cultural, health care and spiritual arena of rural people of India. Medicinal plants contributed significantly to the rural livelihoods. Globally, medicinal and aromatic plants (MAPs) constitute one of the integral parts of the biodiversity, ecosystem and biological heritage. Medicinal and aromatic plants are being used since ancient time for the treatment of many diseases in traditional and recognized systems of healthcare and for therapeutic, fragrance and flavoring products in pharmaceutical and cosmetic industries besides as sources of natural dye, fat, essential oil, bio-pesticide, resin, protein, vitamin, condiment, spice, timber, fiber and other useful substances. These plants are also considered to be the prime source of drug and aroma molecules and their precursors in modern medicine. Medicinal and aromatic plants (MAP)-based livelihood systems are often mediated by the market forces and/ related directly to employment and income of the poor people. Based on the research work carried out by International Development Research Centre (IDRC) in South Asia, MAP and other biodiversity-based livelihoods can not only become poverty reducing they can also be made socially equitable and gender balanced. MAP-based livelihoods can be easily mainstreamed with other components to enhance human welfare, especially among farmwomen. Medicinal plants are the nature's gift for the mankind. According to the World Health Organization, 80% of people from developing countries depend mainly on traditional medicine for primary health care. Traditionally, women have been the main producers of plant based medicinal products. Women conserve economically important plant species (such as plants used for food, traditional medicine, dye and soil stabilization). India one of the world's richest sources of medicinal plants comprises of nearly 45,000 species, but only 60 species of them find major commercial use as per the National Medicinal Plant Board. Medicinal plants provide crucial livelihood options for millions of rural peoples in the world especially tribal peoples and women. The collection, simple processing and trading of medicinal plants contribute significantly to the family income of poor in general and of women in particular. Traditional knowledge (TK) associated with medicinal herbs and cultivation, innovation and preservation of medicinal herbs is a highly gendered activity in most countries. With the day-to-day all round progress, we have invited certain unavoidable troubles for our health. Presently 1/4th of adults in our country and 7.6 crore population are suffering from high blood pressure and diabetes. Medical treatment is very costly and many people are unable to afford the cost of the treatment. In this way medicinal plants are playing crucial role in reducing the cost and maintain health. The addiction to chemical-based medicines causes a number of side-effects in our body in the long run. Whereas in the ancient time our ancestors used to take only plant-based medicine resulting they were healthier without any further deterioration in their health. The use of medicinal and aromatic plants still has the same efficacy if taken properly. But over-exploitation and indiscriminate use of medicinal plants is threatening our natural resources which are of immense importance. Therefore, conservation and utilization of the biodiversity of medicinal plants is the demand of the day.

Since women are the first victims of this shrinking resource base so they should be involved in collecting, conserving, processing and value addition activities of medicinal and aromatic plants. Besides to the above, they are not accessible to recent advances in science, which can help them generate more income and in turn improve the quality of their life. Cultivation of medicinal plants especially high value medicinal plants is creating new dimension in the field of agriculture. For women having marginal land holding, it will be beneficial if they cultivate high value medicinal plants and process them.

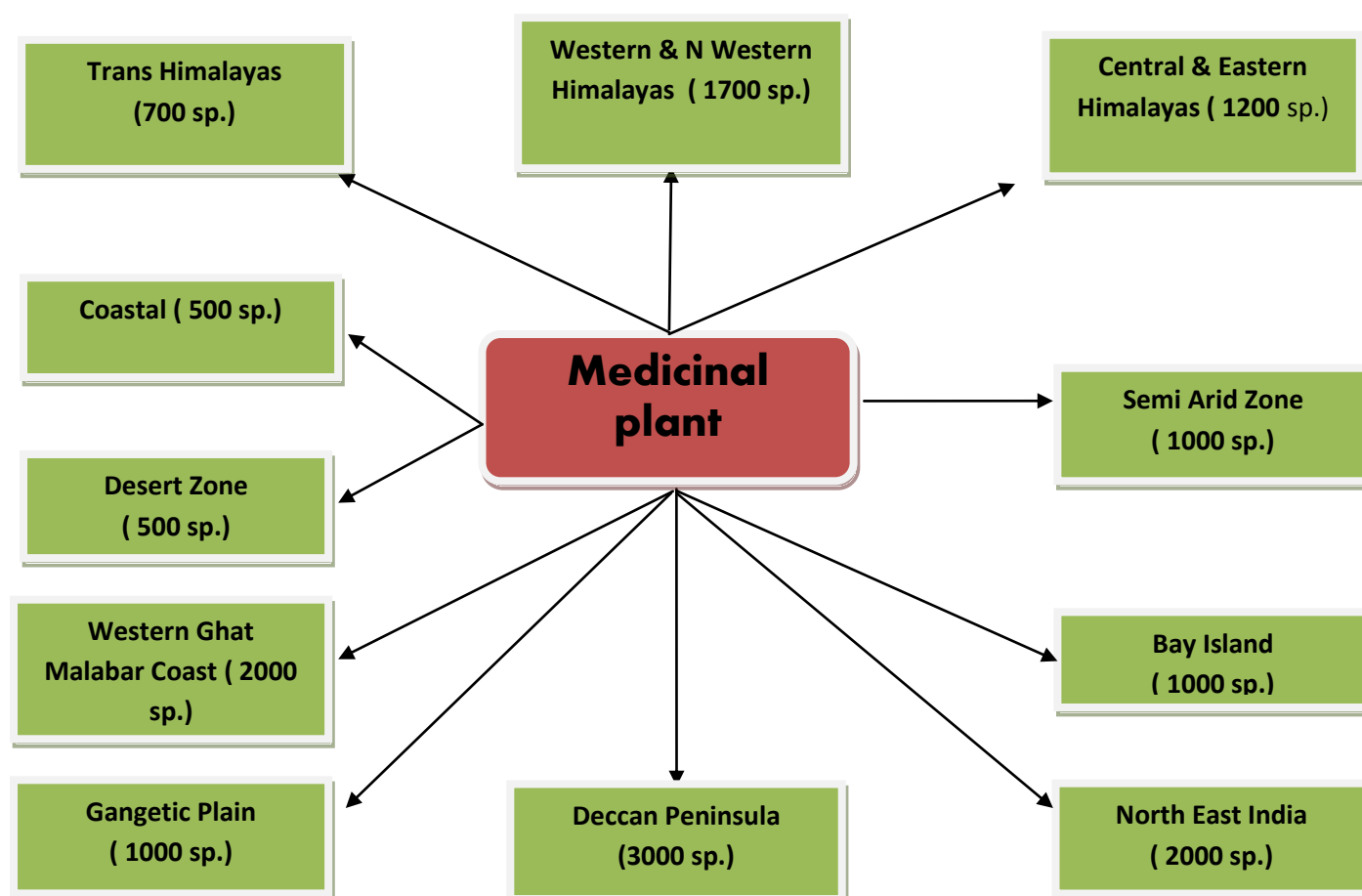
Post harvest storage and processing are the major activities done by the women must be standardized. If considerable research efforts are made to conserve their biodiversity and

popularize for proper utilization. Rural women are very much associated with various types of medicinal plants and using for curing of various types of ails since time immemorial. It has been observed that small and marginal farmer particularly women are collecting some common used and easily available medicinal plants such as *Aloevera*, tulsi, mint, brahmi etc from nearby and using them for curing of different types of ails. They also planted these herbs in their homesteads for future use. In areas where there is out-migration of men leading to the feminization of agriculture, women tend to conserve a wide range of food and medicinal plants for ensuring household food and health security. Hence, cultivation of medicinal plants are very important in many ways thus, there is need to popularize them about the utility and value of medicinal plants among farm women for improving health and livelihoods.

**Scope for medicinal and aromatic plants:** India has different agro-ecological zones suitable for growing different medicinal and aromatic plants, which are in great demand. However, systematic efforts will need to push this particular sector agro-ecological zone wise. The plant species will have to be identified and their package of practices will be developed. Identification of species will be important criteria for marketing. Therefore, planting material of identified varieties from standard source will be important for farming.

**Table 1. Distribution of medicinal plants**

Country or region	Total number of native species in flora	No of medicinal plant species reported	% of medicinal plants	Source
World	297000	52885	10	Schippmann et al. 2002
Indian	17000	7500	44	Shiva 1996
India Himalayas	8000	1748	22	Samant et al. 1998



## Figure 1. Bio -geographical distribution of medicinal plants

Sources: [shodhganga.in.flibnet.ac.in](http://shodhganga.in.flibnet.ac.in)

**Table 2. Medicinal Plants commercially suitable for cultivation in Eastern Region**

Botanical name	Common name	Parts used	Nature of demand	Gestation period	Demand as in 2004-05 (MT)
<i>Andrographis paniculata</i>	Kalmegh	Whole	Both, Domestic/Export	Short	2197.3
<i>Asparagus racemosus</i>	Shatawari	Roots	Both, Domestic/Export	Short	16658.5
<i>Bacopa monnieri</i>	Brahmi	Entire plant and leaves	Both, Domestic/Export	Short	6621.8
<i>Chlorophytum arundinaceum/boerivillianum</i>	Safed musli	Bulbs/tuberous roots	Both, Domestic/Export	Short	NA
<i>Gloriosa superba</i>	Shankpushpi	Roots	Export	Short	100.5
<i>Glycyrrhiza glabra</i>	Liquorice or Jethi madhu	Roots	Both, Domestic/Export	Short	1359.8
<i>Gymnema sylvestre</i>	Madhunashini	Leaves, roots	Both, Domestic/Export	Short	80.70t
<i>Rauwolfia serpentina</i>	Sarpagandha	roots	Export	Short	588.7
<i>Tinospora cordifolia</i>	Giloe	Roots, stem and leaves	Export	Short	2932.6
<i>Withania somnifera</i>	Ashwagandha	Dried roots	Both, Domestic/Export	Short	9127.5

Source: <https://idl-bnc.idrc.ca/dspace/bitstream/123456789/27286/9/g-120936.pdf>

## Importance of Medicinal and Aromatic Plants

### The Social Perspective

Throughout South Asia, the use of medicinal plants in meeting family's primary health care and nutrition needs is traditional and imbedded in all cultures — a practice dating back to at least four thousand years in many countries (Fransworth & Soejarto, 1991). In this respect - it needs no introduction for acceptability regarding familiarity with the usage of plant products, methods of cultivation of many commonly grown plants and technologies required for processing into items of common household uses and value. Medicinal plants are socially acceptable employment avenues for women. Traditionally, women have been the mainstays of medicinal plants-based activities and micro-enterprises because the products and activities thereof easily fit within the average daily needs of women. Medicinal plants have also been

used to develop family-based health and livelihood oriented enterprises in rural areas. Many traditional healers have been running MAP-based health care system to earn their livelihoods. Arya Vaidya Sala (AVS), Kottakal in Kerala is an excellent example of business and traditional medicine service combined. Such industries not only strengthen the social fabric, but also help: a) preserve the traditional medical knowledge, and b) provide easily adaptable enterprising opportunities for unemployed youth and rural poor who can learn the trade from their parents and peers and earn not only their livelihood but also contribute to the society (Karki, 2000).

### **Protection of Traditional Knowledge**

The urgency and need to protect the fast disappearing medicinal plants-based traditional knowledge, which is still abundant in the hills and valleys of South Asia cannot be overemphasized. In fact, the sacred mountains of Himalayas (popularly known as Dev Bhumi or abode of God) are widely believed to be the source of the age-old traditional system of medicine called Ayurveda. The indigenous people of Himalayas have a rich local health traditions and a large number of traditional healers have been practicing indigenous medicine for hundreds of years (Bordekar, 2000). If proper values can be added to the traditional medical knowledge-based health practices and subsistence-oriented MAP applications, a large number of jobs can be created in the rural areas. Even at current level of conversion of traditional medicinal knowledge into economic opportunities, enterprise-based application can account for thousands of jobs in rural areas. Thus, medicinal plants have high potential in creating jobs and pushing economic growth in resource-constrained areas suffering from limited educational opportunities, mountain-specific marginalities and lack of infrastructure, and underdeveloped medicinal plants-based trade and commercial activities. The conversion of socio-cultural traditions and indigenous knowledge into livelihood means and economic opportunities also has the advantage of preserving the rapidly eroding cultural knowledge and practices which are increasingly threatened due to globalization and homogenization of people and communities. As the Himalayas are recognized to be the treasure trove of biological and cultural diversity - the product of millions of years of evolution – there is a need to protect indigenous knowledge and cultural diversity on an urgent basis. In the uplands of Northeast Himalayas, especially in the areas predominated by shifting cultivation and marginal agriculture, the means of achieving this may be by providing economic value to traditional and indigenous knowledge (Ramakrishnan, 1992).

### **Environmental Perspective**

The growing apathy toward products made from chemical products and unsustainably harvested forest products becoming ethically unacceptable consumer goods have created new markets for quality, certified and organic herbal products. Medicinal plants have the potential to fill these needs as they provide green health alternatives and a number of other eco-friendly products of domestic and industrial usage (Bordeker, 2002, Temptesa & King, 1994). Found as trees, shrubs, grasses and vines, these plant species abundantly growing in South Asia. Its entry into the world food and drug market as the environment friendly botanical products is looked upon as an emerging and new opportunity that can help save environment by promoting community-based conservation. The development of medicinal plants-based economic incentives is being increasingly applied to enlist greater participation of people in conservation of forest ecosystem.

