

# GUIDELINES ON GOOD FIELD COLLECTION PRACTICES FOR INDIAN MEDICINAL PLANTS



National Medicinal Plants Board  
Department of AYUSH,  
Ministry of Health and Family Welfare  
Govt. of India

In Collaboration with

WHO Country Office for India,  
New Delhi

2009



# **Guidelines On Good Field Collection Practices For Indian Medicinal Plants**



सत्यमेव जयते  
Government of India

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## FOREWORD

The world is witnessing a change in the health seeking behavior as more and more people world over are seeking health remedies through the use of traditional and herbal medicines. There is an increasing use of the natural products even in the developed world. This is leading to unsustainable collections from natural forests resulting in uncertain availability of a large number of medicinal plants species and their decline in the wild.

It is well known that India has an age-old tradition of plant based health-care in the form of Ayurveda, Siddha and Unani (ASU) systems of medicine. More than 90% of the formulations under these systems are plant based with a very small percentage of formulations having minerals, metals and animal products as ingredients. Almost 90 percent of the raw materials of medicinal plants used by the ASU manufacturing units are sourced from natural forests, often with little regard to environmental and social considerations, often resulting in harvest much in excess of sustainable limits. The Department of AYUSH has taken a number of policy initiatives for quality and standardization of ASU drugs to improve the outreach and acceptability of Indian systems of medicine. Compliance to Good Manufacturing Practices under the Drugs and Cosmetics Act, 1940 and financial assistance to ASU manufacturing units to adopt the standards laid down in pharmacopeias are some of the initiatives in this direction. The quality of the finished products, however to a large extent, depends upon the quality of the raw material and it is for this reason that development of Good Field Collection Practices for medicinal plants will go a long way in improving the quality of the ASU products.

I am confident that these guidelines will be widely disseminated and go a long way in incorporating quality ethos in the manufacture of AYUSH products and thereby help improve the outreach of the Indian systems of medicine, both nationally and globally.

(S. Jalaja)

Secretary to the Government of India  
Department of AYUSH





**World Health  
Organization**

Country Office for India

## FOREWORD

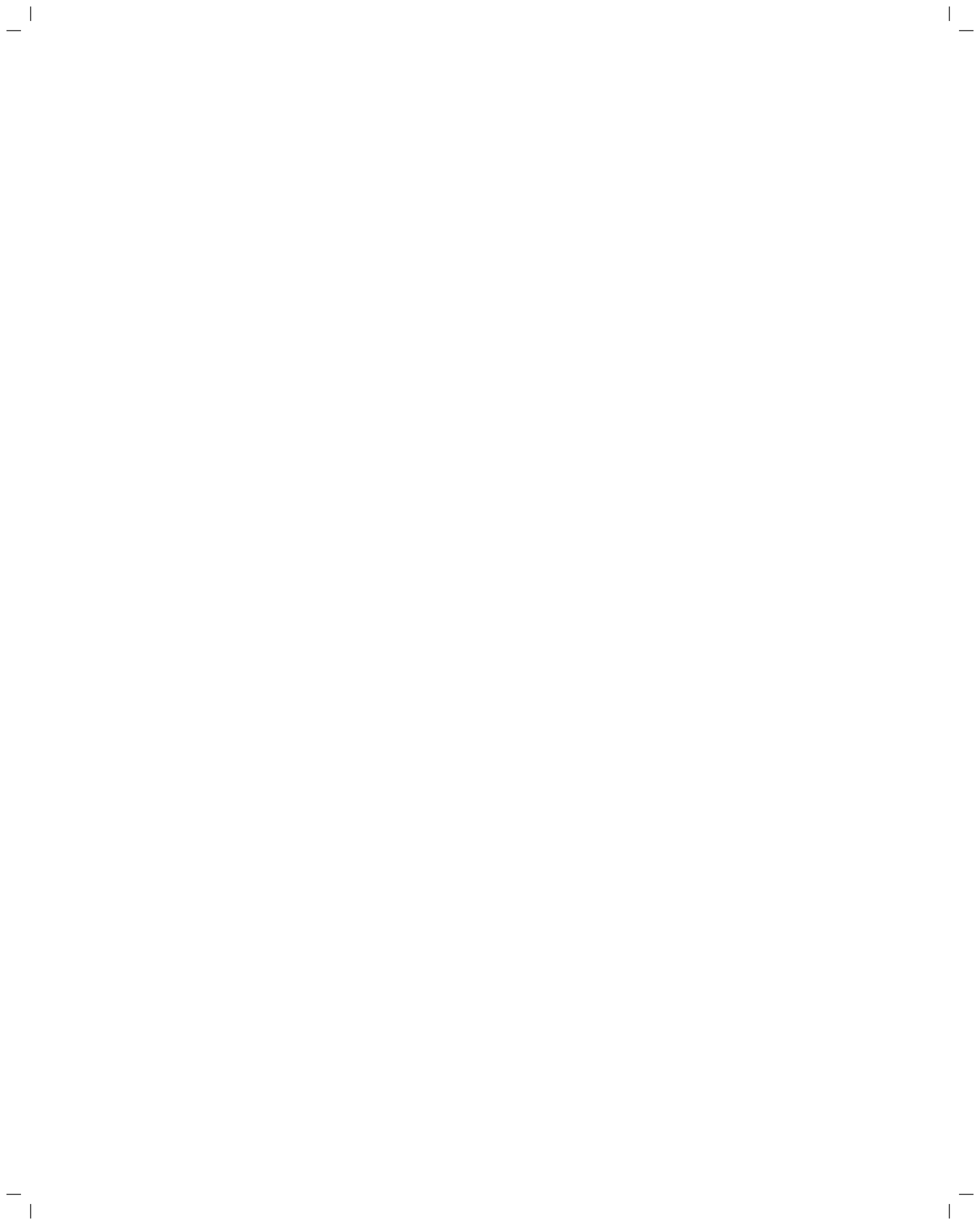
There is a global upsurge in the use of traditional and complementary systems of medicine along with changes in health seeking behavior. India has well documented traditional systems of medicine like Ayurveda, Unani and Siddha with a high degree of societal demand. The dependence of these systems on medicinal plants necessitates the formulation of guidelines and their wide dissemination so as to promote appropriate harvesting. This would contribute to improved quality and sustainable management of medicinal plants resources.

The undertaking of National Medicinal Plants Board in the Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy to develop Good Field Collection Practices for Indian medicinal plants, which are mainly collected from the wild, is a praiseworthy effort in this direction. These guidelines, which should be backed up by capacity building and independent certification, would contribute to alleviating harvesting and quality issues of plant raw materials used in the manufacture of traditional and herbal medicines.

We hope this document will prove useful to the medicinal plants cultivators, collectors and other stakeholders.

**Dr. S.J. Habayeb**  
**WHO Representative to India**







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Government of India

Ministry of Health & Family Welfare

Department of AYUSH

**National Medicinal Plants Board**

## ACKNOWLEDGEMENT

The World Health Organization (WHO) has developed Good Agricultural & Collection Practices (GACPs) for medicinal plants. The present guidelines draw upon the WHO guidelines, International Standards for Sustainable Collection of Medicinal and Aromatic Plants (ISSC-MAP) and other such guidelines for sustainable collection of medicinal plants. These guidelines on Good Field Collection Practices (GFCPs) for wild medicinal plants have been developed through a consultative process among the various experts, Ministries, Departments and Research Councils dealing with medicinal plants.

