

6.4.3 The quality of water should be considered in the light of prevailing soil conditions. A reasonably recent report of soil and water analysis should be taken into account for this purpose.

6.4.4 The soils having the problem of drainage should be dealt in specific manner so as to provide outlet for excess water, if any. The impounding of water through heavy rains should not be allowed.

6.5 Weeding and intercultural operations

6.5.1 Initial flush of weeds must be controlled effectively so as to ensure a weed free environment to young plants. The weeding and hoeing cycles should be so arranged as to keep the field free from weeds.

6.5.2 The prescribed schedule of all inter-cultural operations such as weeding, hoeing, topping, nipping of buds, pruning, shading and earthing up etc., must be adhered to in a manner to optimize the overall productivity.

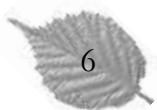
6.5.3 Use of herbicides should be avoided as far as possible. In case of their inevitable usage, available evidence of safety to the target crop should be considered adequately.

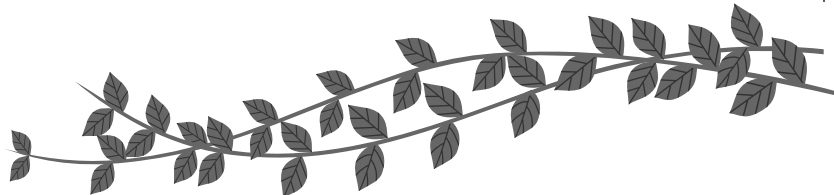
6.6 Crop protection

6.6.1 Comprehensive preventive and control measures enumerated in the agronomic protocol should be used for disease, insect and pest management to minimize loss of the final crop and its quality.

6.6.2 In general crop protection plans should be limited to the use of bio-control agents and bio-pesticides. Under compulsive circumstances care should be taken to use smallest effective dosage of pesticides on the basis of crop protection protocols prescribed for the target species.

6.6.3 When chemical pesticides are used for crop protection, residue analysis should be carried out through appropriate testing agencies following standard procedures.





7. Harvest and post harvest management

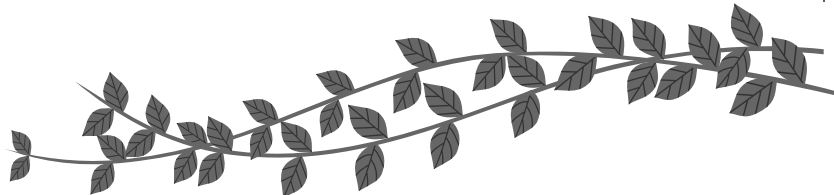
7.1. Harvesting

- 7.1.1 The principle of "maximizing sustainable production" as laid down for the subject crop should be adhered to.
- 7.1.2 The harvesting season should be determined and followed on the basis of qualitative parameters set for the end product of the constituents rather than the total vegetative yield.
- 7.1.3 Harvesting should be carried out only on favorable days avoiding the risks of dew, rain or exceptionally high humidity.
- 7.1.4 The containers used for harvested materials should be kept clean. Care should be taken to ensure freedom from the risks of cross contamination by other species, weeds and such other extraneous matter.
- 7.1.5 Cutting devices employed for harvesting should be selected so as to minimize the contamination by soil particles. While harvesting, care should be taken to avoid incidental and concurrent harvest of weeds.

7.2 Primary processing

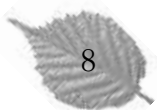
- 7.2.1 Washing and cleaning methods for freshly harvested materials should be laid down in consideration of the target plant part. The procedure for this purpose should ensure removal of soil particles adhering to the materials.
- 7.2.2 Freshly harvested materials should not be stored as such and the drying process should be initiated in a continuum. Where necessary, the length of such storage should be minimized and handled in a manner to prevent degradation or rotting.
- 7.2.3 Processing yards or sites should be clean, well ventilated, and have the facilities for protection against sunlight, dust, rain, rodents, insects and livestock.
- 7.2.4 The drying procedure and the temperature employed for this purpose should be in conformity with the quality needs of the farm produce. In case the agronomic package prescribes specific procedures for this phase, compliance to the same should be ensured. In high humidity conditions, it may be necessary to dry the produce appropriately.
- 7.2.5 Sorting procedure, if any, should be ideally carried out after completion of drying phase and before the material is packed.