## Medicinal Plants and Human Health

South Asia is home to many rich, traditional systems of medicine (TSM). Ayurvedic system dates back to 5000 B.C. Along with the Unani, Siddha and Tibetan systems, these TSMs remain important source of everyday health and livelihood for tens of millions of people. Himalayan sage scholars of Traditional Medicine have said “*Nanaushadhi Bhootam Jagat Kinchit*” i.e. ‘*there is no plant in the world, which does not have medicinal properties.*’ The ancient scholars are estimated to know the medicinal properties of hundreds of species of plants. It is therefore, no exaggeration to say that the uses of plants for human health are probably as old as human beings themselves. Medicinal plants are accessible, affordable and culturally appropriate sources of primary health care for more than 80% of Asia’s population (WHO). Poor and marginalized, who cannot afford or access formal health care systems, are especially dependent on these *culturally familiar, technically simple, financially affordable* and *generally effective* traditional medicines. As such, there is widespread interest in promoting traditional health systems to meet primary health care needs. This is especially true in South Asia, as prices of modern medicines spiral and governments find it increasingly difficult to meet the cost of pharmaceutical-based health care.

## Gender Perspective

Traditionally, women have been the main producers of plant-based medicinal products through household micro-enterprises. Women often can procure and assemble ingredients as part of their established routines and work schedules. At least 25 percent of the drugs in modern pharmacies are derived from plants, and ingredients of many others are synthetic replacements built on related plant compounds. Medicinal and aromatic plants provide crucial livelihood options for millions of rural people in South Asia, especially tribal peoples and the very poor, many of whom are women. The collection, simple processing, and trading of medicinal plants contribute significantly to the cash income of the poor in general and of women in particular, in all countries of South Asia. Many communities in Latin America rely on herbal medicines for health care and traditional women healers. The production and processing of medicinal plants provide many jobs and economic benefits in poor areas, which lack educational opportunities, infrastructure, and health care facilities. In certain rural areas of Costa Rica, the industrialization of medicinal plants has created job opportunities for women, which has contributed to increased family income. The Convention on Biological Diversity recognizes the role of women in the conservation and sustainable use of biodiversity resources and reaffirms the need to guarantee their full participation at all levels of policy making and execution. Nevertheless, women’s ethnobotanical knowledge and medicinal knowledge are often unexplored and undervalued. Special attention should be paid to the significant value of the ancestral knowledge possessed by women. Local medicine specialists and herbalists are often women, especially in Africa and Asia.

When the knowledge and contributions made by women are clearly acknowledged and valued, will be possible if we promote effective participation of women in decision-making processes regarding the conservation of biodiversity of medicinal plants at the local and national levels.

## **Information gaps on gender roles and biodiversity management**

There is a widespread awareness of women's roles and gender-differentiated responsibility in managing biodiversity but there has been no systematic study to document situation-specific gender roles in biodiversity management, nor is there a database on the women who contribute to biodiversity management.

### **Current scenario**

According to the M.S. Swaminathan Research Foundation (MSSRF), available literature on gender and biodiversity provides the following indications:

- Men and women have different kinds of knowledge and information about plants, in part because they have different tasks in farming and providing income and goods for their households.
- In many societies, women are mainly responsible for seed selection and storage, exchanging seed and ensuring that local agro-biodiversity is preserved.
- Both men and women preserve their native plant species. The motivating factors, however, may differ. Men tend to be more interested in the market value of the species, while women may be more interested in their cooking and nutritional value.
- In areas where there is out-migration of men leading to the feminization of agriculture, women tend to conserve a wide range of food and medicinal plants for ensuring household food and health security.

The management of herbal gardens is carried out by both men and women in the Jeypore tract at Koraput, Orissa. However, Apatani women in Arunachal Pradesh seem less knowledgeable about medicinal plants or less willing to share information. On the basis of interviews with ten women and ten men, it became clear that both women and men of Lakshadweep Islands are conscious of the use of medicinal plants. Women take care to grow medicinal plants on their household premises. Both women and men of the Kurichiya tribal community in Kerala have maintained the habitat for several species of medicinal plants through the preservation of sacred groves and associated areas.

### **Equity and Gender**

Both men and women play an important and distinct role in production and marketing of MAPs. While men do harvesting, carrying, trade and transport, the harvesting of products, drying, women do sorting and packing. Most MAP-based communities are poor villagers and therefore, a significant portion of the income earned goes to the disadvantaged sections of the society. In Khasi society women have the right over the resources but it is the men who manage the forests business. The large chunks of forestlands belong to the government or rich forest owners while the poorer inhabitants are usually employed as labourers by the landowners and forest departments.

### **Employment Potential**

Cultivation and gathering of MAPs has a great employment potential. From these vast group of plants, medicine, nutritive food, essential oil and natural dyes can also be extracted which can be exploited by setting up micro-enterprises for processing of the raw materials and value addition locally. This would provide more employment to the local people. For example, in a

small community in Meghalaya, Bay leaf production is providing employment opportunities for the local people in the form of labourers and traders.

### Stake holder's participation

Local communities, especially weaker and marginalized groups including farmwomen need to be involved in medicinal and aromatic plant cultivation. The NGOs and GOs should consult and work with community based organizations and evolved them into participatory process for collection, production and marketing so that technologies will be percolated to the end users.

### Enterprise Development

The demand for medicinal and aromatic plants in India to meet both domestic and export market - comprising 162 species, is expected to increase at about 15 to 16% between 2002 and 2005 (CRPA, 2001). Medicinal and aromatic plants cultivation and management can become highly remunerative both in financial and economic terms for the small-scale growers in general and for farmwomen in particular.

**Table 3. Medicinal plants which have high demand in indigenous drug industry**

Sl No	Species	Common Name	Plant Part
1.	<i>Bacopa monnieri</i>	Jal Brahmi	Whole plant
2.	<i>Centella asiatica</i>	Brahmi/Mandukapaini	Whole plant
3.	<i>Andrographis paniculata</i>	Kalmegh	Whole plant
4.	<i>Withania somnifera</i>	Aswagandha	Root
5.	<i>Asparagus racemosus</i>	Satawar	Tuberous root
6.	<i>Chlorophytum arundinaceum</i>	Safed musli	Tuberous root
7.	<i>Gymnema sylvestre</i>	Gurmar	Leaves
8.	<i>Plumbago</i>	zeylanica Chitrak	Root
9.	<i>Tinospora cordifolia</i>	Guduchi	Stem
10.	<i>Desmodium gangeticum</i>	Salpanni	Root

### Issues:

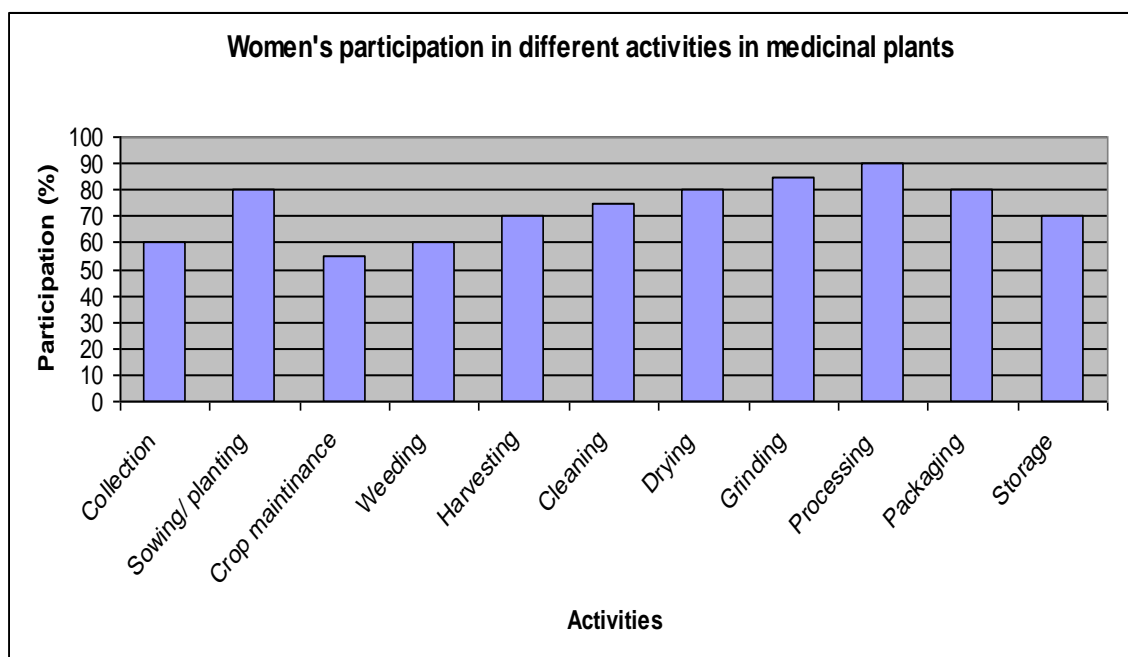
There are a number of issues in production of medicinal and aromatic plants hampering at various stages. Some of the important issues are listed as:

1. Employment generation
2. Lack of awareness about utility and value of medicinal plants
2. Health security
3. Poverty
4. Food security
5. Availability of seeds/planting materials
6. Different types of hazards
7. Lack of technological awareness and exposure
8. Marketing
9. Environmental



**Participation of women in different activities of medicinal and aromatic plants:** Major participation of women in medicinal and aromatic plants cultivation are observed in collection, sowing/ planting, crop maintenance, weeding, harvesting, cleaning, drying, grinding, processing, packaging and storage. However, participation of women in major activities such as sowing, weeding, harvesting, post harvest and storage of MAP was

observed from 60- 90% . These plants are well surviving under poor soil condition and need minimum care.



**Table 4. Commonly used medicinal plants**

Sl No	Common name	Botanical name	Parts use	Medicinal use
1.	Ashwagandha	<i>Withania Somnifera</i>	Leaves and Roots	Restorative Tonic, stress, nerves disorder
2.	Brahmi	<i>Bacopa, Monnieri</i>	Whole plant	Nervous, Memory enhancer, mental disorder
3.	Gritkumari	<i>Aloe Verra</i>	Leaves	Laxative, Wound healing, skin burns & care, Ulcer
4.	Gudmari	<i>Gymnema Sylvestre</i>	Leaves	Gout, Pile, general debility, fever, Jaundice
5.	Guluchi / Giloe	<i>Tinospora Cordifolia</i>	Stem	Hyper tension, insomnia.
6.	Sarpa Gandha	<i>Rauwolfia Serpentina</i>	Root	Enhance lactation, general weakness, cough
7.	Satavari	<i>Asparagus Racemosus</i>	Root	

8.	Tulsi	<i>Ocimum sanctum</i>	Leaves/Seed	Cough, Cold, bronchitis
9.	Bhrungaraj	<i>Eclipta alba</i>	Leaves, Flower,	Anti-inflammatory, Digestive, hair tonic
10.	Pippermint	<i>Mentha pipertia</i>	Oil	Digestive, Pain killer
11.	Akarkara	<i>Splenthos acmella</i>	Leave, flower	Dental troubles, scurvy and asthma
12.	Kalmegh	<i>Andrographis Paniculata</i>	Whole Plant	Fever, weakness, release of gas.
13.	Stevia	<i>Stevia rebaudiana</i>	leaf	Diabetes
14.	Lemon grass	<i>Cymbopogon flexuosus</i>	Leaf, stem	Used in perfumery, herbal tea

### Preference of women

The perception of women was recorded for medicinal plants and it was found that 70-80 % women preferred tulsi, guadamari, aloe vera, stevia, brahmi while 40 % women preferred akarkara. Only 10 % women preferred the other medicinal plants such as surpagandha, satavari, ashwaganda, bhringraj and lemon grass .

**Table 5. Preference of women**

Sl No	Name of medicinal plant	Botanical Name	Preference (%)
1.	Tulsi	<i>Ocimum sanctum</i> Linn	70
2.	Gudamari	<i>Gymnema sylvestre</i> Retz	80
3.	Aloe vera	<i>Aloe barbadensis</i> Mill	70
4.	Stevia	<i>Stevia rebandiana</i>	75
5.	Brahmi	<i>Bacopa monnieri</i> L	50
6.	Akarkara	<i>Splenthos acmella</i>	60
7.	Surpagandha	<i>Rauwolfia serpentine</i> L	30
8.	Shatavari	<i>Asparagus racemosus</i>	20
9.	Ashwaganda	<i>Withania somnifera</i>	10
10.	Lemon grass	<i>Cymbopogon flexuosus</i> ).	10

### Reason of preference

It has been observed that women preferred these crops due to easily available (60%), easy to maintain (70%), easy to use (70%) and health care (80%). While 30% women preferred these crops due to income generation, 15% for employment opportunity and 10% environment (10%).

**Table 6. Reason of preference (%)**

Sl No	Reason	Preference (%)
1.	Easy availability	60
2.	Easy to maintain	70
3.	Health care	80
4.	Multipurpose	40
5.	Short duration	35
6.	Income generation	30
7.	Post harvest and value addition	60
8.	Easy to use	70
9.	Employment opportunities	15
10.	Environment	10

### Advantages of medicinal and aromatic plants:

Major advantages of medicinal and aromatic plants are given below:

1. Homestead cultivation: Various medicinal plants such as tulsi, mint stevia, gudamari and brahmi are suitable for homestead cultivation. Home gardens serve critical functions in fulfilling community and household needs ranging from food security to augmenting the family nutritional status, ensuring primary healthcare, income generation and fulfilling other family needs. In Bangladesh, the NGO Development of Biotechnology and Environmental Conservation Center (DEBTEC) has encouraged women to cultivate backyard home gardens of medicinal plant, both as a strategy to protect endangered species and to empower women through plant cultivation that will provide a source of earnings. The Government of Bangladesh has advocated farmers to grow more medicinal plants to meet both local demand and enter export markets.

2. Easy to establish: Since mostly medicinal and aromatic plants are hardy in nature. Therefore they are easily established in different type of climates, soils. Mostly medicinal and aromatic plants are maintained and conserved by ex-situ and in situ methods.

3. Minimum care: Since mostly medicinal and aromatic plants are hardy in nature and they require minimum care and inputs for growth and yield.

4. Short duration: Mostly medicinal plants are in short duration nature and harvesting is started within 3- 4 month after planting. Harvesting of Brahmi, tulsi, stevia, lemon grass is started after 3- 5 months of planting in the first year and thereafter at interval of 60 -70 days in subsequent harvest.