The National Medicinal Plants Board expresses its gratitude for the financial assistance and collaborative support provided by the World Health Organizations for the development and publication of these guidelines.

Special thanks are due to the WHO-India Office, the Ministries of Environment and Forest, Agriculture, Council of Scientific and Industrial Research, Indian Council of Agricultural Research, Indian Council of Forestry Research & Education, Indian Council of Medical Research, Central Council for Research in Ayurveda and Siddha, Central Council of Unani Medicine, Agriculture and Processed Food Products Export Development Authority (APEDA), Foundation for Revitalization of Local Health Traditions (FRLHT), Indian Institute of Forest Management, and other experts who participated in the meeting of the expert committees and provided their valuable inputs on the draft text, which went through several stages of refinements and improvements.

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## INDEX OF ABBREVIATIONS

<b>ASU</b>	: Ayurveda, Siddha & Unani
<b>AYUSH</b>	: Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy
<b>BFN</b>	: Bundesamt für Naturschutz
<b>BSI</b>	: Botanical Survey of India
<b>CBD</b>	: Convention on Biological Diversity
<b>CITES</b>	: Convention on International Trade in Endangered Species of Wild Fauna and Flora
<b>DFO</b>	: Divisional Forest Officer
<b>FRI</b>	: Forest Research Institute (Dehradun)
<b>GACP</b>	: Good Agriculture and Collection Practices
<b>ISSC-MAP</b>	: International Standards for Sustainable Wild Collection of Medicinal and Aromatic Plants
<b>IUCN</b>	: The World Conservation Union (Formerly International Union of Conservation of Nature and Natural Resources)
<b>MOEF</b>	: Ministry of Environment and Forests
<b>NMPB</b>	: National Medicinal Plants Board
<b>RET</b>	: Rare, Endangered and Threatened (Species)
<b>SOP</b>	: Standard Operating Procedures
<b>TRAFFIC</b>	: Trade Record Analysis of Fauna and Flora in Commerce
<b>WHO</b>	: World Health Organization
<b>WWF</b>	: World Wild Fund for Nature





## 1. Introduction

In recent decades there has been a consistent rise in demand for plant-based medicines and healthcare products worldwide. However, the quality systems and validation procedures governing the sector are not commensurate with such growth. The most frequently encountered criticism about the herbal medicines and allied healthcare products relates to consistency of products in terms of quality, efficacy and safety, which can be summed-up as “minimum therapeutic guarantee”. This concern is genuine as the very purpose of any healthcare product is centered on an ethical assurance to the end-user. There have been many reported instances of sub-quality herbal formulations being marketed, due to non-compliance of even the available requirements of minimum therapeutic guarantee. Lack of appropriate knowledge about the natural resources being used and techno-cultural variance in harvesting and post harvest practices - is one of major contributory factors for such poor quality medicinal produce.

The Government of India recognizes, Ayurveda, Unani, Siddha, Yoga, Naturopathy and Homeopathy (AYUSH), besides, Allopathy as the official systems of medicine. Use of medicinal plants for food and medicine has been an integral part of Ayurveda, Siddha and Unani (ASU) systems. However, historically, the physician or the traditional healer was known to manage the whole supply chain, right from collection of herbs up to preparation and dispensing of the medicine. To meet the burgeoning demand, the supply chain of medicinal plants has, however, become a multi-stakeholders activity. In the process, the principles of sustainability, which were an intrinsic part of traditional systems, got compromised. This has resulted in over-exploitation, habitat loss, threat to plant species and even local extinction in a few cases. At the same time, the demand-supply disparity has resulted in the supply of sub-standard medicinal plant produce. All these factors contributed to the need for conservation and sustainable use of wild medicinal plants on the one hand and achieving the optimum quality of produce on the other.

As per recent estimates worked out by Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore, under the aegis of National Medicinal Plants Board (NMPB), New Delhi, 1286 trade entities of crude herbal drugs<sup>1</sup> representing 960 plant species are being sold in the Indian market. Cumulatively, these materials amount to 137,000 MT per annum. However, only 178 species are significant in terms of annual consumption volumes (exceeding 100 MT per annum (1)).

Contrary to common perceptions, scientific cultivation of medicinal plants is not a panacea to address all the maladies of quality and sustainability. For a variety of scientific, ethical and commercial reasons; mankind will continue its dependence on wild sources for supply of medicinal plants.

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<sup>1</sup> that 'crude herbal drugs' is synonymous with 'medicinal plant produce' – The European Pharmacopoeia provides an official definition for the term “Herbal Drugs” as follows:  
*Mainly whole, fragmented, or cut plants, parts of plants, algae, fungi or lichen, in an unprocessed state, usually in dried form but sometimes fresh. Certain exudates that have not been subjected to a specific treatment are also considered to be herbal drugs*





A few of such reasons are enumerated hereunder:

- ◆ Traditional systems of medicine emphasize the chemical complexity of the botanicals. Such chemical complexity of species is the outcome of biotic and abiotic stresses the plant undergoes in a competitive environment prevailing in the wild. Such factors are difficult to mimic in the farming conditions. As a result, it would be practically difficult to ascertain the qualitative variance between forest and farm produce.
- ◆ The optimal conditions governing different stages of growth are not very well documented in case of many medicinal plant species.
- ◆ The natural survival and multiplication of many herbaceous species in forest scenario is linked to the associated flora and fauna. Opting for farming of these species is not always scientifically feasible.
- ◆ In Indian scenario, the collection of forest produce for medicinal purposes is estimated to generate over 6 million man-days of employment to communities living in or near the forests particularly during the non- agricultural season. Moving these species to pure farming sector, would invoke ethical issues, especially because the dependent stakeholders are different.
- ◆ Diversion of fertile agricultural lands for non-food crops like medicinal plants can adversely impact food security, besides being a land use issue.
- ◆ Going by the current market trends, a large of number of species are used by traditional pharmacies in smaller volumes. Obviously, these species offer little economic incentive to initiate farming.
- ◆ Promotion of plantations of tree species for eventual medicinal purpose on commercial scale appears a difficult proposition, particularly, when the end use involves destructive harvesting process.

For sustainable harvest and long term conservation of wild medicinal plants, best strategy appears to be the following “three-pronged but inter-dependent approach”.

- ◆ Skill up-gradation of collectors.
- ◆ Opportunities for fair trade through established forward linkages.
- ◆ Continued focus on assisted natural regeneration.

This document provides guidelines on “Good field collection practices for Indian medicinal Plants” evolved through a consultative process by a team of experts in the field of conservation, management and processing of medicinal plants in India.



### **1.1. Background:**

The WHO guidelines on Good Agriculture and Collection Practices (GACPs) recommend that individual countries should develop their own national guidelines for collection of medicinal plants (2). So far only European Union and a few other countries such as China and Japan have developed region specific guidelines for good collection practices. The Good field collection practices for Indian medicinal plants intend to provide India specific guidelines for sustainable collection of wild medicinal plants. Stakeholders are encouraged to adopt these guidelines in order to improve the quality, efficacy and safety of the finished ASU and herbal products as well as to suitably address the socio-economic and environmental issues related to medicinal plants. The ASU and herbal industries should also promote use of produce, which has been collected and processed as per good field collection practices.

