

COLLECTION AND POST-HARVEST MANAGEMENT PRACTICES*

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.

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.

1. **Underground parts:**

- The roots of annual plants must be dug when the plants are well developed and mature. 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.
- 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.
- 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.

*World Health Organization (2003) WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. World Health Organization, Geneva.

- 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.
- When roots of species that are propagated vegetatively in nature are collected, enough underground part should be left at site to allow regeneration.
- It must be ensured that underground parts are thoroughly washed and thereafter dried to reduce the moisture content before packing the produce.

2. Annual herbs/ Whole plants:

- 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.
- Whole population in a given area should never be harvested. Adequate population should be left in nature for regeneration to facilitate future collections.
- Use of mathematical procedures including computer software to estimate collection of individuals from a population may be resorted when target area is large to ensure even harvesting throughout the habitat.
- 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.
- 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.

3. Stem Bark:

- Stem bark should not be harvested when the tree is under new growth (like spring season)
- 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.
- 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.
- 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

- The rhytidome (outer dead bark) should be removed except where it is the usable part of the produce
- The bark should be split in pieces of appropriate size to ensure complete drying
- Unless otherwise required in specific cases, barks should be dried in direct sunlight

4. Stem or wood:

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

5. Leaves:

- 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.
- 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.
- Trees, shrubs or their branches should not be chopped to facilitate the collection of otherwise inaccessible leaves.
- Tender leaves should not be harvested unless they constitute the officially recognized produce. Leaves turned pale, those infected, deficient and unhealthy should be discarded.
- 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.
- 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.

- 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.
- The leaves should be harvested during the season when growth and leaf production is the highest.
- When environmental conditions are stressful for the plants leaf harvesting should be postponed or should be harvested in less quantity.
- If the leaf size is decreasing the rate of harvest should be lowered as it indicates stressful condition.
- 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.
- 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. Flower and floral parts:

- Flowers must be harvested (or if specified, flowering tops) when they have just opened or shortly afterwards to capture its aroma.
- 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.
- The flowers rich in essential oils must be handled carefully to prevent bruising that could result in essential oil degradation.
- 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.
- Floral parts like stigma, anthers, petals etc. should be collected at appropriate time of their maturity to ensure the availability of desired active substance.
- 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.
- Medicinal plant produce consisting of flowers and floral parts should be packed in moisture resistant well-protected containers, away from direct sun light.

7. Fruits and seeds:

- Fruits and seeds should be collected only on maturity unless immature ones constitute the medicinal produce (e.g. *Emblica officinalis*, *Aegle marmelos*) except the fruit of family Apiaceae that dehisce on drying should also be collected before maturation .
- 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.
- Trees, shrubs or their branches should not be cut for ease of collection of fruits and seeds
- Immature, infected and deformed fruits should be separated and discarded appropriately
- 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. Wherever required, seeds should be removed completely from the fruit rind before they are trade.
- As per the need of the produce, fruits may be split or cut into small pieces to facilitate drying and packaging
- 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.

8. Gums and resins:

- 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.
- 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.
- Where there is a likelihood of some foreign matter being mixed with the collect gums and resins, it should be carefully removed.
- Source tree or shrub should be allowed appropriate recovery period before collecting the exudates again from them
- 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.
- No fire should be ignited near the base of the tree to increase gum/resin flow.

- 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.
- Flow of gum is more in hot weather. Therefore, tapping in such species, should be done between June-October.
- 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.
- Sharp knives or chisels can be used to make blazes.
- 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.
- 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.

9. Others (Galls, Lac etc.):

- Galls should be collected only from stipulated species (Karkatshringi from *Pistacia intergerrima*).
 - Collectors must ensure that no live insects are present inside the galls 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