5. Multipurpose: The women always choose those medicinal plants that are having multipurpose uses. The medicinal plants such as tulsi, aloe vera, mint, brahmi etc., are preferred by women because of day to day uses in their life.

6. Income generation: MAPs provide supplementary income to the forest dwellers and poor rural people. The degree of dependence of local people on MAP-based livelihoods is significant as it provides jobs to the poor people and much needed cash to the subsistence farmers, especially to the small scale cultivators, collectors, processors and traders.

7. Employment opportunities: The labourers are employed for a number of activities such as harvesting, drying, plucking, packing, carrying, sorting, repacking, loading and unloading and transporting. Thus MAP-based activities can create employment for the poor and disadvantaged section of the society.

8. Post harvesting and value addition: Post harvesting activities of horticultural crops including medicinal plants is done by women. A study has been conducted in Pakistan and found that tribal women and children collected 90 percent of the medicinal herbs and all drying is done by women. About 71 percent of medicinal herbs are sold by women and children, and 29 percent by men.

### **Perception of women for medicinal and aromatic plants:**

The selection of medicinal and aromatic plants by women depends on several factors. The women always choose the medicinal plants for cultivation based on following traits.

1. The women always choose those medicinal plants that are having multipurpose uses. The medicinal plants such as tulsi, aloe vera, brahmi etc. are preferred by women because of day to day uses in their life.
2. Women are likely maintaining those crops, which require minimum care and inputs.
3. Women preferred those plants which are easily available and having common use.
4. Women also preferred those plants which are easy to establish and easy to use.

The perception of women was recorded for medicinal plants and it was found that 70-80 % women preferred tulsi, gudamari, aloe vera, stevia, brahmi and kalmegh while 40 % women preferred akarkara. More than 90% women preferred tulsi for worship purpose. Only 10 % women preferred the other medicinal plants such as sarpagandha, satabari, aswagandha, bhrungaraj and lemon grass.

Information on the propagation of medicinal plants is available for less than 10% and production technology is available only for 1% of the total known plants globally. This trend shows that developing production technology of the common used medicinal and aromatic plants should be one of the thrust areas for research. Furthermore, in order to meet the escalating demand and availability of medicinal plants, cultivation of following medicinal plant species is imperative. Apart from meeting the present demand, cultivation may be

helpful in conserving the bio genetic diversity of medicinal plants. It is therefore necessary to collect, conserve and evaluate germplasm and to develop production technologies for medicinal and aromatic plants with potential for farming. The production technologies of some medicinal and aromatic plants are described below:

## PRODUCTION TECHNOLOGY

### BRAHMI

Brahmi (*Bacopa monnieri* L.) plant is used in manufacturing medicines for mental disorders, epilepsy, anxiety neurosis and insanity. It is a remarkable herb for enhancing memory. Leaves are believed to improve the receptive and retentive capacity of mind. It is also used in Ayurveda, Siddha and Unani system of medicine. It is used for production of hair oil. Flowering was started from 3 months after planting of crop and crop was ready for harvest within 3 to 4 months after planting. The plant was cut 4 to 5 cm. above base and rest was left for subsequent regeneration. It can also be maintained as a perennial crop. It has been observed that highest biomass was at flowering stage.

**Common Names:** Brahmi, Jalnaveri, Jalamimba, Sambrani chettu, thyme-leaved gratiola, Bacopa, Babies tear, Bacopa monnieri, Hespestis monniera, Nirbrahmi, Indian Pennywort and water hyssop. In English it is commonly called as the 'Herb of Grace'

**Variety:** Subodhak and Pragyashkti varieties are found suitable for cultivation for higher productivity and quality produce.

**Soil and climate:** The plant is known to grow under varying soil and climatic conditions. It grows exceptionally well in poorly drained soils and waterlogged areas under sub-tropical conditions. The plants grow faster at high temperatures (33-40<sup>0</sup> C) and humidity (65-80%) and should be cultivated as summer-rainy season crop.

**Land preparation:** The field should be ploughed thoroughly and made free of weeds. The land should be irrigated a day before planting for successful establishment of plant cuttings.

**Transplanting:** Plant cuttings about 4-5 cm long, each containing a few leaves, nodes and roots are ideal planting materials. These can be obtained by cutting mother plants into small pieces with roots. The cutting are transplanted in wet soil at spacing of 40 cm x 40 cm. Flood irrigation is provided immediately after planting. Ideally, the plants should be transplanted in March-June and allowed to grow and proliferate through hot and humid months of monsoon till September after which harvesting should be done. The plants can also be maintained in a perennial state with two harvests in a year, the first one in June and the other one after monsoon, in October.

**Irrigation:** Irrigation immediately after transplanting is essential for the successful survival of the plants. Subsequently, the fields are irrigated by flooding as per requirement usually every 7-8 days. There is no need for irrigation during the monsoon.

**Weeding:** Initially hand weeding is required every 5-20 days. Later as the plant proliferate and forms a dense mat of vegetation, weeding may be required sporadically.

**Harvesting/ Post harvesting:** The plants should be harvested between October-November, after that there is loss of plant biomass and bacoside yield. The plant can be ideally harvested by ratooning so that the upper portions of the stem 4-5 cm from the base are removed and the

rest left for subsequent regeneration. The plants can be dried in a conventional manner by spreading on the ground under shade at room temperature. Alternatively, they can be treated at 80°C in oven for 30 minutes immediately after harvest for a two-fold more retention of bacoside-A content of dried herb. After treatment they can be further air dried by spreading on the ground at room temperature or in the oven at 80°C for 30 minutes. They were further dried for 8 to 10 days under shade by spreading on mat. The material is to be cleaned free of any external matter. Well dried materials were packed in 50 gm high 100 gauge polyethylene bags and stored in cool and dry place. Precautions also need to be taken to avoid infestation with fungi and insects.

**Yield:** The fresh and dry herb yields of Brahmi go upto 300q/ha and 60q/ha, respectively, when harvested after September while bacoside-A yield can be as much as 85kg/ha. After the first harvest, 40q dry herb yield from the June harvest, totalling to 100 q dry herb yield in a year will be obtainable.

**Value added products:** Brahmighrtam, Sarasvataristam, Brahmitailam, Misrakasneham, Memory Plus, Megamind Plus

#### **Economics**

Expenditure per hectare Rs.80,000/-

Gross return @Rs.50/kg of dry

matter yield Rs.5,00,000/-

Net income Rs.4,20,000/-

## **TULSI**

Tulsi (*Ocimum sanctum* Linn) plant is used for treatment of common cold, cough, tonsillitis, asthma, diabetes, earache and in preparation of many Ayurvedic formulations. The leaf oil is used in dental cream, mouth wash and toothpaste. It also possesses insecticidal, antibacterial and mosquito repellent properties. The eugenol of leaf oil is widely used in perfumery, cosmetics and confectionary industries. The leaves were harvested at full bloom stage after 3 months of planting. The plants were cut on bright sunny days for better quality and yield. Plants were cut at 20- 25 cm above the ground level. Subsequent harvesting was done at an interval of 70-75 days. The field was irrigated immediately after harvesting for regeneration. The yield of leaf and seeds were 16 and 6.5q/ha / year, respectively. Two varieties of tulsi namely Sri Tulsi and Krishna Tulsi are cultivated. The leaves of Sri Tulsi are green whereas Krishna Tulsi leaves are purplish blue in colour. Krishna Tulsi was found more suitable for commercial cultivation and medicinal purposes. Harvested leaves were dried for 7- 8 days and packed in polyethylene bags.

**Common Names:** Holy Basil, Krishna Tulsi, Manjari & Brinda

**Soil:** Sacred basil thrives well on a wide range of soils. Rich loam, poor laterite, saline and alkaline to moderately acidic soils are also well suited for its cultivation. Well drained soil helps in better vegetative growth. Water logged conditions can cause root-rot and results in stunted growth.

**Type:** Two types tulsi are available Sri tulsi (White type) and Krishna Tulsi (Black type).

**Climate :** It flourishes well under fairly high rainfall and humid conditions. Long days and high temperatures have been found favourable for plant growth and oil production. It can

grow up to an altitude of 900 m. The plant is moderately tolerant to drought and frost. The plant can be grown under partially shaded conditions but with low oil contents.

**Propagation:** *Tulsi* is propagated through seeds. Seeds will get deteriorated over generations, due to its high cross-pollination. Hence, for fresh plantings, the growers have to take fresh seeds from the pedigree stock.

**Nursery:** Raised seed beds of 15 × 4 × 9 ft size should be thoroughly prepared and well manured by the addition of farm yard manure 10 kg per bed. About 200-300 g seeds are enough to raise the seedlings for transplanting in one hectare of land. The seeds are very small and hence it should be mixed with sand and sown to a depth of 2 cm. After sowing, the seeds in the nursery, a mixture of farm yard manure and soil should be spread in a thin layer over the seeds and irrigate with a sprinkler hose. The seeds germinate in 8-12 days and the seedlings are ready for transplanting in about 6 weeks time at 4-5 leaf stage. A spray of 2% urea solution on the nursery plants at 15 to 20 days before transplanting helps in getting healthy seedlings for transplanting.

**Land preparation:** The land is brought to fine tilth and laid out into plots of convenient sizes. It is preferable to add 15 t/ha of farm yard manure and recommended fertilizers as basal dose during the preparation of land and should be mixed well in the soil.

**Transplanting:** Seedlings of six weeks old and having 4-5 leaves are transplanted at a spacing of 40 × 40 cm, 40 × 50 cm and 50 × 30 cm to get high herbage and oil yield at Lucknow, New Delhi and Indore respectively. The plots are irrigated immediately after transplanting. The seedlings will establish well by the time of second irrigation. At this stage gap filling and replacement of the poor plants are also done so that uniform plant stand is achieved.

**Planting time:** The nursery can be raised in the third week of May and transplanting is generally done in the middle of July.

**Manures and fertilizer:** As *Tulsi* is grown for its herbage, it is necessary to frequently replenish the soil. Farm yard manure / compost are to be applied at 10 t/ha before planting. Ensure that FYM / compost is well decomposed before use. Do not use compost made from city waste and human excreta. Do not apply fresh manure for plant nutrition. The optimum fertilizer dose recommended for this crop is 120 kg N, 60 kg of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O per hectare. Half the dose of N and the entire dose of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O should be given as a basal dose, whereas, the remaining N is applied in two split doses after first and second cuttings.

**Irrigation:** Irrigation of crop depends upon the season and moisture content of soil. In summer season twice a week irrigations are necessary whereas, during winter it should be irrigated one week intervals. Apply mulch to conserve soil moisture. However, before harvesting, irrigation should be discontinued.

**Weeding:** Weeds have to be managed before they start competing with the main crop for nutrients and light. First weeding is done one month after planting and the second 4 weeks later. After this, no further weeding is required as the plants become bushy thereby suppress the weeds. One hoeing and earthing up operation is required at two months after planting. Use mulch to maintain soil moisture and to inhibit growth of weeds. Do not use chemical herbicides to eradicate weeds and do not keep weeds till flowering as this will increase weed pressure in coming years. Do not allow the soil to dry up due to excessive weeding.

**Harvesting:** Care should be taken while harvesting *Tulsi* to avoid any type of contamination. Clean all the surfaces that comes into contact with the plant during and after harvest. The crop is to be harvested at full bloom stage to obtain maximum essential oil yield and better quality oil. The first harvest is obtained at 90-95 days after planting. Thereafter, it may be harvested at every 65-75 days interval. Harvesting should be done usually on bright sunny days for high and good quality oil. It is not desirable to harvest the crop if there was a rain in the previous day. The crop should be cut at 15-20 cm above the ground level.

**Processing:** The harvested produce may be allowed to wilt in the field itself for 4-5 hours so as to reduce the moisture and also the bulkiness. However, oil quality and its yield do not diminish up to 6-8 hours after harvest, but further delay may cause considerable loss in yield and quality of oil. Steam distillation is found to be superior to hydro distillation and hydro cum steam distillation. Distillation unit should be clean, rust free and free of any other odour. The oil obtained is then decanted and filtered. The distilled oil is treated with anhydrous sodium sulphate or common salt at the rate of 20 g per litre to remove the moisture. The oil should be stored in sealed amber coloured glass bottles or containers made of stainless steel, galvanised tanks, aluminium containers and stored in a cool and dry place.

**Yield:** About 5 tonnes of fresh herbage per hectare can be obtained by two to three harvests in a year. The oil yield varies with type, season and place of origin. The whole herb contains 0.1-0.23% essential oil and an oil yield of 10-23 kg can be obtained per hectare.

**Value added products:** Panch Tulsi Oil, Tulsi Ginger, Tulsi Powder, Tulsi Tea and Tulsi Capsule

### **Economics:**

Expenditure per ha. Rs.70,000/-

Return per ha. Rs.300,000/-

Net income Rs.230,000/-

### **GUDMAR**

Gudmar (*Gymnema sylvestre* Retz) is an important medicinal woody climber belonging to family Asclepiadaceae. In India, it is found growing in the forests of Andhra Pradesh, Bihar, Chhatisgarh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa Tamil Nadu, Uttar Pradesh and West Bengal. The leaves are simple, opposite, elliptic or ovate and hairy; the flowers are small, yellow and in umbellate cymes; follicles are terete, lanceolate and upto 7.5 cm in length. Leaf was used as antidiabetic, stomachic, liver tonic, laxative, diuretic, cardiac stimulant and useful in diabetes, jaundice, piles, leprosy. Leaf was harvested after 18 months of planting during October to February and again in May. The aerial part of the creeper was trimmed and leaves collected. The creeper becomes branchy and dense after repeated cutting of aerial parts. About 2.5 kg fresh leaves or 500 g of dry leaves per plant were obtained in a year. About 20 kg of dry leaves were obtained from one quintal of green leaves. Collected leaves were dried under shade for 8- 10 days preferably by spreading on a cloth. A leaf powder was prepared by grinding of dried leaves. Due to increase in demand and destructive harvesting, the plant has become vulnerable.