### **1.2. Objectives:**

The objectives of these guidelines are to -

- 1.2.1.** Encourage and support conservation and sustainable utilization of medicinal plants for inter generational equity.
- 1.2.2.** Ensure consistency in the quality of raw medicinal plants which have a bearing upon the safety and efficacy of herbal formulations.
- 1.2.3.** Ensure that medicinal plants produce is free from any extraneous contaminants and toxic adulterants.
- 1.2.4.** Minimize direct and indirect negative impact on environment due to collection of medicinal plants from the wild .
- 1.2.5.** Promote community involvement in management of medicinal plant resource including its quality and sustainability.
- 1.2.6.** Encourage training and benefit sharing to optimize the returns to the collectors, and other stakeholders.
- 1.2.7.** Encourage documentation of required information related to medicinal plant produce.
- 1.2.8.** Ensure equitable returns to collectors and other stakeholders.

### **1.3. Scope and Structure:**

- 1.3.1.** The document, “Guidelines on good field collection practices for Indian medicinal plants”, is primarily meant for medicinal plant produce collected from the wild and seeks to address issues associated with harvesting and post harvest management. The guidelines will be useful for stakeholders dealing with harvesting, primary processing, drying, packing, storage and transportation of medicinal plant produce of wild origin.



Nonetheless, most of the recommendations contained in the document are valid for cultivated medicinal plant species as well.

- 1.3.2.** This document is structured in eight sections. General introduction gives a brief background, objective and scope of the guidelines including the explanation of the terms used in the document. Section 2 deals with regulatory requirements for sustainable harvesting of medicinal plants from wild, while sections 3 and 4 contain guidelines on harvesting and post harvest management. Section 5 deals with the right packaging and storage requirement for dried medicinal plant produce. The section also recommends the minimum requirement for packaging various categories of medicinal plant produce. Specific needs regarding harvesting and post harvest management of various categories of medicinal plant produce are explained in section 6. The last two sections deal with documentation requirements, training and monitoring.
- 1.3.3.** This document attempts to provide technical guidance for harvesting and post harvest management of medicinal plants. Long-established empirical knowledge and techniques of collection and post harvest processes, if any, may be continued. However, such empirical methods should be restricted to medicinal plant produce, which is used by the collectors themselves and is not meant for trade.
- 1.3.4.** These guidelines should be considered in conjunction with the existing documents relating to quality of medicinal produce, for example, the “Good Manufacturing Practices (GMPs) for Ayurveda, Siddha and Unani Medicines” published in Schedule 'T' of the Drugs and Cosmetic Act and Rules (3).

#### **1.4. Definitions of the terms used:**

The terms used in this document are defined below. Some of the terms and their definitions have been adopted from widely used authentic documents. The number at the end of the definition denotes the reference number listed at the end of the document, from which the definition has been adopted. In some cases the definition has been modified slightly to make it more relevant for the current document.

**Collector:** Any person who harvests the medicinal plant produce from any live or dead medicinal plant species as part of his livelihood or for trade.

**Contamination:** The undesired inclusion of impurities of biological or non-biological origin into or onto medicinal plant produces during harvesting, processing, drying, packaging, storage or transport (4).

**Cross-contamination:** Contamination of medicinal plant produce with any other produce during harvesting, processing, drying, packaging, storage or transport.



**Foreign Matter:** Any matter found with medicinal plant produce, other than the medicinal plant produce itself. This also includes parts of the same medicinal plant other than the officially accepted plant part or parts.

**Herbal Formulation<sup>2</sup>:** Herbal preparation obtained by subjecting the medicinal plants produce to treatments like – extraction, distillation, fractionation, purification, concentration, fermentation and blending. These include comminuted or powdered herbal drugs, tinctures, extracts, essential oils, expressed juices and processed exudates. Herbal formulation may be food, dietary supplement, medicine or a cosmetic preparation.

**Manufacturer:** A company or individual producing herbal formulations or extracts or active compounds using medicinal plant produce as the source material for such products.

**Medicinal Plant:** Any plant species including fungi, algae, lichen, fern, which is entirely or partly used, either alone or in combination, for therapeutic benefit or maintenance of health in humans, animals or both.

**Medicinal Plant Produce:** Any plant material - whole, fragmented or cut, usually dried but rarely fresh, obtained from a medicinal plant species, used for further preparation of products or sold commercially. This includes but is not restricted to – whole plant, root, leaves, stem, wood, bark, fruit, seeds, flower, floral parts, exudates, gum and resin. In this document, unless otherwise mentioned, medicinal plant produce means produce that is obtained from wild medicinal plants. The “Medicinal plant produce” is also interchangeably used as “Plant Produce” or “Produce” in this document.

**Phenological Stage:** Various phases of growth and development of plant in relation to season and microclimate of the habitat.

**Post-harvest Management:** Handling of the medicinal plant produce after it has been harvested from the mother plant until it is ready for the sale or further use.

**Primary Processing:** Washing, cutting, sorting, peeling, squeezing, brushing, drying and grading or any other such activity performed in making the medicinal plant produce usable.

**Standard Operating Procedure (SOP):** A written document having instructions for performing any operation.

**Sustainable Utilization of Medicinal Plants:** The use of wild medicinal plants, in a way and at a rate that does not lead to the long-term decline of the species, thereby maintaining its potential to meet the needs and aspirations of present as well as the future generations (5).

**Sustainable Harvesting:** The use of plant resources at such levels of harvesting and in such ways that the plants are able to continue to supply the desired produce in perpetuity(6).

**Wild Medicinal Plant:** Any medicinal plant growing in wild either on its own or as part of systematic propagation and any other resource management interventions.

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<sup>2</sup> *Herbal Drug Preparation as: Obtained by subjecting Herbal Drugs to treatments such as extraction, distillation, expression, fractionation, purification, concentration or fermentation. These include comminuted or powdered herbal drugs, tinctures, extracts, essential oils, expressed juices and processed exudates.*



## **2. Compliance to Regulatory Requirement**

The collection, processing, storage and sale of medicinal plant produce must be carried out in accordance with the existing laws. Being a concurrent subject, forests in India are regulated by both Central as well as State Governments, concurrently. This needs compliance to laws enacted by both Central and local Governments. Further, India being a signatory to various international treaties and conventions related to conservation of biodiversity, provisions laid down in such and other regulations applicable from time to time must be respected while collecting any medicinal plant produce from the wild.

### **2.1. International regulation and guidelines:**

Provisions laid down in the CITES regulations must be adhered to while collecting any medicinal plant produce from the wild. In case the medicinal plant produce is meant for export, existing laws of the importing country must be honoured. Besides the regulatory authorities in the country of import, local secretariats of CITES, IUCN and TRAFFIC International may be consulted for such laws and regulations.

### **2.2. National regulations:**

Government of India, from time to time, has enacted various Acts to ensure conservation and sustainable use of wild resources including medicinal plants. Indian Forest Act 1927, The Wildlife (Protection) Act 1972, The Forest (Conservation) Act 1980, The Biological Diversity Act 2002, The Scheduled Tribes and Other Traditional Forest-Dwellers (Recognition of Forest Rights) Act 2006 contain provisions related to collection, transit and trade of medicinal plant produce. Collectors and collection managers must keep themselves updated about the provisions in such Acts, Rules and amendments made from time to time and must abide by the conditions laid down in them. In addition to the Acts and Rules, collectors should also be aware about Export-import policy and the negative list of export, brought out from time to time by Govt. of India in order to comply with the provisions laid down in such policy documents.