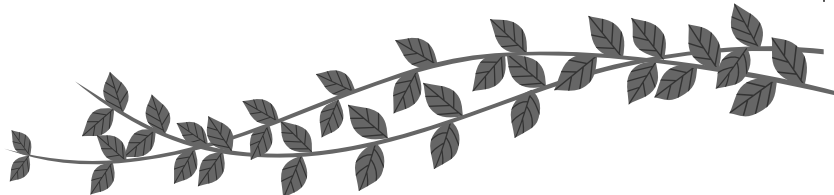




7.3 Packaging, storage and transportation

- 7.3.1** The selection of packaging material should be based on the quality requirements and possible length of storage before consumption. It should be clean, dry and undamaged.
- 7.3.2** Essential product description such as the product name, plant part, month and year of harvest and the name of farmer/farming agency must be legibly inscribed on every pack. If the material was tested before, an appropriate label may be used indicating quality approval.
- 7.3.3** While packaging, mechanical damages and undue compacting of the dried plant material that may result in undesirable quality changes should be avoided. Care should be taken to avoid overfilling of the containers.
- 7.3.4** The storage area should be a dry place protected from insects and rodents and such other factors that may be detrimental to the quality of the product.
- 7.3.5** Organic herbs must be stored separately from the non-organic products.
- 7.3.6** When multiple commodities are handled in the same storage area, care must be taken to prevent product mix up and cross contamination. Plant materials having strong aromatic compounds should be kept at a reasonably good distance from others.

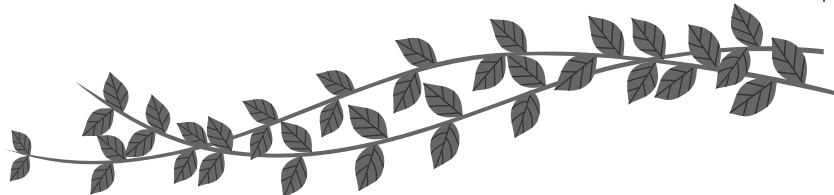




8. Documentation

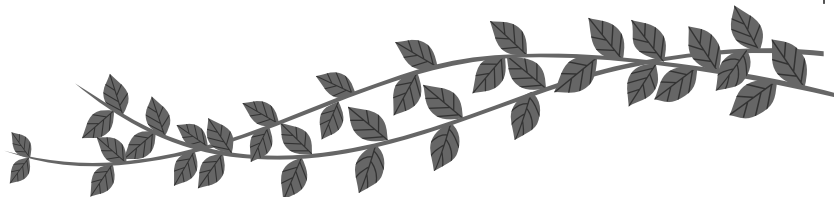
- 8.1 All the documents pertaining to entire cultivation process should be maintained in a manner that ensures easy accessibility and traceability for the concerned personnel. The content of documents should be simple and easily comprehensible for the key personnel engaged at the site.
- 8.2 Agronomic protocol for target crop involving all stages of cultivation including the component of pre-planning should be adopted. Appropriate compliance reports should be generated for each stage and sub-stages of various operations and dates on which they were carried out. The records should include:
 - 8.2.1 Meteorological data, reasonably recent reports of soil and water testing and any other grounds employed for site/ crop selection
 - 8.2.2 The source, quantity and time of procurement/ collection of seeds/ planting materials, relevant documents accompanying the supplies.
 - 8.2.3 All procedures adopted for handling the planting materials and for procedures employed during the nursery phase.
 - 8.2.4 Soil preparation and transplantation procedures
 - 8.2.5 Crop management phase comprising irrigation cycles, the kind of manures and fertilizer used, and the time, amount and method of their use; the type of pesticides used- including insecticides, fungicides and herbicides – and the amount, time and method of their use, if any.
 - 8.2.6 Compliance records to weeding cycles and inter-culture practices.
 - 8.2.7 Procedural deviations that could affect the quality of crop
 - 8.2.8 Extraordinary situations encountered (such as weather conditions or new types of diseases/ pest infestations etc.) during the crop cycle and spontaneous management practices that were adopted
 - 8.2.9 Reports of any laboratory tests and/ or the observations by technical experts carried out on the standing crop or the materials used during cultivation, if any.
 - 8.2.10 Adequate photographic records should support the documentation on a need and operational convenience basis.
 - 8.2.11 The documents suggested above and any other documents having a relevance to the target crop must be maintained for a minimum period of 3 years for crops with gestation periods less than 1 year and for a minimum period of 5 years for those crops having a gestation periods exceeding one year.