**Common Names:** Hindi: छोटा दूधिलता chhota-dudhilata, गुदमार gudmar, गुरमार gurmar, मेदशिंगी medhashingi, • Marathi: kavali, bedaki, bedakuli, kalikardori, kaoli • Tamil: adigam, amudupushpam, ayagam, kogilam • Malayalam: chakkarakkolli, madhunasini • Telugu: bodaparta, podapatra • Kannada: kadhasige, sannagera, sannagerasehambu • Oriya: meshasingi • Urdu: gurmar گُرمار, gurmar booti, gurmar patta • Sanskrit: ajaballi, अजगंधिनी ajaghandini, कर्णिका karnika, kshinavartta, मधुनसिनी madhunasini

**Soil and climate:** The plant grows in a variety of soil and agro-climatic conditions in tropical and sub-tropical regions up to 600 m. Red sandy loam or medium deep black soil are reported to be ideal for this crop. The plant is sensitive to water logging and hence its cultivation on such soil should be avoided. Madhunashini prefers tropical and sub-tropical type of climate. It is found growing even in dry areas also. The areas with high or medium well distributed rainfall are suitable for its cultivation.



**Varieties/types:** Based on the leaf size. The climber can be classified into two types:

a) *Small leaves type:* Leaves are oval measuring 1.0-3.5 cm length and 1.5 –2.5 cm very soft, found in dry regions.

b) *Broad and pubescent type:* These leaves are also oval measuring 3-6 cm in length and 3.5-5.0 cm in width. Leaves are dark green compared to small leaves type and also are pubescent.

**Nursery raising:** Mature seeds are collected between October-December and sown in polyboxes/bags or small plots as nursery. The seedlings raised are transplanted in field during February-March. The plant grows well with the on-set of rainy season. The climber is given proper support for its better growth and development. It can also be planted in between trees as intercropping. The plant can also be propagated through cuttings and planted during rainy season.

**Land preparation and planting:** Gudamar (Madhunashini) is an evergreen climber and the best season for planting is June-July. After the ploughing and leveling of the land, 45 cm<sup>3</sup> sized pits are made at a distance of 2.5 m between the rows and 1.75 m between plants (within the row). The pits are dug open 15 days earlier to planting, they are filled with green leaves and top soil and 2 kgs of well rotten manure per pit is added. The pits are to be irrigated and left for one week, then the rooted cuttings are planted in the pits.

**Irrigation:** Irrigation is given immediately after planting and fertilizers are applied. Later on, irrigation once in 5-6 days is sufficient. During summer depending on the weather condition irrigation frequency needs to be increased

**Weeding and hoeing:** Periodical weeding and hoeing was done during and after rainy season. On proper establishment of plants weeding was done on quarterly intervals.

#### **Insect pest and diseases**

Major insects : Thrips, mites and green fly

Major diseases : Powdery mildew and leaf spot

#### **Management**

1. Spray the vines with 2 ml of Rogor per liter of water to control thrips. Mites can be effectively controlled by any Acaricide. To control green fly spray 1 ml nuvacron mixed in one liter of water.
2. The diseases can be controlled by spraying 3 g of water soluble sulphur (or) 2 g of Mancozeb in one liter of water at an interval of 10-15 days.

**Harvesting and Yield:** The crop was ready for harvest after two years of planting. Leaves are the economic part and the harvesting of the leaves was done twice in the year. First harvest was done when the plant started flowering, i.e. during June and second harvest was done in September-October. Leaves were harvested by hand plucking and the main stem was not cut during harvest of leaves unlike the prevailing practice. The harvested leaves were dried under shade by allowing sufficient air to circulate by spreading thinly on clear ground for about 7-8 days. Direct sunlight was avoided to maintain quality of the leaves. The crop is harvested only once in a year during flowering and on an average 5-6 kg dried leaves per plant can be obtained from a 4 years old plant yielding about 10,000 – 15,000 kgs of dried leaves per hectare. The crop can be cultivated for 10-15 years under good management.

**Value added products:** Gudmar Powder

#### **Economics:**

Expenditure per ha. Rs.50,000/-

Return per ha. Rs.250,000/-

Net income Rs.200,000/-

## LEMON GRASS

Lemon grass (*Cymbopogon schoenanthus* L.Spreng) is used as stimulant carminative, antiperiodic and perfumery, herbal tea, hair oil, scent and soap making. Harvesting was started after 5 months of planting in the 1<sup>st</sup> year and thereafter at interval of 60 days in subsequent harvest. Delay in harvesting decreases oil content. Moreover yield of oil is lowest in rainy season during July to September and highest in summer season. The grass was cut with the help of sickles at 10- 15 cm. above ground level. The yield was 160q/ha after 5 months of planting.

Three types of lemon grasses viz. East Indian lemongrass (*C. flexuosus*), West Indian lemon grass (*C. citratus*), and Jammu lemongrass (*C. pendulus*) are in cultivation in our country as the important sources of citrates.

In North India, Jammu lemon grass (*C. pendulus*) is cultivated under irrigated condition as a source of citral. The cultural practices are almost similar to East Indian lemon grass. It is propagated exclusively by slips which are planted on flat beds. A spacing of 50 x 50 cm is adopted. A dose of 260 N, 80 kg P<sub>2</sub>O<sub>5</sub> and 120 kg K<sub>2</sub>O per hectare is recommended in 3-4 split doses. The crop responds to irrigation especially during hot summer months.

**Common Names:** (*C. citratus*) West Indian lemongrass and Madagascar lemongrass, (*C. flexuosus*) East Indian lemongrass, Cochin lemongrass, France Indian verbena and Malabar lemongrass

**Climate and soil:** The plants are hardy and grow under a variety of conditions. The most ideal conditions are a warm and humid climate with, plenty of sunshine and rainfall of 250-280 cm per annum, uniformly distributed. Regarding the soil, it can be grown from poor soils, in the hill slopes. Soil pH ranging from 4.5 to 7.5 is ideal. As it has good soil binding nature, they can be grown as vegetative cover over naked, eroded slopes.

**Varieties:** The Medicinal and Aromatic Plants Research Station, Odakkali (Kerala) and CTMAP, Lucknow have developed improved strains viz. OD-19 and SD-68 respectively as a result of breeding. The important of these two improved varieties are now recommended for wide cultivation. Recently the RRI, Jammu has developed hybrids strain CKP-25 by crossing *C. khasianus* and *C. pendulus* and CPK-F2-38 which is capable of yielding 50 % and 140 % oil yield than RRL-16 and OD-19 respectively.

**Nursery:** The soil should be well pulverized for forming the seed bed and it should be a raised bed one. Leaf mould and farm yard manure are also added to the soil while forming the bed. 15-20 kg of seeds are required for raising seedlings for one hectare. Seeds are sown in lines drawn at 10 cm interval in the beds and covered with cut grass materials when the seedlings are about 2 months old or, about 12 to 15 cm high, they are ready for transplanting.

**Field preparation:** The land is cleared of the underground vegetations and pits of 5 cm cube are made at a spacing of 15 x 19 cm. Splits from old clumps can also be used for propagations.

**Manures and fertilizer:** The Aromatic Plants Research Station, Odakkali (Kerala) recommended 100 kg of N/ha. Under North East conditions, application of 60 kg N, 50 kg P and 35 kg K is recommended per hectare for optimum production .

**Harvesting:** Lemon grass comes to harvest 90 days after planting and subsequently it is harvested at 50-55 days interval.. The grass is cut 10 cm above the ground level and 5-6 cuttings can be taken in a year subject to the climatic conditions. Depending upon the soil and climatic conditions, the crop can be retained in like field for 5 to 6 years.

On an average 25 kg of oil can be obtained from first year per hectare plantation and about 80 to 100 kg of oil per year from 2nd to 6th year if well maintained.

**Value added products:** Lemon grass oil, Lemon grass lotion

### Economics

Expenditure per ha. Rs.60,000/-

Return per ha. Rs.200,000/-

Net income Rs.140,000/- 1st year, Rs. 190000/- 2nd year

### PALMA ROSA

Palmarosa (*Cymbopogon martinii* [Roxb] Wats) plant is a native of India and it grows wild in forests of Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Uttar Pradesh and Odisha. It is also found in lesser frequency in Karnataka, Tamil Nadu and in some parts of Uttar Pradesh. There is now expansion in cultivated area which is spread over in the states of Uttar Pradesh, Andhra Pradesh, Rajasthan, Karnataka, Maharashtra, Madhya Pradesh, Gujarat and Tamil Nadu.

**Common Names:** Rosha grass, Rusha ghas (Hindi); Rauns, Rosdo (Gujarati); Rohisha, Rohisa (Sanskrit)

Palmarosa (*C. martinii*) has two cultivable varieties

1. *C. martinii* var. motia - Palmarosa

2.. *C. martinii* var. sofia - Ginger grass

Varieties like IW-31243, IW-31245, PRC-1, Trishna, Tripta, Vaishnavi, Cim-Harsha are suitable for cultivation by different institutes in India.

**Soil:** Palmarosa can be grown in poor sandy loam to heavy fertile soils. A well drained loamy soil with pH 6 to 7 is ideal. Although it grows best on soils having neutral pH, it survives and gives economic yield on alkaline soils of pH up to 9. A rise in pH above 8.5 is found to decrease the plant growth and oil yield but has no adverse influence on the quality of oil produced. But, if the soil is not well drained after heavy irrigation, standing water during summer seasons can affect the growth of the grass.

**Climate:** Palmarosa grows well in warm humid areas with high temperature and, plenty of sunshine during its growing period. The ideal elevation for its cultivation is up to 300 m. Annual rainfall of 90-150 cm and a temperature of 15 to 35°C with ample sunshine is congenial for its cultivation. It is susceptible to frost and hence frost-prone areas are not suitable for its cultivation.

**Propagation:** The crop can be propagated by both seeds and slips. For commercial cultivation, the crop is propagated by seeds. It is always better to use fresh seeds that were harvested during the previous season, which are in good condition and free from pests.

**By seedlings:** The best method for large scale propagation is by raising seedlings in nursery and transplanting in the main field. Raised nursery beds of 5 × 1 m should be prepared with 50 cm height during mid May – June. Seed beds should be well pulverized and add 50 kg of cow dung manure. As seeds are very small and light in weight they are usually mixed with fine sand or soil in a ratio of 1:10 for even distribution and ease in sowing. Lines of 3 cm deep and 10 cm apart are made and the seeds are uniformly sown in lines and covered with soil and manure mixture. The beds are irrigated with rose can on alternate days. The seeds start germinating within 3-4 days and in about 4-6 weeks seedlings are ready for transplanting in the main field. About 2.5 to 3 kg seeds are enough to transplant one hectare of land.

**By slips:** Plants producing high yield and better quality oil are to be selected for taking slips. Clumps are trimmed from 20-25 cm above ground and dug out without injuring the roots. The individual slip or a group of 2-3 slips having enough healthy root system are separated just before planting to minimize drying and loss of the roots.

**Planting time:** Onset of monsoon (June end to August) is the best time for planting. Healthy and established seedlings or slips of 20-25 cm long are planted in rows of 30-60 cm apart with plants spaced at 30-60 cm within the rows. Transplanting is done usually in the evening hours to avoid transplantation shock. The plots are given light irrigation after transplanting. Gap filling should be done within 8-10 days of planting. It is advisable to plant two seedlings/slips per hill to avoid seedling mortality.

**Irrigation:** Water requirement depends up on the climatic conditions. With an ample supply of water, growth is luxuriant, but if drought prevails the growth is arrested, leaves wither and the oil content gets reduced. The crop is highly sensitive to water logging, where the plant becomes stunted and dies at later stages and proper drainage should be provided to prevent water logging. In general, the field is to be irrigated at 10-14 days interval during summer. Apply mulches to conserve soil moisture. Irrigation should be discontinued 7-10 days before harvesting.

**Intercultural operation:** Keeping the crop weed free during early establishment period is essential to get good harvest. Manage weeds before they start competing with the main crop for nutrients and light. It needs 3-4 hoeing and weeding during the first year, which can be restricted to two in the subsequent years. Use of mulches not only maintains soil moisture but also inhibits weed growth.

**Harvesting:** Harvest palmarosa at the right stage to get high oil yield. The essential oil is present in all parts of the grass, viz. inflorescence, leaves and stems of which the inflorescence contains the major portion. Hence, the crop should be harvested at full flowering to seed production stage in order to obtain maximum and good quality oil. Harvesting is usually done with a sickle at 15-20 cm above the ground surface. Harvest the crop in dry weather or during the hot hours of the day and do not harvest the crop when it is raining, or early in the morning when there is dew on the ground.

The number of harvests depends upon the climatic condition of the place, where it is grown. Generally during the first year, only one harvesting can be done during October-November, whereas 3-4 harvests can be obtained during the subsequent years. The crop remains productive up to 4-5 years depending upon the management practices followed. However, both herbage and oil yield start decreasing from the fourth year onwards. It is, therefore, recommended to keep the crop for only 4-5 years.

**Processing:** Post harvest processing is usually the most critical stage in determining the end quality of the Palmarosa. Immediately after harvesting, transport the plant part for further processing. To obtain maximum yield of essential oil and to facilitate easy release of oil,

harvested and cleaned palmarosa grass is chopped into 5-10 cm length (communion). Chopping the grass has further advantages that more grass can be filled into the still and even packing is facilitated. For economical production of the oil, it is advisable that the harvested material is allowed to wilt in shade for 24-48 hours. From quality point of view, the grass should be distilled as fresh as possible. Oil obtained from dry or fermented grass is of inferior quality.

Palmarosa can be distilled either by hydro-distillation or steam distillation methods. Steam distillation results in maximum yield of better quality oil.