### **2.3. Local regulations:**

Majority of the States in India have additional laws enacted and enforced for regulating removal and use forest resources. Some of the examples are – The Madhya Pradesh Sustainable Harvesting Act 2005, The Andhra Pradesh Red Sanders Wood Possession Rules 1989, The HP Forest Produce Transit (Land Routes) Rules, 1977, The Tamil Nadu Sandalwood Transit Rules, 1967, and The Maharashtra Forest Produce (Regulation of Trade) Act, 1969.



Further, most of the States in India have modified Indian Forest Act 1927, to accommodate the regional intricacies and necessities of conservation and utilization of wild resources. Collectors/collection managers should be aware of such regulation governing the collection, transit and sale of the medicinal plant produce applicable at the time of such activity in the given area and should abide by the rules therein.

**2.4. Permission for collections:**

Wherever the provision requires, collectors/collection managers should take prior written permission from the authorized agency for collection, possession, transit and sale of the medicinal plant produce. The documentary proof of such permissions must be kept in safe custody. Such medicinal plant produce, when traded, must be accompanied by appropriate documentation in accordance with the laws.



### **3. Harvesting of Medicinal Plant Produce**

Medicinal plants should be harvested in such ways and at such rates that the species perpetuates indefinitely in its natural habits. Collectors should adopt such practices that do not merely fulfill their commercial needs but also ensure that the produce the quality. Collectors/collection managers should adopt following guidelines for harvesting the medicinal plants produce.

#### **3.1. Quality Considerations:**

##### **3.1.1. Botanical authenticity of species:**

Botanical identity must be established before a plant species is collected from the wild. The comprehensive identity of the plant from which the produce is being collected should be verified and recorded. The information sought should include - genus, species, sub-species, if any, along with author citation. The species collected should be same as described in Ayurvedic Pharmacopoeia of India (7), Homoeopathic Pharmacopoeia of India (8), Siddha Pharmacopoeia of India (9) Unani Pharmacopoeia of India (10), Indian Pharmacopoeia (11), Indian Herbal Pharmacopoeia (12) or any recognized reference books like ICMR Monographs (13) or Major Herbs of Ayurveda (14). If a new medicinal plant species is being collected, which does not have any monographs in any of the pharmacopoeias or reference books, its identity should be established in consultation with BSI or FRI or any recognized national or regional herbaria.

##### **3.1.2. Collection of healthy plants:**

Only healthy individuals of desired plant species should be harvested. Plants, which are infested with insects, pests, fungi, bacteria or virus, should be avoided (unless the medicinal value of the species comes from such associations as in the case of insect galls, agar wood and specified parts developed due to pathogens) as such infested plant produce may deteriorate the whole lot.

##### **3.1.3. Harvesting at right phenological stage:**

The concentration of biologically active substances varies with the stages of growth and development of plant. In order to ensure optimum quantity of biologically active substances in the medicinal plant produce, the harvesting should be done at appropriate developmental stage. For those species where right stage of collection is not known, collection managers may seek guidance from the responsible person of the finished product manufacturers for such medicinal species for herbal formulations. The collection time in terms of phenological stage of plant species along with dates and months for each medicinal plant must be documented.



#### **3.1.4. Weather conditions for collection:**

Harvesting should not be done during rain, mist or exceptionally high humid conditions as this would encourage fungal attack. If harvesting in wet conditions becomes inevitable, provisions should be made to dry the water content as soon as possible from the produce. Wet plant material may be dried in intermittent light and shade. Collection should not be done during early hours to avoid dew, unless it is a specific need for any produce (e.g. floral parts like stigmas and anthers are better harvested under dew).

#### **3.1.5. Right places for collection:**

Collection of medicinal plant produce should be done only from places, which are clean and free from any possible exposure to insects, chemicals, toxic gases, sewage, automobiles etc. Collection from or near anthills, industrial areas, sewage lines, crematoria, hospitals, mining sites, public utilities, automobile workshops and any other places, which are likely to contaminate the medicinal plant produce, should never be done. Medicinal plant produce should not be harvested from plants close to roadside as perpetual exposure to vehicular exhaust might have rendered the plant and its produce unsuitable for human consumption.

#### **3.1.6. Sorting of produce:**

The medicinal plant produce should be sorted out from any immature or over matured produce, which may downgrade the overall quality of the lot. Where trading of different grades of produce is in vogue, grading should also be done in accordance with established parameters. The basis of such grade-wise sorting should be defined objectively (e.g. diameter of roots, size or weight of the fruit etc.)<sup>3</sup> Sorting for various grades may be done either immediately after the harvesting or after drying of the produce depending upon the ease of sorting.

#### **3.1.7. Foreign matter:**

Care should be taken to avoid any accidental mixing of foreign matter with medicinal plant produce. There is high probability of soil particles, organic matters like leaves, stems, wood pieces or food articles being inadvertently mixed with the medicinal plant produce during the harvesting and post harvest management. Collectors should be vigilant to avoid such mixing. Cross-contamination with other medicinal plant produce being harvested or processed simultaneously should also be avoided.

#### **3.1.8. Mixing of Toxic weeds:**

In nature, the desired medicinal plant may be growing in close vicinity with some toxic weed. While harvesting the produce, care should be taken to ensure that no such toxic weeds get mixed with medicinal plant produce.

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<sup>3</sup> For example, there are AGMARK grading rules for Khadira, the dried pieces of heart-wood of *Acacia catechu*: <http://www.agmarknet.nic.in/catechugmr.pdf>





### **3.2. Environmental Considerations:**

The collection of medicinal plants from wild may threaten the ecosystem in more than one ways in the absence of adequate pre-emptive measures. The consequences of unsustainable harvesting of many plant species are evident at global scale (15). The over exploitation of any plant species may threaten the existence of the species in natural habitat. Ignorance of the adverse environmental impact of over- exploitation may affect the ecological balance and loss of genetic diversity of the surrounding habitats.

The presence of collectors within the ecosystems, be it forests, grasslands or any other, is bound to influence the species of flora and fauna of the surroundings. Collection practices should ensure the long- term survival of wild populations and their associated natural habitats. Before collection of plant materials, collectors may consult the local resource managers or botanists well conversant with the local ecosystem. Application of the Principles and Criteria of the International Standard for Sustainable Collection of wild medicinal plants (ISSC – MAP) developed by the IUCN/WWF/BfN through an intensive consultation of various stakeholders. This application can be ensured through different paths such as a scientific resource management regime, legal and regulatory adherence or through a certification process. (16)

#### **3.2.1. Conservation status of species:**

Regulators (e.g. forest and wild life field officials) as well as the collectors must be aware of the current conservation status of the desired plant species. The RET status of the plant species in the respective areas should be known and any existing regulation applicable in the area of collection to conserve such species should be adhered to.

#### **3.2.2. Sensitive species:**

Collection managers should be aware of endemic plant species available in the areas of collection and should adhere to the existing legal and ecological prescriptions to ensure that the species is not subjected to an increased threat.

#### **3.2.3. Distribution of species:**

The quantity of collection of any plant species should be commensurate with the distribution of the species in the area of collection, including their geographic domain. Collection of a species should only be done from areas where its frequency of occurrence is sustainable.

#### **3.2.4. Regeneration of species:**

Medicinal plant species should be harvested within the limits of their capacity for regeneration. In any given population certain percentage of the population should be left as such so as to allow the natural regeneration. The population size to be left may



vary from species to species, depending on the habit and intrinsic regenerative capability of the species.

**3.2.5. Frequency of collection:**

Irrespective of the demand of any medicinal plant produce, its collection cycle should synchronize with the regeneration cycle of the plant species or the produce, whichever is the case. Enough gaps should be given for the plant to recoup the harvested parts.

**3.2.6. Minimizing the harm to source plant:**

While collecting the desired plant parts such as leaves, fruits, flowers, seeds etc. efforts should be made to minimize harm to the plant from which these parts are being harvested. Cutting the branches to ease collection of its bearings (fruits, leaves, flowers etc.) should not be attempted.

**3.2.7. Habitat management:**

While harvesting the desired species, collectors should ensure that the damage to habitat of the species is minimized to ensure its sustainability. It is especially important where roots or other underground parts are to be harvested but result in uprooting of the associated species, which are otherwise of no interest to the collector. Climbers and twiners should be harvested in a way so as to cause least disturbance to associated plant species. Certain species only occur in specialized habitats (e.g. *Acorus calamus* in waterlogged areas or *Bergenia ciliata* syn. *Bergenia ligulata* on rock crevices). Due care should be taken to avoid destruction of such specialized habitats in wild while collecting produce from such plant species.

**3.2.8. Equipments for collection:**

Equipment used for digging, cutting, sorting, peeling and any other activity must be suitable for the purpose they are used. Equipment should be made of a non-toxic material and should be maintained in proper working condition. It is particularly important to ensure that parts of the equipment, which come in direct contact with the produce, are clean and free from any potential contaminant like paint, lubricant etc. Tools that are used for activities like cutting, shearing, spilling or peeling must be thoroughly cleaned after use to avoid cross contamination with the remaining residues.

**3.3. Social Considerations:**

The social impact of large-scale collection from wild on local communities should be observed to ensure that negative impact on their livelihoods is avoided. In case of organized large-scale collection, care should be taken that local inhabitants get the equitable employment opportunities and wages.



### **3.3.1. Local use of the species:**

In India, local people enjoy certain bonafide rights over the wild resources for food, fodder, fuel wood, medicines, wild craft, agricultural implements etc. Further, local healers in India collect medicinal plant produce for use as raw materials for their medicinal recipes from forests. The organized collection of medicinal plant produce from the wild should not affect the availability of species for use by local people. (ISSC-MAP Criterion 4.1: Traditional use, access rights, and cultural heritage)

### **3.3.2. Fair Pricing:**

The collectors of medicinal plant produce often do not get returns, which commensurate with their efforts under current supply chain mechanism in India (17). Provisions should be laid down for a fair price mechanism for all the species that are harvested.

### **3.3.3. Benefit Sharing:**

The Biological Diversity Act, 2002 of India has the provision of benefit sharing for medicinal plant resources and the associated knowledge. Mechanism for a fair and equitable benefit sharing should be evolved and adhered to by all the stakeholders of medicinal plant produce.

### **3.3.4. Health Status of Collectors:**

Persons having allergies to natural ingredients such as pollens, plant exudates, aromas should avoid collection from the wild. Those with open wounds, inflammations and skin infections should keep away from the areas, where primary processing is taking place. Collectors should consider wearing appropriate personal protective equipments like safety shoes, gloves, and eye and nose protection while collecting produce from wild habitats.

### **3.3.5. Cultural Considerations:**

The harvesting as well as the post-harvest management of medicinal plant produce must be carried out in accordance with ethical codes and norms of local community and the region in which the activities take place. Various plant species in India are attached with some social and religious values. Plants like Tulsi (*Ocimum spp.*), Doorba (*Cynodon dactylon*), Bael (*Aegle marmelos*), Peepal (*Ficus religiosa*), Mango (*Mangifera indica*) etc. are considered holy in certain communities and selected individual or population of such species may not be allowed to be harvested by the society. Further certain acts (e.g. touching the holy species with feet) may be considered inauspicious in some communities. Due respect should be given to such values during harvesting and post harvest management of medicinal plant produce.



## 4. Post Harvest Management

### 4.1. Primary Processing:

Timely and right processing of medicinal plant produce after it has been harvested is imperative to preserve the quality and enhance shelf life of the produce. After harvesting, the produce should be separated from any organic or inorganic matter stuck to it. Any part of the mother plant, that does not constitute official medicinal plant produce. (e. g. immature lateral roots where taproot is the officially recognized produce), should be removed. If the soil is attached to the harvested produce, which is common with the underground parts, it should be washed with potable water. In some cases, the harvested produce may need to be scraped, peeled or brushed. Such processed produce should be washed with potable water before drying the same.

### 4.2. Drying:

The medicinal plant produce should be properly dried before it is packed for shipping or storage. Information on the optimum moisture content of particular produce may be obtained from national pharmacopoeias and other monographs (7-13). Medicinal plant produce such as rhizomes, fleshy roots, fleshy stem (*Cissus*), fleshy leaves (*Aloe*), pulpy fruits, woody parts, fleshy petals and those containing polysaccharides need more attention to ensure proper drying. The following points may be useful to achieve better processing and drying of medicinal plant produce:

- 4.2.1.** In case the harvested produce is morphologically thick, fleshy or of bigger size, it should be cut or sliced into small/ thin pieces to ensure proper drying of the produce. The produce should be cut into pieces in a manner that enhances the drying while retaining the visual appearance of the produce.
- 4.2.2.** Where the delicate plant parts and aromatic parts constitute the produce, these should be dried only under shade. If a medicinal plant produce, which needs to be dried in shade, is in wet condition, it may be dried under sunlight initially to get rid of external moisture, before being transferred to shade. Collectors should seek guidance from the buyers of the produce to choose sun drying, air-drying, shade drying or combinations on a case-to-case basis.
- 4.2.3.** In case of open sun or air-drying, the medicinal plant produce must be spread out in a thin layer on a drying frame. In absence of drying frame a sheet of cloth or tarpaulin can be used to spread the produce. Spreading the produce directly on the ground should be avoided. The produce should be stirred up or turned upside down at frequent intervals to allow even and complete drying.



- 4.2.4.** During drying cycles (sun drying or shade drying), care should be taken that, the materials are moved into covered/ partially covered spaces during evening hours. This practice prevents undesirable exposure to night fog, unforeseen night drizzles etc.
- 4.2.5.** Artificial means of drying like oven or hot air may also be used. However, such procedures must be standardized and validated for their overall effect on the quality of medicinal plant produce before introduction at field level. The temperature range and time duration in such drying should be recorded and documented.
- 4.2.6.** The quality and safety risk of sun drying, if not done with sufficient protection (for example the potential for salmonella spot contamination from bird excreta) must be given due importance.