**Yield:** Herbage yield and essential oil content of palmarosa depend upon many factors such as soil and climatic conditions, crop nutrition, management practices, harvesting time, maturity stage of grass, extent of wilting and distillation process. Fresh herbage yield of 30-40 tonnes can be obtained per hectare per year. An oil yield of about 220-250 kg/ha may be obtained from second year onwards from an irrigated crop. Oil yield is low in first year and it increases during 2-4 years of planting but gradually decreases thereafter. All parts of the plant contain essential oil, the maximum being present in inflorescence and the least in stem.

**Value added products:** Palmarosa oil

#### **Economics**

Expenditure per ha. Rs.50,000/-

Return per ha. Rs.2960,000/-

Net income Rs.240,000/-

## **BHRINGRAJ**

Bhringraj (*Eclipta prostrata* L.) is a tonic, rejuvenator, hepatoprotective and useful in spleen enlargement, jaundice, skin diseases, asthma, darkening of hair, liver disorders, stomach ailments and preparation of bhringraj hair oil. . People are using fresh leaves, bhringraj powder and bhringraj capsules for curing of various health problems. There are two varieties of bhringraj, one variety produces yellow flowers and the other variety produces beautiful small white flowers. Out of the two varieties of bhringraj, the yellow variety is used more for home remedies. Bhringraj plant is also suitable for growing in the home garden to enjoy its many health benefits. Moreover, this plant needs very little to no maintenance, regular watering and little bit of natural manure will be enough to maintain.

**Common Names:** English: Trailing eclipta, Thistles, False Daisy, Sanskrit: Bhringaraja, Angaraka, Kesharaja, Kesharanjana, nilapushpa, Bhringa, Markava, Hindi: Balari, Bhringraj, Bhengra, Bhangra, Mochkand, Babri, Marathi: Maka, Bhangra, Bhringuraja Gajarati: Kalobhangro, Dadhal, Bhangro, Tamil: Kaikeshi, karishalanganni, karisalankanni; Telugu: gunta-kalagara, galagara, Malayalam: Kayyoni, Kannada: Kadiggagaraga, garagadasappu;

**Soil and climate:** It is a hardy crop and can be grown on varied types of soil. Soils with high moisture content are preferred. Red loamy soils rich in organic matter are best for its cultivation. The crop is sufficiently hardy and comes up well in tropical, sub-tropical and temperate regions. However, it prefers warm climate with a temperature range of 25 C to 35<sup>0</sup> C for its good growth and yield.

**Land preparation:** The soil is prepared up to a depth of 30 cm and mixed with farm yard manure at the rate of 2 kg/m<sup>2</sup> with a little sand.

**Propagation:** The crop can be propagated through seeds as well as cuttings. For raising the seedlings, seeds are sown in the nursery beds of 1 x 3 x 0.15 m in rows about 6 cm apart, gently covered with soil and watered using a sprinkler. Seedlings are ready for transplanting when 45-60 days old. Vegetatively this species can be propagated by using terminal cuttings with 5-6 nodes and 10-15 cm length. They are planted in well prepared nursery beds or polythene bags. In about 4-6 weeks time the rooting is complete and they are ready for transplanting into the main field. The plants are transplanted into the main field at a spacing of 15 x 20 cm. 2.5 kg seeds per hectare are required.

An efficient method of micro propagation of Bhringraj from young nodal axils of shoot tip explants has now been developed. It results in increased number of roots, higher chlorophyll level in leaves and increase in plant biomass. The arrested undesirable shoot elongation makes the plants sturdier and more suitable for acclimatization. The primed micro propagated Bhringraj plants are healthy and survive by higher frequency in soil in comparison to the non-treated plants.

**Manure and fertilizer:** About 20 t FYM and 50:75:30 kg NPK is sufficient for one ha of area. FYM along with half of nitrogen and the entire dose of phosphorus and potassium is given as a basal dose and the remaining nitrogen is applied in two split doses after first and second cuttings.

**Irrigation:** After transplanting, irrigation is provided twice a week till one month, so that the plants establish well. Later, it is given at weekly intervals depending upon the rainfall and soil moisture status.

**Weed control:** The first weeding is done 30-35 days after transplanting. After each harvest, weeding should be done to avoid weed growth in the interspaces, if any.

**Pest and disease control:** There are no major insects noticed on this crop but diseases like yellow net, leaf blight and gall formation are known to cause damage to this crop. These diseases can be controlled by spraying the crop with 0.2 % Mancozeb.

**Harvesting:** Harvesting is done by plucking out the plant from the ground and the root of the plant is chopped.

**Processing:** The plant material is cut into moderate size pieces. Shade drying is preferred. Careful and proper drying of the plant is important to avoid microbial attack and decomposition. The right time to collect the seed is when it begins to turn black in colour.

**Yield :** The whole plant was cut at 5- 10 cm above ground level after 4 months of planting. Harvesting was done 2-3 times in a year. New shoots come up from the left out root stock after irrigation. On an average Bhringraj plant yields about 6000 kg of dried herbage per hectare per year.

**Value added products:** Bhringraj hair oil, Bhringraj powder bhringraj capsules

**Economics:** The prevailing price is Rs. 40/kg in the market. With an average yield of 6,000 dry herbage per year, the gross returns are Rs.240, 000. The cost of cultivation is estimated as Rs. 60,000/ ha. Thus the plant provides a net return of Rs. 180,000 /ha/year.

## MINT

Mint (*Mentha asiatica* L) has numerous applications in the kitchen, being used all over the world as flavoring as well as key ingredients to foods and drinks. Peppermint sprigs can be added to drinks and fruit dishes as a garnish. It also makes a refreshing tea. Peppermint makes an excellent flavoring for ice cream, chocolates, and other deserts. Women suffering from morning sickness can add lime juice, ginger juice and honey to the mint decoction and have it twice a day for getting relief. Mint leaves also repel ants and cockroaches.

**Common Names:** Hindi, Bengali, Gujarati, Punjabi, Urdu, Marathi, Tamil, Telugu: Pudina; Malayalam: Puthina; Kashmiri: Pudyanu

**Variety:** RRL (J) ML-4 is suitable for cultivation in eastern part of country.

**Soil:** Deep soils, loam to sandy loam well drained, well aerated and loose textured soil. Clay soils are not suitable.

**Climate:** Temperate climatic condition, Tropical climate is not suitable, plentiful rainfall during growth and good sunshine during harvest is best suitable during crop growth.

**Land preparation:** Bring the soil to fine tilth by ploughing and 2 cross harrowing. Apply FYM 50 t per hectare at the time of field preparation.

**Propagation:** It is propagated through suckers, runners or Rhizomes.

**Planting time:** June- July is the appropriate time for planting in north as well as in central areas

**Planting:** Approximately 500 kg suckers are required to plant one ha area. Suckers should be set in furrows 5-10 cm deep with a spacing of 60-75. Plant the suckers end to end. Cut the suckers into 10-12 cm length before sowing. Plants should be spaced 30 cm apart in rows 60 cm apart.

**Intercultural operation:** In order to keep the top soil loose for better penetration of water, air, sun light and weed free *Mentha* needs frequent inter culturing weeding and hoeing.

**Irrigation:** Mint crop requires considerable moisture well distributed through out the entire growing season. As roots do not penetrate deep in the soil, light and frequent irrigations are recommended. During summer irrigate the crop weekly.

**Fertilizer:** 50 kg N + 75 kg P<sub>2</sub>O<sub>5</sub> + 37 kg K<sub>2</sub>O per hectare is given as basal dose and 75 kg of N per hectare as top dressing in three equal doses should be applied.

**Harvesting:** Normally 2-3 times in a year (120 days)  
1. First crop should be harvested before the onset of monsoon (May-June).  
2. Second harvesting well after monsoon (September - October).  
3. Third harvesting (November - December).

**Yield:** The crop planted through stolons in January and February is harvested twice i.e. in June and October months. The first crop is harvested after 100-120 days of growth and the second harvest in about 80-90 days following the first harvest. The fresh herbage at harvesting stage contains 0.5 to 0.68% of oil and is ready for distillation after wilting for 6-10 hrs. The wilted crop is cut 10cm. above the ground by means of a sickle on bright sunny days, since harvesting on cloudy or rainy days decrease the menthol content in the oil. Approximately 150 kg of Oil per hectare during the first year and subsequently 200 - 250 kg per hectare can be obtained under good management.

**Post harvest management:** Mint herbage should be shade dried for about a day before it is distilled. Care should be taken so that decomposition of the herbage does not initiate during the drying process. There would be some reduction in oil yield if wilted herbage crop is stored for a longer period of 2-3 days. As such, storage of herbage for a longer period is not recommended.

**Spent grass:** The material left after distillation of oil is called spent grass. It can be used for mulching or as manure in Citronella fields.

**Storage of Oil:** Containers are stored in a cool place away from light. Oil changes its colour from yellow to green if exposed to light.

**Value added products:** Mint oil

### **Economics**

Expenditure per ha. Rs.60,000/-

Return per ha. Rs.260,000/-

Net income Rs.200,000/-

## **SARPAGANDHA**

Sarpagandha (*Rauvolfia serpentina* L.) roots are useful in hypertension, anxiety, insomnia, epilepsy and snake bite. Harvesting of roots from the forest of Orissa has been strictly prohibited, so it is essential to cultivation of Rauvolfia to meet the increasing market demand and some of the farmers have started its cultivation. It is evergreen shrub of 0.6 to 1 m height.

**Common Names:** Candrabhaga, Chota chand, Serpentina root & Chandrika

**Varieties:** RS-1 variety is found suitable for quality and higher production in eastern part of country.

**Soil:** Well drained medium to deep black soil.- In some pockets sandy loam to laterites.



**Climate:** Humid, warm climate, shade loving. Rainfall: 300-300 mm.

**Sowing:** Crop can be grown either by seed or vegetative propagation.

1) Rootcuttings

2) Rootstumps

3) Stem cutting (100 kg cuttings/ha) but indicates that transplanting of seedling gives better yield.

**Germination:** 50 to 60 % seedlings are raised in the nursery by sowing the seeds at the rate of 7 to 8 kg/ha. Fresh seeds indicate more germinations.

**Manuring:** Apply well rotten FYM @ 25-30 tones/ha during land preparations for higher yield .

**Spacing:** Plant to plant spacing are 45 x 30 cm.

**Fertilizers:** 10 kg N 60 kg P<sub>2</sub>O<sub>5</sub> before transplanting and followed by irrigation. Two equal doses of nitrogen each 20 kg/ha mixed in soil after 50 to 70 days of plantings.

**Seed Collection:** It has been observed that fruits were matured during January -February. The fruits are collected and immediately kept for drying in shade. Plumpy matter should be removed by rubbing the seeds.

**Harvesting:** Plants are dugged out after 2-3 years after plantation. At the time of digging, soil must be moist, weight of harvested material should be reduced by 40 % by air drying method and stored in store house.

**Yield:** Yield of the dry roots varies from 2000 to 2500 kg/ha depending upon the crop condition. Keep in air tight container in 7-10 cm pieces of root with 10 - 12 % moisture. The roots are harvested after two and half years of planting usually during the month of November- December when the plant becomes almost leafless. The alkaloid content is higher at this stage. Care is taken not to cause any damage to root bark during digging, as the bark contains higher percentage (40- 60 %) of total alkaloid content. The aerial parts were separated from the roots and thoroughly washed in running water to get rid of adhering soil and cut into pieces of 10- 15 cm. long and dried in the sun for 8- 10 days. Weight of harvested material should be reduced by 40 % by air drying method and stored in store house. The prevailing retail market price of roots is Rs. 250 – 300 kg.

**Value added products:** Sarpagandha powder, Sarpagandha tablets, Sarpagandha ghanavati, Sarpagandha yoga Mahesvari vati

## Economics

Expenditure per ha. Rs.80,000/-

Return per ha. Rs.300,000/-

Net income Rs.220,000/- from 24 months

## ASHWAGANDHA

Ashwagandha (*Withania somnifera* L. Dunal) also known as Indian ginseng, is an important ancient plant, the roots of which have been employed in Indian traditional systems of medicine, Ayurveda and Unani. It is an erect branching under shrub reaching about 1.50 m in height. It grows in dry and sub-tropical regions. Being hardy and drought tolerant species with its enormous bio compounds, its usage is forever regarded and continuous to enjoy the monopoly in many parts of India, particularly in Madhya Pradesh. It grows in dry parts in sub-tropical regions. Rajasthan, Punjab, Haryana, Uttar Pradesh, Gujarat, Maharashtra and Madhya Pradesh are the major Ashwagandha producing states of the country. In Madhya Pradesh alone it is cultivated in more than 5000 hectare. The estimated production of Ashwagandha roots in India is more than 1500 tonnes and the annual requirement is about 7000 tonnes necessitating the increase in its cultivation and higher production.

**Common Name:** Ashwagandha, Varahakarni (Sanakrit), Askandhatilli, Asgandh, Punir (Hindi), Hiremaddinagida, Panneru, Ashwagandha Kiremallinagida (Kannada) Amukkira, Amukkiran Kizhangu (Tamil) and Winter cherry (English) .

**Varieties:** Poshita variety is found suitable for cultivation of quality produce in the most part of the country.

**Soil:** Ashwagandha grows well in sandy loam or light red soil having pH 7.5 to 8.0 with good drainage. Black soils or such heavy soils are suitable for cultivation.

**Climate:** It is grown as late rainy season (kharif) crop. The semi-tropical areas receiving 500 to 750 mm rainfall are suitable for its cultivation as rainfed crop. If one or two winter rains are received, the root development improves. The crop requires relatively dry season during its growing period. It can tolerate a temperature range of 20<sup>0</sup>C to 38<sup>0</sup>C and even low temperature as low as 10<sup>0</sup>C. The plant grows from sea level to an altitude of 1500 meter above sea level.

**Varieties:** The Jawaharlal Nehru Krishi Vishwavidyalay, Madhya Pradesh, has released one high alkaloid variety "Jawahar" which is short in stature and most amenable for high density planting. The variety yields in 180 days and yields a total withanolides content of 0.30 per cent in dry roots. The other variety "AGB-002" is also potential for cultivation.

**Nursery raising:** It is propagated by seeds. Fresh seeds are sown in well prepared nursery beds. Although it can be sown by broadcast method in the main field, transplanting method is preferred for better quality and export purpose. For export, a well maintained nursery is a prerequisite. The nursery bed usually raised from ground level is prepared by thorough mixing with compost and sand. About 5 kg of seeds are required for planting in one hectare of land. Nursery is raised in the month of June-July. Seeds are treated in carbendazim to control wilt and seed borne diseases. Seeds are sown just before the onset of monsoon and

covered thinly using sand. The seeds germinate in 5 to 7 days. About 35 days old seedlings are transplanted in the main field.

**Field preparation:** Two to three ploughing should be done before rains. The land is well ploughed and pulverized and brought to a fine tilth and field is then levelled.

**Manures and fertilizers application:** The crop does not require heavy doses of manures and fertilizers. It responds well to organic manures and addition of 10 tonnes FYM / or 1 tonne vermicompost per hectare is recommended. Application of 15 kg of Nitrogen and 15 kg of Phosphorous per hectare is beneficial for higher production.

**Transplanting:** After the manures are incorporated in the soil, ridges are prepared at 60 cm spacing. Healthy seedlings are planted at 30 cm spacing. In some places, 60 cm x 60 cm or 45 cm x 30 cm spacing is also followed. However, a spacing of 60 cm x 30 cm with a plant population of about 55000 seedlings per hectare is considered optimum.

**Seed rate and sowing method:** A seed rate of 10 to 12 kg per ha is sufficient for broadcasting method. They can be sown in lines also. Line to line method is preferred as it increases root production and helps in performing intercultural operations smoothly. The seeds are usually sown about 1 to 3 cm deep. Seeds should be covered with light soil in both the methods. Line to line distance of 20 to 25 cm and plant to plant distance of 8 to 10 cm should be maintained. According to soil fertility, in fertile soil, distance can be extended.

**Seed treatment:** Seed should be treated with thirum or dithane M45 (Indofil M45) at the rate of 3 g/kg seed before sowing to protect the seedlings from the seed borne diseases.

**Irrigation:** Excessive rainfall or water is harmful for this crop. Light shower after transplantation ensures better establishment of seedlings. Life saving irrigation may be applied, if required. Under irrigated conditions, the crop can be irrigated once in 10 days.

**Pests and diseases:** Diseases like seedling rot and blight are observed. Seedling mortality becomes severe under high temperature and humid conditions. Disease can be minimised by use of disease free seeds and by giving seed proper treatment. Carbofuran should be applied @ 2-2.5 kg/ha at the time of sowing. Neem cake also can be applied. It will save root damage done by nematodes and insects. Further, adoption of crop rotation, timely sowing and keeping field well drained also protect the crop.

**Harvesting:** Maturity of the crop is judged by drying out of leaves and yellow-red berries. Flowering and bearing of fruits start from December onwards. The crop is harvested for roots by digging in January to March i.e. 150 to 180 days after sowing. There should be moisture in soil at the time of digging. Roots are dug out or ploughed using power tiller or a country plough. The tap root should be carefully pulled out not damaging even the small lateral roots.

**Yield:** On an average, 3 to 5 qt. of dry roots and 50 to 75 kg of seeds is recorded from one hectare of area. A maximum yield can be procured up to 6.5 to 7.0 q/ha. Six to fifteen mm diameter, seven to ten cm length root and 0.13 to 0.31% alkaloid are better for marketing.

**Value added products:** Ashwagandha powder, Ashwagandha extract, Ashwagandha tablets.

**Marketing:** The Neemuch and Mandasaur markets of Madhya Pradesh are popular world over for Ashwagandha. Importers, buyers within the country, processors, traditional practitioners, Ayurvedic and Siddha Drug manufacturers through these markets for procurement of Ashwagandha roots every year. The domestic demand for Ashwagandha roots is about 7000 tonnes annually. As the production is much less (around 1500 tonnes) in India, the internal market itself is highly potential.

### **Grading:**

**A Grade:** This includes root pieces of 7 cm and above in length, cylindrical and about 1 to 1.5 cm diameter. The roots are smooth and light in colour with clear white starchy fractured surface.

**B Grade:** Root pieces of 5 cm to below 7 cm length with 1 cm diameter are included in this and brittle and white from inside.

**C Grade:** Root pieces of 3-4 cm length with diameter of 1.2 cm or less are included in this category.

**Lower Grade:** Small Root pieces, yellowish inside and rarely exceeding 3 mm diameter are lower grade.

### **Economics**

Cost of cultivation: Rs. 70000

Income : Rs 300000

Net income :Rs. 230000

## **ASPARAGUS**

Asparagus (*Asparagus racemosus* Willd) or Shatavari is actually considered to be the most helpful herb for women as it helps in balancing the female hormonal system. It is the main herbal rejuvenative for women. Shatavari totally nourishes and cleanses the blood and the female reproductive organs, enhancing female fertility. It nourishes the womb and ovum and almost prepares the female organs for pregnancy and prevents threatened miscarriage. It also improves super lactation. Roots are well known for their galactagogue (enhances breast milk secretion in lactating mothers) tonic and stomachic properties and useful in improving physical strength and maintaining youthfulness.

It is found throughout India and also cultivated both for medicinal & ornamental purpose.

**Common Names:** Satamuli, Satavar, Abhiru

**Soil and climate:** Plant usually grows in a variety of soils including medium black having pH 7-8, electrical conductivity 0.15, organic carbon 0.79% and phosphorus 7.3 kg/acre. It can be easily grown in sub-tropical & sub-temperate agro-climatic regions up to 1400 m.

**Land preparation:** The soil is given 20-30 cm deep ploughing followed by 2-3 harrowings after few days. Grasses and weeds are removed. The land is properly levelled and 40-45 cm broad ridges are prepared for plantation, leaving 15-20 cm furrow space as a channel for irrigation.

**Propagule rate and pretreatment:** About 7 kg of seeds are required for raising seedlings for 1 hectare of crop. The seeds of satavar have a hard seed coat. To obtain early and higher germination percentage, presoaking in water is required for softening the seed coat. Higher germination is also achieved by soaking the seeds in cow urine for 24 hours. The germination commences after 20 days of sowing and is completed in 30 days.

**Nursery raising and planting:** Seeds are sown in June in raised beds at 5 cm apart to facilitate decay of its hard seed coat by the time monsoon commenced. Germination of seeds start in 8 to 10 days after the first shower of monsoon. The seedlings were transplanted on ridges at 60 x 60 cm apart and provided bamboo stakes when the plants attained a height of 45 cm.

Vegetative propagation is by division of rhizomatous disc present at the base of the aerial stem. The rhizomatous disc develops several vegetative buds around the aerial shoots. The disc is divided in such a way that each piece possessed at least two buds along with 2-3 tuberous roots. These pieces are planted conversing the buds with 1 cm of soil followed by irrigation. The sprouting commenced in 8-10 days after plantation. For commercial cultivation, root suckers are preferred over seeds.

**Weeding:** Shatavar initially grows slowly for 60 days, which keeps inter-row space virtually vacant, allowing easy weed growth. It is necessary to carry out three weeding and hoeing operations to keep the field free from weeds for initial two-month period. After two months, Shatavar grows enough to cover the inter-row spaces and prevents weed growth.

**Irrigation:** Water requirement of Shatavar crop is not much. It can be grown without irrigation in areas that receive 800–1200 mm of well-distributed rainfall. Irrigating the field once immediately after transplanting is a must for establishment of seedlings in field. The second irrigation is done after seven days of seedling establishment. If there is no rainfall and dry spell prevails for more than 15 days, one more irrigation should be given. During winters, irrigation at 30-day intervals is enough for good growth. Irrigation should be done during seed formation stage and before harvesting of the tuberous roots for obtaining higher seed yield and easy digging of tuberous roots. Deficient soil moisture during March–June brings down root yield significantly. Hence, three to four irrigations during this period are essential.

**Manures and fertilizer application:** Asparagus plants have to be grown without chemical fertilizers and use of pesticides. Organic manures like, Farm Yard Manure (FYM) may be applied at the rate 10t /ha. Vermicompost and Green Manure may be applied @ 3-5t/ha for better production and quality of roots. Shatavar further requires a fertilizer dose of 60 kg nitrogen, 40 kg phosphate and 40 kg potash per hectare for optimum growth and higher tuberous root yield. One-third of nitrogen and entire dose of phosphate and potash should be placed 10–12 cm deep in the rows before transplanting. The balance two-third N is applied in two equal split doses at ridges during September and in late February.

**Harvesting and processing:** The plant are harvested after 40 months in winter. Light irrigation is done to facilitate digging. The harvested roots were thoroughly washed in flowing water. Inner woody threads were removed by splitting the roots. The roots were then dried in the shade for 8- 10 days. The fresh roots loose about 90% of their weight after peeling and drying. It is observed that in case the roots are not peeled off within a few days, it is a bit difficult to remove the skin as such. In such a condition the roots are kept in boiling

water for about 10 minutes, followed by cold-water treatment to facilitate peeling. Value addition of root powder enhances marketability and sale price. The processed roots are packed in sacks and root powder in air tight HDPF containers and stored in cool and dry place. The roots are dugout collected, washed and cleaned . The roots are peeled off with the help of sharp knife immediately after harvesting. After removing the skin, it is cut transversely into small pieces and dried in shade.

**Yield:** The average yield is reported to about 3kg fresh weight per plant after 40 months age. Estimate yield of 5-7 tons/hectare dry roots is recorded. Precaution may be taken for rodents and rats which occasionally eat tender shoots.

**Value added products:** Satavari powder, Satavari gulam, Satavari ghritam.

#### **Economics**

Expenditure per ha Rs.80000/-

The prevailing market price of roots is Rs 50/ kg. The root powder is also sold at Rs. 300/kg

Return per ha Rs.280000/-

Net income per ha Rs.200000/- Approx

### **ALOEVERA**

Aloevera (*Aloe barbadensis* Mill) is used for burn, wound, liver complaints, intestinal worms, uterine disorders. It is widely used in preparation of cosmetic products. Leaves were harvested after 8- 9 months of planting usually during March- April. The broken rhizome parts left in the soil throws out new sprouts for raising succeeding crop. The bitter principles are at the maximum when the leaves change from green to brown colour. The yield of fresh leaves were 500 q/ha. When harvesting is done manually, the lowest and larger leaves are first harvested. Aloevera leaves are sold at Rs. 4- 6/ kg. Women can also sell suckers from the field @ Rs 1- 2/ each. Every year one mother plant produces about 6 suckers. In India, aloe is cultivated in Alwar in Rajasthan, Satanapalli in Andhra Pradesh, Rajpipla in Gujarat and some parts of Tamil Nadu.

**Common Names:** English: Aloe vera, Medicinal aloe, Burn plant; Hindi: Gheekumari घीकुमारी ; Marathi: Khorpad Tamil: கற்றாழை Kathalai ;Malayalam: Chotthu kathalai

*Aloevera* Linn., *A. barbadensis* Miller, *A. ferox* Miller, *A. chinensis* Baker, *A. indica* Royle, *A. perryi* Baker, etc., belonging to family *Liliaceae*. Among these *A. vera* Linn. syn. *A. barbadensis* Miller is accepted unanimously as the correct botanical source of Aloe. In most reference books, *A. barbadensis* Miller is regarded as the correct name but as per the WHO monograph, *A. vera* Linn. is accepted as the legitimate name of this species.

**Climate:** Because of stiff, rugged and harsh habit they are grown in desert and dry situations. Grows well in hot and dry climate.

**Soil:** It grows well on variety of soils, light, muram, loam, black, hill slopes, sea coasts, desert areas etc.

**Tillage:** One shallow ploughing followed by harrowing to bring the soils to fine tilth. Mix 5-20 cart loads of FYM in soil. This will facilitate better moisture holding capacity improve soil texture and structure.

**Varieties:** Commercially important sub-species are Aloe barbedensis, A. chinensis, A. perfoliata, A. vulgaris, A. indica, A. littoralis and A. abyssinica. National Botanical and Plant Genetic Resource, ICAR, has released varieties like IC111271, IC111269, IC111280 etc. Central Institute of Medicinal and Aromatic Plants, Lucknow, has also released the variety AL-1 for cultivation.

**Propagation:** It is propagated by suckers.

**Spacing:** 40x 45 cm (between rows and between plants) in flat beds or by opening ridges 60x30 cm apart. This method accommodates about 55000 plants per hectare..

**Land preparation and planting:** The land is ploughed and cross ploughed thoroughly. Farm yard manure is applied @ 15 t/ha during the last ploughing. Ridges and furrows are formed at 45 or 60cm apart. The plot may be irrigated if necessary. On set of monsoon is the best time for planting of Aloe. The suckers are planted at 40 or 30cm apart, maintaining the spacing suggested. The crop can be planted throughout the year under irrigated conditions. The planting with 60 x 45 sq.cm will require 14800 - 15000 suckers / acre.

**Manures and Fertilizer:** The crop responds well to the application of farm yard manure and compost. In the first year of plantation, FYM @15 t/ha is applied during the land preparation. During the subsequent years, the same dose of FYM is applied every year. Besides 50 :50:50 kg/ha of N:P:K is applied as basal dose to facilitate good growth of the crop.

**Weeding and earthing up:** The crop should be kept weed free. Suckers planted in flat beds should be supported at the bottom with adjoining soil.

**Irrigation:** During rainy season there is no need to irrigate the crop, however, during summer crop should be irrigated with an interval of 15 days will ensure good yields. However, the plants are sensitive to water logged conditions.