## 5. Packaging and Storage

### 5.1. Packaging of Medicinal Plant Produce:

The storage containers of medicinal plant produce must provide protection from heat, humidity and temperature and at the same time should not contaminate the produce. Each category of produce requires specific packaging needs. Appendix 1 enlists a few packaging options for Indian medicinal plant produce, which can be adopted. In no circumstance, previously used bags for food articles, construction articles such as cement, sand or that of fertilizers or other chemicals should be used for packing medicinal produce. The containers of the medicinal plant produce should not be cross-used, though the containers of same species and produce may be used.

While handling material in bulk (like Shankhapushpi, Bhringaraj, Bhumyamlaki etc), effort should be made for “compaction” using, manually/ mechanically operated compactors (termed as “bale-packing” like the ones use for packing cotton). This practice helps the communities in minimizing the storage area requirements and for primary transport purposes.

Each container of medicinal plant produce should be labeled properly. The label should contain all the required information of medicinal plant produce. A prototype label is given as Appendix II.

### 5.2. Storage of Medicinal Plant Produce:

Storage of produce is of utmost importance as inappropriate storage conditions may render the produce unusable, no matter with what care it has been harvested and processed. Following storage recommendations may be adopted, which will help protect the quality of the medicinal plant produce during storage:

- 5.2.1.** Medicinal plant produce should be stored in a dedicated storehouse, constructed in such away as to avoid entry of rodents, birds and other animals and should be free from dampness, dirt and dust. Medicinal plant produce should never be stored in open areas and in or near cattle sheds.
- 5.2.2.** The storehouse should have provision for keeping approved, rejected and untested lots separately with appropriate signboards.
- 5.2.3.** Properly sealed and labeled containers of medicinal plant produce should be kept preferably on wooden pallets, at cool and dry places. Never stack the containers, especially gunny bags, jute bags, woven sacks, corrugated box etc. directly on the floor.
- 5.2.4.** Dedicated areas for each species should be clearly earmarked and enough space should be left between two species and different parts of same species to ensure smooth movement of persons and machine and to avoid any cross-contamination. Containers of two or more medicinal plant produces should never be stacked one



above the other.

- 5.2.5.** Each lot of the produce should have its shelf life clearly marked on its label and the produce should be used within the valid shelf life period. In case of traders, the supplies of the produce should be done in a way so as to allow enough shelf life period to the manufacturers. To the greatest possible extent, the medicinal plant produce should be supplied/consumed on FIFO (First in first out) basis to minimize storage of old stock. FIFO system allows sequential use of produce, in order of the arrivals in the storehouse. Documentation of produce coming in and going out should be displayed at an appropriate place to know the exact availability of the medicinal plant produce in stock.
- 5.2.6.** There should be provision for separate climate (temperature and humidity) controlled facility to store hygroscopic material and volatile material.
- 5.2.7.** Inflammable produce like resins, gum-resins, oils etc. should be stored at isolated place in closed containers (flammable materials should be clearly labeled as such on each container).



## **6. Guidelines for collection and post-harvest management of various Categories of Medicinal Plant Produce**

The whole plant is used as a medicinal plant produce only in a few cases. Often it is one or more part like root, bark, stem, leaves, flowers, fruits, seeds of the species which constitute the officially accepted produce. While the general guidelines for harvesting and post-harvest management are applicable to any collected part, the specific plant parts need additional care, Appendix III.

Ancient science, like Ayurveda, recommends collecting different parts of the plants in different seasons. This was perhaps done keeping in view the optimum activity of herbs when harvested at a specific season. Further, collecting the parts from the plant at a season when it causes the minimum harm to the plant is also important.

It is recommended that a detailed SOP should be written for each category of produce in order to minimize the harm to nature and to optimize the quality of the produce. Some of the important points, which need to be taken care of while harvesting various categories, are given below.

### **6.1. Underground parts:**

- 6.1.1.** The roots of annual plants must be dug when the plants are well developed and mature.
- 6.1.2.** Roots of perennials should be harvested late in the fall or early in the spring. Roots of biennial should be collected in either the fall of the first year or spring of the second year.
- 6.1.3.** The root material that is rich in essential oils should be handled carefully to prevent bruising of the epidermis, where the oils typically reside, which could result in loss of essential oil or its degradation.
- 6.1.4.** Unless otherwise required for any specific species, underground parts like roots and rhizomes should be collected only after the seed shedding. It also facilitates regeneration of species.
- 6.1.5.** Where taproot is the desired produce and needs to be uprooted, harm to other plant species in the vicinity should be minimized. Underground parts should be collected with minimum possible digging by using appropriate tools.
- 6.1.6.** When roots of species that are propagated vegetatively in nature are collected, enough underground part should be left at site to allow regeneration.
- 6.1.7.** It must be ensured that underground parts are thoroughly washed and thereafter dried to reduce the moisture content before packing the produce.

### **6.2. Annual herbs/ Whole plants:**

- 6.2.1.** When collecting whole herbaceous plant, or its aerial parts, the harvesting should be done at flower bud or flowering stage but prior to any visual decline in any of the plant parts.





- 6.2.2. Whole population in a given area should never be harvested. Adequate population should be left in nature for regeneration to facilitate future collections.
- 6.2.3. Use of mathematical procedures including computer softwares to estimate collection of individuals from a population may be resorted when target area is large to ensure even harvesting throughout the habitat.
- 6.2.4. Annuals, especially small herbs, creepers, grasses are more prone to contamination as well as cross-contamination. It is easier to sort the annuals immediately after the collection rather than after drying.
- 6.2.5. Aromatic plants and delicate parts like pistils or stamens of the other plants should not be dried in direct sunlight. If these are collected in wet conditions, they should be shifted to the shade as soon as the external moisture has been removed.

### **6.3. Stem Bark:**

- 6.3.1. Stem bark should not be harvested when the tree is under new growth (like spring season)
- 6.3.2. As far as possible, the bark should be collected from mature branches of the trees leaving the main trunk intact. Bark from entire branch or trunk should not be taken at one time.
- 6.3.3. Girdling of trees or branches by removing the bark all the way around should not be done, unless the tree is to be felled for other purposes like, timber. Bark should be stripped longitudinally (partially along the length of the stem) to allow smooth conduction of water and nutrients.
- 6.3.4. Stem bark should not be collected again from same tree unless adequate time has been allowed for it to be reformed completely. It should not be collected from immature trees or branches.
- 6.3.5. The rhytidome (outer dead bark) should be removed except where it is the usable part of the produce.
- 6.3.6. The bark should be split in pieces of appropriate size to ensure complete drying.
- 6.3.7. Unless otherwise required in specific cases, barks should be dried in direct sunlight

### **6.4. Stem or wood:**

- 6.4.1. Only select mature branches of a tree or shrub should be harvested at a time. The branches from the same plant should not be harvested every year. Where the trunk is used as medicinal produce, the main axis should be harvested.
- 6.4.2. The produce should be cut in smaller pieces to facilitate faster drying, packaging and



storage of the produce. In case of wood, the material can be made into small chips or shavings to facilitate drying and packaging.

**6.4.3.** Unless otherwise required in specific cases, stems and woods should be dried in direct sunlight.

### **6.5. Leaves:**

**6.5.1.** The leaves of herbaceous plants should be collected before their flowering, unless otherwise specified. As far as possible, leaves should be collected from mature trees. Where bio-active contents in the leaves do not fluctuate with age, the collection could be extended to later stage also.