**Diseases:** Appearance of black brown spot can be well controlled by any sulphur containing insecticides.

**Harvesting:** The thick fleshy leaves are ready for harvest after 10-12 months of planting. Normally, three harvests are taken in a year by removing three to four leaves per plant. Harvesting is labour intensive. It is carried out in the morning and / or evening. The leaves will regenerate from the scar and thus the crop can be harvested upto 5 years after planting. Cut the leaves with sharp sickle close to the stem. Keep the cut leaves for some time till the

viscous gel from the cut end dries up. Then collect the leaves for packing. Apart from leaves, the side suckers, which can be used as planting material, can also be sold.

**Yield:** One year old plant will produce approximately 3-4 kg leaves. It means 40-45 tons of leaves can be harvested from 1 acre planting.

### **Indoor cultivation of Aloe vera**

Generally, Aloe grows openly in the field, but it can also be grown indoors in pots kept in sunny southern or eastern window. Containers have to be filled a quarter with full drainage material and compost consisting of two parts loam and one part coarse sand, broken bricks and crushed limestone, with a bit of bone meal added. Plant should be potted in the spring and watered carefully until established. During the summer, water can be given as soon as the soil is dry, but from September to March very little water is required, just enough to prevent the leaves from shrivelling. Over water will kill the plant. Well rooted plant will benefit from occasional applications of liquid fertilizer in the summer. Large plants, however, do need an occasional top dressing of fresh soil in each spring; any loose soil should be removed and replaced with new. The drainage hole should be plugged up. Aloes do not need to be repotted often; plants in large pots will flourish for many years without being moved. The plant takes four years to reach maturity and has a lifespan of about 12 years. The leaves are harvested after four years when it reaches maturity. The plants can be harvested every 6-8 weeks by removing 3-4 leaves per plant.

**Value added products:** Aloe jelly, Aloe candy, Crack cream, Aloe moisturizer, Aloe juice

### **Economics**

Expenditure per ha. Rs.80,000/-

Return per ha. Rs.340,000/-

Net income Rs.260,000/-

### **AKARKARA**

Akarkara (*Spilanthes acmella* L.) is also known as *Acmella oleracea* is a unique and versatile herbal plant and also known as anti-toothache plant with high medicinal usages. So, it has been recognized as an important medicinal plant. Due to its traditional uses in health care and as food, now-a-days, there is an increasingly demand all over the world. Akarkara flowers begin with thick red stuff; they increasingly stretch and turn yellow, keeping the red on the top. Naturally leaves are dark green and the stems, leaf stalks and veins dark green with light-purple colour. It is an annual herb found throughout country. The herb is found widely in the natural forest of Chhattisgarh. The whole herb excluding root is taken to prepare a curry, known as Akarakara ke Sag. This curry is very useful in urinary system related trouble.



Akarakara is also an accepted herbal medicine for dental troubles, scurvy and asthma. The plants have long been used in India for the treatment of gum and dental problems.

**Common Names:** Sanskrit: Sarahattika; Gujarati: Marethi; Marathi: Akkalkadha, Pipulka, Akalkarra, Acharbomdi; Kannada: Hemmugalu; Tamil: Vana-Mugali; Assamese: Pirazha; Manipuri: Leishabi; Naga, Changki: Tefu Mozitang

**Preparation of land:** The Land is to be prepared in the month of May-June.

- Proper soil treatment including give land a better Pulverize and drying.
- Approximate 10 t well rotten FYM / ha should be mixed.
- Beds or plain pan should be prepared (as per planning of plantation)
- The distance of two beds should be kept 2 mt for irrigation.
- Land should be well irrigated before sowing the planting material.

**Planting :** The sowing/ planting of Akarkara starts in month of August.

**Maintenance:** Weeds of the crop are required to free it from the weeds, which should be controlled manually by labours. The first three to four months from the sowing date are very important and needs care.

**Mature of crop:** Flower: Flowering is started after the two to three month of showing and collect mature flower. Root: In the month of February – March

### Harvesting of the crop

After the two to three month of showing of Akarkara plant start flowering then take mature flower buds gently. Fresh flower buds are yellow in colour with red top. After the starting of flowering plant produce number of flowers and take it periodically. After that dry it properly through proper procedure. After The crop cycle is complete root should be dug out and dry it.

### Economics

Expenditure per ha. Rs.50,000/-

Return per ha. Rs.200,000/-

Net income Rs.150,000/-

## STEVIA

Stevia (*Stevia rebaudiana* Bertoni) leaves are used as medicinal teas in Brazil for treating heartburn and other ailments. More recent medical research has shown promise in treating obesity, high blood pressure, and hyper tension. Stevia has a negligible effect on blood glucose, even enhancing glucose tolerance. Therefore, it is attractive as a natural sweetener to diabetics and others on carbohydrate controlled diets. Stevia leaves are 30 times sweeter than normal sugar. The extract of stevia Rebaudioside-A is around 300-400 times sweeter than normal sugar. It is also used for the treatment of obesity and high blood sugar patient. There is not increase in sugar level after consumption of stevia as sweetener as substitute of normal sugar.

Stevia crop has good potential in India. There is low risk in this crop. The investment in stevia is also tax free as it is agriculture production. The return also starts to come early. As it is planted for five years so the cost of plantation also accrue one time in 5 years. There is high potential of return as compared to traditional crop.

**Common Name :** Stevia, Sweet Leaf, Sugar Leaf, Sweet Honey Leaf, Rebiana

**Land Preparation:** The land should be ploughed initially with a disc plough or harrowed to break down, the clods. Fine tilth of soil is required for Stevia cultivation. 1 to 2 ploughing has to be done after harrowing.

**All Type:** Red soil and sandy loam types are best suitable for the cultivation of stevia with pH between 6 to 7. Clay loam soil does not show good results.

**Raised Bed Preparation:** Forming raised beds is the best and economical way to grow stevia. Raised bed of height half feet and width half feet is required. The distance between the 2 rows in bed is one feet. The distance between each plant in a row is half feet. With such a spacing the plant population is around 50,000 plants per 'acre.

**Irrigation:** Micro sprinkler is the best method of irrigating stevia plants. Flood or canal irrigation would not supply the required amount of water at the right time. Micro sprinklers, can be used to sprinkle the water once in a day in winter and 4 times in a day in summer or more depending upon the heat and relative humidity in the air; Watering frequency should be scheduled so that the plants do not wilt for want of water.

**Organic Application and Plant Protection :** There is no such pest and disease incidence in this crop. In case any disease symptoms are noticed, spraying of neem oil diluted in water is the best organic method. For root grubs use castor oil mixed with cow manure and spray very little near the plant.

**Weeding:** Removal of weeds can be done manually. Since the crop is grown in raised beds, Intercultural operations are easier by manual labour.

**Maintenance:** Flowering of the plant should be avoided. Since stevia has a significant apical dominance, the plant tends to grow tall and tender. Pinching of the apical bud would enhance bushy growth of the plant with side branches. With good management the perennial plant can be maintained economically for 375 years.

**Harvesting:** Harvesting of the leaves is done by plucking the leaves. If required in a small quantity. The entire plant with the side branches is cut leaving 10-15 cm from the base.

**Value added products:** Stevia powder, Stevia Sugar free tablets

#### **Economics**

Expenditure per ha. Rs.60,000/-

Return per ha. Rs.260,000/-

Net income Rs.200,000/-

## **KALMEGH**

Kalmegh (*Andrographis paniculata* Burm f.) is a bitter annual (perennial, if maintained) herb, erect, 50 cm to 1m. in height, stem quadrangular, much branched; leaves opposite, short petioled; flowers in racemes. Fruit capsule linear, oblong or elliptic; seeds about 12 in number, subquadrate, brownish or creamy yellow. It is widely distributed throughout plains of India from Uttar Pradesh to Assam, Madhya Pradesh, Tamil Nadu and Kerala.

**Common Name :** Kirayat, Hara-chiretta, Kalpnath

**Soil and climate:** It can be cultivated on wide range of soils from loam to lateritic soils with moderate fertility. It can be cultivated on shady wastelands also.

The climatic requirement of the plant is hot and humid conditions with ample sunshine. With the onset of monsoon, plant grows luxuriantly and starts flowering with the moderation in temperature during September. Flowering and fruiting continues upto December until temperature drops drastically in Northern plains.

**Nursery raising and planting:** Its propagation is through shattered seeds in nature. Vegetative propagation is also possible in certain special cases through layering as each node is capable of producing enough roots. Seeds are small and remain dormant for five to six months. For raising crop in one hectare three beds of 10x2 m size should be tilled, pulverized and levelled during the month of May. Liberal use of organic manure in nursery is advised for raising healthy seedling. Seeds should be covered by very thin layer of soil and compost mixture. Beds should be covered properly by suitable mulch and irrigated regularly with water fountain till seedlings merge (6-7 days).

Immediately after germination, mulch is removed to avoid elongation of the seedlings. After 10-15 days regular flood irrigation can be given till it becomes ready for planting. Transplanting of seedling is done in second fortnight of June at a row and plant spacing of 45 to 60 cm and 30 to 45 cm respectively. Beds should be irrigated immediately after planting.

**Weeding:** To begin with one or two weeding/hoeing are essential to get the crop established. After establishment, crop grows well during monsoon and does not face any competition from weed.

**Manures and fertilizer application:** Kalmegh have to be grown without chemical fertilizers and use of pesticides. Organic manures like, Farm Yard Manure (FYM) @ 10t/ha, Vermi-Compost @ 2t/ha, may be used for higher quality production .

### **Irrigation:**

Fairly distributed rainfall during monsoon is sufficient to raise annual crop in the country. But prior to rain 2-3 irrigations are required. Irrigation during autumn does not show much effect on biomass yield as by that time plant is in reproductive phase.

**Harvesting and processing:** Maximum herb biomass can be obtained in 90-100 days beyond which leaves start shedding. If crop is raised as annual crop and planted during the month of May June, it should be harvested by the end of the September when flowering is initiated. At the time of flower initiation, active principle and rographolide is high in leaves. Since the whole plant contains active principles, entire harvested material is dried in shade and powdered.

**Yield:** A well-maintained crop grown during monsoon season yields 4 to 5 tons of dried leave per hectare should be recorded.

**Value added products:** Kalmegh powder, Kalmegh extract

### **Economics**

Expenditure per ha. Rs.70,000/-

Return per ha. Rs.300,000/-

Net income Rs.230,000/-

## GILOE

Giloe (*Tinispora cordifolia* (Thunb) Miers) plant occurs throughout tropical regions of India extending from Kumaon to Assam and Myanmar, Bihar, Konkan to Sri Lanka. It is a large climber which grows over the highest trees in the forests and throws out aerial roots which reach the length of 10 metres, though not thicker than pack-thread.

**Common Names:** The plant is also known as Gilo, Gulancha, Guduchi (Hindi), Amrita (Sanskrit), Guduchi, Gulancha (Bengali), Gado , Galo (Gujarati), Gulvel (Marathi), Duyutige , Teppatige (Telugu), Amrutha balli (Kannada), Shindila kodi (Tamil) and Heartleaf moonseed (English).

**Variety:** RRL (J- 82) is found suitable for cultivation.

**Soil and climate:** It grows well in almost any type of soils and under varying climatic conditions.

**Variety:** The variety RRL (J)-82 is found suitable for cultivation and quality yield.

**Nursery raising and planting:** The plant is cultivated by stem cutting in the month of May-June. It requires some support preferably Neem and Mango trees, such plants are supposed to possess better medicinal values.

**Weeding and hoeing:** Periodical hoeing is done, both in the nursery and field as per requirement.

**Manures, fertilisers and pesticides:** The medicinal plants should be grown without chemical fertilizers and use of pesticides. Organic manures like, Farm Yard Manure @10t/ha, Vermi-Compost @2t/ha and Green Manure @10t/ha should be used for good yield. To prevent diseases, bio-pesticides could be prepared (either single or mixture) from Neem (kernel, seeds & leaves) and Cow's urine etc.

**Irrigation:** The field after plantation should be irrigated periodically weekly during summer season and fortnightly during winter season

**Harvesting/post harvesting operation:** When the leaves begin to fall in August-September, the stems should be cut 30 cm above the ground and collected. Pale green coloured stems are cut into small pieces and dried in shade.

**Yield:** Approximately 10-15 q./ha from second year onward.

### Economics

Expenditure per ha. Rs.80,000/-

Return per ha. Rs.220,000/-

Net income Rs.140,000/- during 2nd year and Rs.330,000 during 3rd year.

## KALI HALDI

Kali haldi (*Curcuma caesia* Roxb) is native to India. It is commonly known as 'Black turmeric'. In India it grows in West Bengal, Madhya Pradesh, Orissa, Bihar, North-East and Uttar Pradesh and is widely used by ethnic communities for various ailments. Kali haldi is recognized as a medical herb with strong antibiotic properties. It is used as remedy for wound, bruises and sprain, skin problems, digestive aid, liver protection. It helps in reducing cholesterol. It is believed to play a role in preventing and curing cancer in Chinese medicine. It contains aromatic volatile oils that help to remove excessive lipids from the blood, reduce aggregation of platelets and reduce inflammation.

**Common Names :** Kali haldi

**Soil and climate :** It grows best in sandy or pebbly, loamy soil with moist. It flourishes well in moist deciduous forest areas. This species is found in the eastern Himalayas and inhabits warm forest areas. It can withstand temperatures 15-40<sup>0</sup> C.

**Land preparation:** The land should be ploughed and harrowed to get a fine tilth. The field must be levelled properly and drainage arrangements made to avoid water logging during the rains. About 20 t per ha of FYM or compost should be mixed well into the soil. The land is divided into beds of 1 m width and convenient length rhizomes are planted in shallow pits on the top of the ridges. Spacing should be done at 45-60 cm between the ridges and 15-22 cm between the plants.

**Cropping method:** The rhizomes are cut into pieces each 4-5 cm long and planted as such or split into two; each having at least one sound bud. The crop is sown from April to July, depending upon the rains. Mulching the bed with green leaves is an important practice beneficial to this crop. Two or three mulching are given, the first immediately after planting and the second and the third at intervals of 40-50 days.