**6.5.2.** The source plant should not be ripped off the leaves completely. Certain percentage of leaves should be left to ensure normal physiological processes of the plant.

**6.5.3.** Trees, shrubs or their branches should not be chopped to facilitate the collection of otherwise inaccessible leaves.

**6.5.4.** Tender leaves should not be harvested unless they constitute the officially recognized produce. Leaves turned pale, those infected, deficient and unhealthy should be discarded.

**6.5.5.** Generally leaves should not be dried in direct sunlight, unless they have external moisture, in which case they may initially be dried in direct sunlight for some time and be shifted to shade or indirect sunlight as soon as the external moisture is wiped dry. The produce should be turned periodically while drying to facilitate faster and even drying.

**6.5.6.** Packing of the leaves should be done after ensuring the complete drying. Even a small amount of moisture present in some leaves, may invite fungal contamination and spoilage of whole lot.

**6.5.7.** Leaf material rich in essential oil must be handled carefully to avoid bruising of the leaves that could result in loss of essential oil or its degradation.

**6.5.8.** The leaves should be harvested during the season when growth and leaf production is the highest.

**6.5.9.** When environmental conditions are stressful for the plants leaf harvesting should be postponed or should be harvested in less quantity.

**6.5.10.** If the leaf size is decreasing the rate of harvest should be lowered as it indicates stressful condition.

**6.5.11.** If the plant size in a population appears to be decreasing, even if vegetative sprouting is increasing (i.e. the population is becoming dense), the rate of harvest should be lowered.

**6.5.12.** The rate of harvest should be decreased if there is heavy pressure from grazing, fire or other incidents that may negatively affect the plants.



## **6.6. Flower and floral parts:**

- 6.6.1.** Flowers must be harvested (or if specified, flowering tops) when they have just opened or shortly afterwards to capture its aroma.
- 6.6.2.** The flower buds must be collected before the buds open and in early morning hours. In this case the departure of insects must be encouraged by shaking the materials.
- 6.6.3.** The flowers rich in essential oils must be handled carefully to prevent bruising that could result in essential oil degradation.
- 6.6.4.** All the flowers from perennials like shrubs, trees and climbers should not be harvested completely. Similarly, flowers from a complete population of annual plants should not be collected at a time. Enough flowers must be left over the plants to allow the natural process of pollination, fertilization, fruit/seed formation and dispersal.
- 6.6.5.** Floral parts like stigma, anthers, petals etc should be collected at appropriate time of their maturity to ensure the availability of desired active substance.
- 6.6.6.** The delicate flowers and floral parts should not be dried in direct sun light. Flowers that are fleshy (like *Madhuca indica*) may be initially dried in sun to get rid of surface moisture and shifted to shade or indirect sunlight afterward.
- 6.6.7.** Medicinal plant produce consisting of flowers and floral parts should be packed in moisture resistant well-protected containers, away from direct sun light.

## **6.7. Fruits and seeds:**

- 6.7.1.** Fruits and seeds should be collected only on maturity unless immature ones constitute the medicinal produce (e.g. *Emblca officinalis*, *Aegle marmelos*) except the fruit of family Apiaceae that dehisce on drying should also be collected before maturation .
- 6.7.2.** In case of shrubs and trees, all the fruits from individual plant should not be collected at a time leaving behind a few healthy ones for further multiplication of the species. Similarly, the whole population of annuals should not be ripped off all the fruits and seeds at a time.
- 6.7.3.** Trees, shrubs or their branches should not be cut for ease of collection of fruits and seeds.
- 6.7.4.** Immature, infected and deformed fruits should be separated and discarded appropriately.
- 6.7.5.** If the medicinal plant produce consists of fresh fruits (e.g. *Phyllanthus emblica*) the same should be transported to cold storage or pulping units immediately after harvesting.
- 6.7.6.** Wherever required, seeds should be removed completely from the fruit rind before they are traded.
- 6.7.7.** As per the need of the produce, fruits may be split or cut into small pieces to facilitate drying and packaging.
- 6.7.8.** Complete drying of fruits should be ensured before they are packed. Randomly selected individuals fruits should be dissected to ensure that there is no inherent moisture left.



## **6.8. Gums and resins:**

- 6.8.1.** Collectors/collection managers should ensure minimum harm to the mother plant while collecting the exudates. Only a few small longitudinal incisions should be made to collect the exudates and the exposed parts should be treated appropriately to avoid any fungal or bacterial infestation after the exudates has been collected.
- 6.8.2.** Incisions, too close to the ground, easily approachable by the cattle and wild animals, should be avoided. The collection container should be designed in a way to prevent rain, bird droppings and any other such possible contaminations.
- 6.8.3.** Where there is a likelihood of some foreign matter being mixed with the collect gums and resins, it should be carefully removed.
- 6.8.4.** Source tree or shrub should be allowed appropriate recovery period before collecting the exudates again from them.
- 6.8.5.** Most of the gums and resins, being inflammable, should be packed in appropriate containers and stored at isolated places. The containers of resins like Damar (*Shorea robusta*) and Saral (*Pinus longifolia*) should be labeled as "Inflammable Material", while on transit and storage.
- 6.8.6.** No fire should be ignited near the base of the tree to increase gum/resin flow.
- 6.8.7.** Younger trees should not be tapped. The girth of the trees has to be decided below which tapping of gum/resin will not be allowed.
- 6.8.8.** Flow of gum is more in hot weather. Therefore, tapping in such species, should be done between June-October.
- 6.8.9.** Long sharp cut blazes are best as they give pure resin/gum and the bark heals faster. Irregular cuts add impurities to the resin. Long cuts are better as they provide more area for exudation and heal faster. Square and round cuts take longer time to heal as the distance between the two walls is more.
- 6.8.10.** Sharp knives or chisels can be used to make blazes.
- 6.8.11.** Instead of letting the gum or resin solidify on the bark, it is better to fix a collection trough e.g. coconut shell, hollow bamboo etc.
- 6.8.12.** On the same tree more than one blaze is made, these should be staggered for optimum exudation. After 3 years of tapping, sufficient rest should be given to the tree to rejuvenate from the injury.

## **6.9. Others (Galls, Lac etc.):**

- 6.9.1.** Galls should be collected only from stipulated species (Karkatshringi from *Pistacia intergerrima*).
- 6.9.2.** Collectors must ensure that no live insects are present inside the galls.
- 6.9.3.** Post harvest management of galls should be done at an isolated place and the content should be packed and stored appropriately so as to avoid possible infestation of other produce.



## 7. Documentation

The documentation of essential information related to collection of medicinal plant produce carries two distinct advantages. Firstly, it allows smooth tracing of history and quality of produce. Secondly, it facilitates in drawing all tactical plans related to the collection activity. To the extent possible, therefore, collectors, supervisors or managers should ensure that maximum information is recorded during the collection of the produce. Observations like phenological stage vis-à-vis the quality of the produce may help plan future collection of the species at right season. Following information may be recorded during harvesting and post harvest management of medicinal plant produce:

- 7.1. The basic information about the plant species, area of collection, time of collection, regulatory information etc. must be captured. All the medicinal plant produce in trade should accompany a document containing information, enough to trace its identity, history, habitat, time of collection, grade etc. An outline for recording such passport data is given as Appendix -III, which collectors can adopt. This may be modified to suit the species from case to case basis. The passport data sheet should go to all buyers till the produce is finally processed to make the ASU or the herbal formulations.
- 7.2. The phenological stage of species at the time of collection.
- 7.3. All processes or events that could affect the quality of the produce. Extra-ordinary circumstances, which could influence the content of the produce such as extreme conditions (e.g. drought) during the harvest time.
- 7.4. All agreements between collectors (e.g. co-operative society, village Panchayat etc.) with traders and manufacturers.
- 7.5. The drying conditions and temperature range, if artificial drying has been employed.
- 7.6. Wherever the collectors have taken the permission for harvesting, processing or storage of plant produce, proper records of such permits should be maintained. All the permits obtained from the authorities, should be kept in safe custody and should be available for verification by regulators, traders and manufactures. A copy of such permits should accompany the produce in trade up to the point of use.