**Manures and fertilizer application:** It needs heavy manuring. Usually, 40-50 tonnes of well rotten farmyard manure is applied at the time of preparing the land. For quality production, chemical fertilizers like 30 kg each of N, and P<sub>2</sub>O<sub>5</sub> and 60 kg of K<sub>2</sub>O per ha may also be applied in split doses.

**Irrigation:** During summer, irrigation at 5 day intervals is recommended in case of red loam and at 7-9 days in the case of black loams. During the period of rhizome development and maturity, frequent irrigations are necessary.

**Weeding:** Manual weeding is a common practice for controlling weeds. It should be done at regular intervals for the good growth of plants.

**Harvesting:** It is ready for harvesting after 8 and half months. Rhizomes should be dug very carefully. After digging the rhizomes should be lifted from soil and cleaned. The harvested rhizomes are washed well to remove adhering soil. After washing, the rhizomes should be kept in the shade for drying.

**Yield:** Approximately 5000 kg dry rhizomes estimated from one hectare of land.

**Value added products:** Curcuma caesia Powder

#### **Economics**

Expenditure per ha. Rs.90,000/-

Return per ha. Rs.300,000/-

Net income Rs.210,000/-

*Note: Market for medicinal plants is volatile and the economics may vary*

### **List of some Institutions/ Organizations engaged in Research/Cultivation of Medicinal and Aromatic Plants**

1. ICAR- National Bureau of Plant Genetics and Resources, New Delhi
2. ICAR- Directorate of Medicinal and Aromatic Plant Research Anand (Gujarat)
3. ICAR- Indian Institute of Horticulture Research Bangalore
4. Central Institute of Medicinal and Aromatic Plants, Lucknow ( UP) and Research Centre at Bangalore, Hyderabad and Pantnagar and Purara ( Uttarakhand)
5. National Botanical Research Institute, Rana Pratap Marg, LUCKNOW, Uttar Pradesh
6. Regional Research Laboratory ( CSIR) Bhubaneswar, Orissa
7. Regional Research Laboratory (CSIR), Jorhat, Assam
8. Centre for Advanced Study in Botany, University of Madras, Guindy Campus, CHENNAI, Tamil Nadu

- 9.Kerala Agricultural University, Vellanikkara, Trichur, KERALA
- 10.Narendra Dev University of Kumarganj, Faizabad, Uttar Pradesh
- University of Agricultural Sciences, G.K.V.K., Campus, Bangalore, Karnataka
- 11.G.B. Pant University of Agriculture & Technology, Pant Nagar, Uttaranchal (At Ranichora Station)
- 12.Department of Horticulture, S.K.N. College of Agriculture, Rajasthan Agriculture University, Rajasthan
- 13.Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra
- 14..Pandit Jawahar Lal Nehru College of Agriculture, Karikal, Pondicherry
- 15.High Altitude Plant Physiology Research Centre, HNB Garhwal University, Srinagar, Garwal, Uttaranchal
- 16.Herbal Garden, Herbarium and Research Institute, Joginder Nagar, Govt. of Himachal Pradesh, Shimla, Himachal Pradesh
- 17.Instt. of Himalayan Bioresource Technology, Palampur, P.O. No. 6, Himachal Pradesh
- 18.University of Agricultural Sciences, G.K.V.K., Campus, Bangalore, Karnataka
- 19.Department of Botany, Jai Narayan Vyas University, Jodhpur, Rajasthan
- 20.Himachal Pradesh Krishi Vishwa Vidyalaya, Palampur, Himachal Pradesh
- 21.Herbal Garden, Herbarium and Research Institute, Joginder Nagar, Govt. of Himachal Pradesh, Shimla, Himachal Pradesh
- 22.Tropical Botanical Garden and Research Instt. Karimancode, Research Instt., Karimancode, P.O. Palode, Thiruvanthapuram, Kerala
- 23.Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh

### **List of National traders of medicinal and aromatic plants**

- 1.Mittal Musli Farm, Mumbai Tel: 022-23465447 Fax : 022-23441403
- 2.Dabur India, New Delhi Tel:011-26968422 Fax : 011-26968443
- 3.Himalayan Drugs, Bangalore Tel:080-28394885 Fax:080-28396057
- 4.Green Hill Exports, Mumbai Tel:022-2345888
- 5.Natural Remedy, Bangalore Tel:080-2622673 Fax:080-26612050
- 6.Indoworld Trading Corp. Tel:011-2378059 Fax:011-2374521
- 7.Medi Herb, Trichur, kerala Tel:0487-2426968 Fax: 0487-423742

#### **Chattisgarh**

- 1.Sarswati Trading, Satkargally, Station Road - 0771-2523268/2523272
- 2.Singhal Trading - 0771-2520521/258868
- 3.Shiv Trading - 0771-2524893
- 4.Bhagwati Trading - 0771-2528335/2538445
- 5.A.P. Mishra, Narayan Pharamceutical, Ashok Nagar, 0674-2536301/2530039
- 6.Afzal Broker, Telghani Naka, Kamala Super market - 0771-2527786
- 7.Gupta and company,near Hanuman Mandir - 0771-2537383
- 8.Vikash Trader, kamal Super Market - 0771-2520663/2551021
- 9.Maa Danteswari - 0771-242113

#### **Kolkata**

- 1.Morex India, 89, Netaji Subash Road - 033-2431238/2103259
- 2.Excel Drug House, 18-B,Sukeas Lane - 033-22428571/22421254
- 3.Minex Agency, 71, Ganesh Ch Avenue - 033-2216791/2257067

4.Hiralal Gajadharlal, Near Machhua Bazar - 033-22311752

#### **Andhra Pradesh**

1.Agrigold Farms Catholik Coplex, Vijayawada - 0866-2473711.

2.Agritech, Vijayawada-12 - 0866-2413089

3.Nandan Agro Farms, Samjiguda, Hyderabad - 040-255507799

#### **Bhubaneswar**

1.Abhimannu Dhal, 110, Baramunda Housing Board Colony, 0674-2551332

2.A.P. Mishra, Narayan Pharamceutical, Ashok Nagar, 0674-2536301/2530039

3.Max Care Laboratory, Mancheswar, BBSR - 06755-2580888

4.Nature Herbals, Plot No.84, Satyanagar, BBSR.

5.ABICEE Pharmaceutical, 217,Mancheswar Ind. Estate, BBSR.

6.Herby International, 271, Chandaka Ind.Estate, BBSR

7.Jagannath Ayurvedic Pharmacy, 248, Jagamara, Khandagiri, BBSR

8.Nalin Herbal Product, HIG, 118,Baramunda, BBSR.

9.Chilika Biotech, Plot No.52-55, Rasulgarh Ind.Estate, BBSR.

10.Braj Sundar Sahoo, Green initiative, 267, Barabari, Khandagiri

11.G.Das, BG Pharmaceutical, Plot No.187,Zone- B, Sector - A, BBSR

12.S.Senapati, Madhav Enterprise, S-1/90, Niladri Vihar, BBSR,0674-2442619.

### **List of some medicinal plants and their uses**

1. *Withornia sommifern* : अश्वगन्धा गठिया व पाचन में उपयोगी.

2. *Curcuma longa* : हल्दी मिरगी, दमा, खांसी, दर्द में उपयोगी.

3. *Calotropis sigantea* :सफेद आक: खांसी, बुखार, पीलिया, टी. बी. में उपयोगी.

4. *Salvia algyptica*: तुखम मलंगा: आँखों की तमाम बीमारियां तथा काजल तैयार करने में उपयोगी.

5. *Cestrium diuaranum*: दिन का राजा: गंध नाशक एवं हृदय बल में उपयोगी.

6. *Mentha piperata*: पिपर मिंट: मुंह की दुर्गन्ध रोकने एवं बच्चों के लिए अमृत धारा तैयार करने हेतु.

7. *Adenocyma nitidum*: लहसुन बेल: वायुनाशक

8. *Latura metel*: काला धतूरा: टी. बी. एवं बुखार में उपयोगी.

9. काला बांसा: सांस की बीमारी में लाभदायक

10. सफेद बांसा: डेंगू बुखार में उपयोगी.

11. *Barieria prionitis*: पीला बांसा: खांसी में उपयोगी.

12. *Lawsonia inermis*:मेहंदी, पित्त, जिगर एवं रंग में उपयोगी.

13. *Ocimum Nocturnum*: रात तुलसी- उल्टी रोकने हेतु.

14. *Ocimum basilicum*: काली तुलसी: कैंसर, नजला जुकाम में उपयोगी

15. *Cymbopogon citratus*: लैमन ग्रास: विटामिन ए व आंखों में उपयोगी.

16. नर्गिस: तेल अधरंग में उपयोगी.
17. *Abeimoschus moschatus*: कस्तूरी भिंडी: बीज कस्तूरी बनाने में उपयोगी.
18. *Acacia concinna*: शिकाकाई: कफ, स्वांस, रूसी में उपयोगी.
19. *Streculla vrens*: गौंद कतीरा: प्रसव पीड़ा, दांत व ठंडाई हेतु उपयोगी.
20. *Terminalia beierica*: बेहदारू: त्रिफला पेट के लिए उपयोगी.
21. *Kigeila pinnata*: बालम खीरा: अल्सर के लिए उपयोगी.
22. *Acorus calamus*: बच: बुखार मिरगी स्त्री रोग में उपयोगी.
23. *Asparagus odsce Mems*: सतावरी: ताकत में उपयोगी.
24. *Aspara ausar Gentuil*: सतावर: पौष्टिक वीर्य वाहक में उपयोगी.
25. *Vitex negumde*: निर्गुडी; रसायन गले के टांसिल में उपयोगी.
26. *Centello asialica*: मंडूक पर्णी: दिमाग की ताकत में उपयोगी.
27. *Mimosa pudica*: छुई मुई: फिस्टूल बाबासीर, वीर्य वर्धक हेतु उपयोगी.
28. *Androgrdhis paniculata*: पुर्ननवा: जिगर, सूखा, कैंसर में उपयोगी.
29. *Bacopa monnieri*: ब्राह्मी: दिमागी ताकत के लिए उपयोगी.
30. *Bryophy lulm pinnata*: पत्थर चूर: पथरी विनाशक.
31. *Androgrphis panleulata*: कालमेघ: लीवर में उपयोगी.
32. *Nyctanthu savoritritus*: हार सिंगार: पत्ते बुखार में, बीज बाबासीर में उपयोगी.
33. *Spindus mukorossi*: रीठा: कपड़े एवं केश साफ़ करने में उपयोगी.
34. करी पत्ता: पेचिश, टॉनिक व कीड़ों की दवा में उपयोगी.
35. *Elettaria cardaman*: छोटी इलाइची: साँस व रुंदे गले में उपयोगी.
36. *Sansevieria roxburghina*: नाग दमन: सर्पदंश में उपयोगी.
37. *Stevia rebaudiana*: स्टीविया: मधुमेह में उपयोगी.
38. *Spitanthus acemella*: अकरकरा: मुत्रबर्धक व तुतलाने में लाभदायक.
39. *Mesua ferra*: नागकेसर: खांसी एवं त्वचा रोग में उपयोगी.
40. *Catheranthus roseus*: सदाबहार: मधुमेह व कैंसर में उपयोगी.
41. *Matricarid chamomilla*: जर्मन चमेली: जोड़ों के दर्द, बुखार, बाल रोग व पाचनशक्ति में उपयोगी.
42. *Crinum aisaticum*: सुखदर्शन: कर्ण पीड़ा में पत्तियों का रस उपयोगी.
43. *Vrginea indica*: वन प्याज: चर्म रोग में उपयोगी.
44. *Rauvolfia serpentina*: सर्प गंधा: उच्च रक्तचाप, अनिद्रा, सर्प के काटने में उपयोगी.
45. *Coleus barbats*: पत्थर चट: चटनी खाने से पित्ताशय की पत्थरी का नाश.
46. *Aloe barbadensis*: घी क्वार: कब्ज आमाशय ताकत हेतु उपयोगी.
47. *Aloe vera*: ग्वार पठा: पेट जिगर तिल्ली ऐगिजिमा रोग में उपयोगी.
48. *Putraujiva roxterghll*: पुत्रन्जीवा: बुखार एवं बच्चों की सेहत वृद्धि में उपयोगी.



## **Conclusion**

India has favourable agro- climate conditions for cultivation of various medicinal and aromatic crops. Since, medicinal and aromatic plants have a immense potential for providing livelihood support to marginal and small farmers in general and to farmwomen in particular. It will be helpful for health security as well as for economic security of farm families in the field of horticulture. To meet the internal and international demands, it has now become imperative to produce the quality raw materials in significant quantities. This can only be achieved to promote the domestication and cultivation of medicinal plants among end users which have internal demand and have export potential. During the last few decades the area under forests has considerably decreased while the demands for raw materials of medicinal plants has been increasing due to increased number of users. Therefore, the forest resources are not able to meet the full requirement of medicinal plants. Further, as a results of continuous exploitation of these plants in forests and absence of major regular developmental programmes in the forestry and agriculture sectors, a number of species of these plants are reported vulnerable to extinction. There is a growing demand for medicinal and aromatic plants at the global level due to health awareness. Therefore, conservation and sustainable use of these species are necessary to meet the needs of present and future generations. Women are well known for conserving genetic biodiversity. Moreover, production of medicinal plants will help for utilization of land for additional income and for conserving the important plant species which are now neglected and under extinction due to deforestation. Skill trainings cum exposure visits on medicinal and aromatic plants production will help and encourage to the farmwomen for cultivation and value addition of these plants like tulsi, stevia, gudmar, brahmi citronella, aloe vera, mentha, bhringraj, akarkara, lemongrass etc at their home. Therefore, it is important that medicinal and aromatic plant production technology, enterprise and schemes can be promoted among farmwomen by the NGOs, Government of India, State Agriculture/ forest departments and private industries for an employment opportunities and as a source of income throughout the year.

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Shankhpushpy