## 8. Training and Monitoring

### 8.1. Training and capacity building:

Proper training for ensuring the collection of quality produce without any negative impact on the environment should be imparted to the collectors. Provision should be made to train the collectors about the recommendations made in this document.

Collectors should have received adequate botanical training on areas like – identification of species and their produce, understanding of phenological stages of plant, broad internal (e.g. heart wood and sap wood) and external structures (e.g. rhytidome) along with some appreciation of natural processes like pollination, regeneration etc, which occur in nature. Collectors should also be in a position to discriminate the morphologically similar looking but botanically different species in the nature to avoid collection from wrong plant species.

The collection managers and collectors should also be imparted adequate training on regulatory requirements for collection from specific sites and the procedures to fulfill such requirements. Collectors should be made aware of various situations of collections, which can be detrimental to the habitat and environment. They should be instructed on all the issues related to protection of environment and conservation of plant species.

The Table at Appendix IV gives the most appropriate seasons for collection of plant parts of different medicinal plant species. The collection season may, however, vary from region to region depending on climatic differences. The actual season for harvest be, however finalized in consultation with the local Forest Department, the industry and the trade.

Collectors should be aware of the need of maintaining better personal hygiene as well as their personal safety at collection sites.

### 8.2. Baseline Assessment and Monitoring:

Demand and supply mismatch is the primary reason for unsustainable harvesting and quality degradation. Baseline assessment of availability of medicinal plant produce in wild should be done adopting mathematical approaches (18) including computer softwares. The assessment should also be done for sustainable level of harvesting for each species at least for those likely to be threatened in short durations. Once the baseline data is available, the regular monitoring should be carried out as a part of routine management plan. Wherever it is not possible to arrive at sustainable level of harvest, it can be carried out with reference to supply (for example setting of extraction quotas) or with reference to both supply and demand (determine whether supplies from a particular area will be sufficient for a given purpose) (18) including computer softwares. The assessment should also be done for sustainable level of harvesting for each species at least for those likely to be threatened in short durations. Once the baseline data is available, the regular monitoring should be carried out as a part of routine management plan.

Wherever it is not possible to arrive at sustainable level of harvesting, it can be carried out with reference to supply (for example setting of extraction quotas) or with reference to both supply and demand (determine whether supplies from a particular area will be sufficient for a given purpose) (18)



## Appendix I

### Recommended packaging for Medicinal Produce

Type of the Produce	Packaging Options
Woody in nature – roots, stem, wood, woody bark etc.	<ol style="list-style-type: none"><li>1. Gunny Bags</li><li>2. Jute Bags</li><li>3. Woven Sacks</li></ol>
Annual whole herbs, creepers, twiners, leaves, etc.	<ol style="list-style-type: none"><li>1. Woven sacks with low density liner</li><li>2. Jute bags</li></ol>
Fleshy materials-fleshy rhizomes (e.g. Shatavari), fruit rinds (Kokum butter) of flowers (Mahua), fruit (Amla) etc.	<ol style="list-style-type: none"><li>1. Jute bags with high gauge polyethylene liners</li><li>2. Woven sacks with high gauge polyethylene liners</li></ol>
Delicate flowers and floral parts – Anthers, Stigma, Petals etc.	<ol style="list-style-type: none"><li>1. Corrugated box with polyethylene liners</li><li>2. Card-board box with woven sacks</li></ol>
Gums and resins	<ol style="list-style-type: none"><li>1. Air-tight Plastic drums</li><li>2. Corrugated box with polyethylene liners</li></ol>
Aromatic plant produces	<ol style="list-style-type: none"><li>1. Air tight High Density Polyethylene (HDPE) containers</li><li>2. Fiber board drums with polyethylene liners</li></ol>



## Appendix II

### Information on container label

The Label of the container of medicinal produce should bear following information

1. Name of the produce		2. Grade, if any	
3. Quantity		4. Date of receipt (from Collector)	
5. Shelf Life or Best before date		6. Collected from	
7. Quality Analysis Status	e.g. Approved/ Rejected/On Hold	8. Quality Report No and Date	
Signature of the Store Manager		Date:	





## Appendix III

### Passport data sheet for Medicinal Plant Produce

Name of Produce and grade, if any:		Plant Source:	
Part used:		Quantity harvested: (Dried produce)	
Collected by:		How was the produce dried:	
Collected from (give name of region/ forest/ community land, along with village, Taluka, District and State)			
Period during which the produce was collected		Moisture content at the time of packaging	
Does the species need prior permission to collect from wild		Name of the authority who has given the permission	
Phenological state of the plant when collection of produce was undertaken			
Any other information on produce:			



## Appendix IV

### Harvesting Time of Selected Medicinal Plants

Name of the herb	Local Name	Part Used	Season for Collection*			
			February to April	May to July	August to October	November to January
<i>Abies webbiana</i>	Talishpatra	Leaves		√	√	
<i>Acacia chundra</i>	Khadir	Wood				√
<i>Acacia nilotica</i>	Babool	Bark			√	
<i>Achyranthes aspera</i>	Apamarga	Whole Plant	√			
<i>Aconitum ferox</i>	Ativisha	Rhizome			√	
<i>Aconitum heterophyllum</i>	Atish	Rhizome			√	
<i>Acorus calamus</i>	Vacha	Rhizome		√		
<i>Adhatoda vasica</i>	Adusa	Leaves	√			
<i>Aegle marmelos</i>	Belgiri	Fruit	–	√		
	Belchhal	Bark	√	--		
<i>Alpinia galanga</i>	Kulinjana	Rhizome			√	
<i>Alstonia scholaris</i>	Saptaparni	Bark		√		
<i>Andrographis paniculata</i>	Kalmegh	Aerial Parts	√			√
<i>Aquilaria agallocha</i>	Agaru	Stem		√		
<i>Argyrea speciosa</i>	Vidhara	Root		√		
<i>Asparagus adscendens</i>	Safed Musli	Root			√	
<i>Asparagus racemosus</i>	Shatawari	Root			√	
<i>Azadirachta indica</i>	Neem	Leaves		√		--
		Bark		--		√
<i>Barringtonia acutangula</i>	Hizzal	Seeds			√	
<i>Berberis aristata</i>	Daruhaldi	Roots/Stem			√	
<i>Blepharis edulis</i>	Utigan Beej	Seeds	√	√		
<i>Boerhaavia diffusa</i>	Punarnava	Aerial Parts		√		
		Root		√	√	
<i>Boswellia serrata</i>	Sallaki	Gum-resin	√			√