9. Personnel and Equipment

- 9.1 Key resource persons engaged at the site (such as farm owner/ supervisor) must be conversant with all aspects related to the target crop such as, quality requirements of the end product, crop husbandry etc.
- 9.2 The personnel should have basic exposure to subject matters like safety and hygiene.
- 9.3 Appropriate measures/ systems should be in place to ensure that personnel suffering from infectious diseases are not engaged at the site.
- 9.4 The machinery used in fertilizer and pesticide application must be calibrated at prescribed schedules and calibration certificates/ records should be maintained.
- 9.5 Equipments must be clean and mounted where applicable, in an easily accessible manner. Scheduled servicing procedures must be adhered to keep them in working order.
- 9.6 Additional care should be taken for cleaning those machine parts that get into direct contact with the harvested medicinal plant.
- 9.7 The material used for the equipment, particularly that coming into direct contact, should be safe. Equipments that pose a risk of hazardous metallic contamination of the harvested crop should be avoided.



Annexure-I

A model structure for developing monographs on GAP for individual species of medicinal plants

1. Name of medicinal plant

I. Scientific name -----

II. Pharmacopoeial name of the medicinal plant -----

III. Local name (specify language) -----

2. Part to be employed as the medicinal plant material

(Description of the part of the plant used for medicinal purposes)

3. Characteristics of the medicinal plant

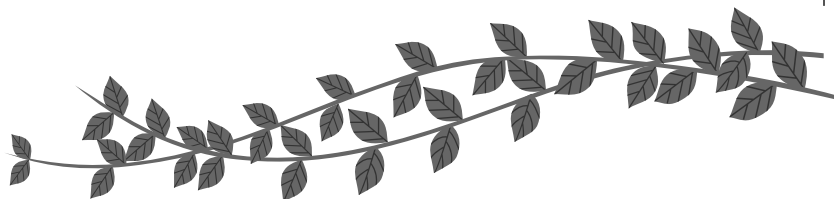
(Describe the agro-morphological and botanical characteristics of the medicinal plant concerned.)

4. Characteristics of medicinal plant material and major production areas

I. Characteristics of the medicinal plant material -----

II. Major production areas of the medicinal plant material should be mentioned





5. Characteristics of strain(s) for cultivation

- I. Taxonomical identity -----
- II. Ecological characteristics -----
- III. Major chemical compound responsible for drug value along with chemical profile

IV. Preferred growing conditions -----

a) Climatic conditions -----

(Rain fall, Temperature and Daylight length)

b) Soil conditions

Soil type -----

Soil condition (pH, water retention capacity; nutrient status as per soil test report etc.)

c) Shade requirements, if any. -----

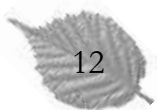
6. Cultivation methods

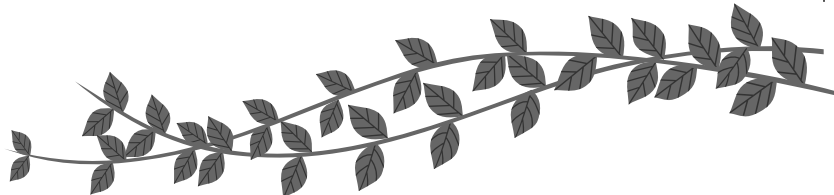
I. Species and strains

II. Propagation methods

III. Cultivation

- a) Suitable cultivation conditions:
- b) Propagation
- c) Sowing
- d) Planting/nursery
- e) Manures & fertilizers including microbial fertilizers
- f) Crop management
- g) Diseases and pests management
- h) Harvesting stage, time & procedures
- i) Post harvest handling & processing
- j) Expected yield with desired quality





7. Quality evaluation of the medicinal plant material

- I. National quality standard of the medicinal plant material
(Defined as the quality and quantity standard)
- II. Name of major chemical/ chemicals constituents and its percentage
- III. Chemical structure of selected major constituents
- IV. Chemical profile, if known

8. Comparative summary table of the characteristics of different cultivated strains, if any

Morphological characteristics of each strain chemotype, morphotype etc. being cultivated, including height, growth, morphology/shape of root, stem, leaf, flower, fruit and 'seed, resistance/tolerance to diseases/pests, and composition and quantitative indications of major chemical constituents of the medicinal plant.

9. Cultivation calendar

A tabulated schedule of cultivation practices whichever to be followed indicating the type of care and management work/ actions and their timing during the entire growing period.

10. Background data and other information

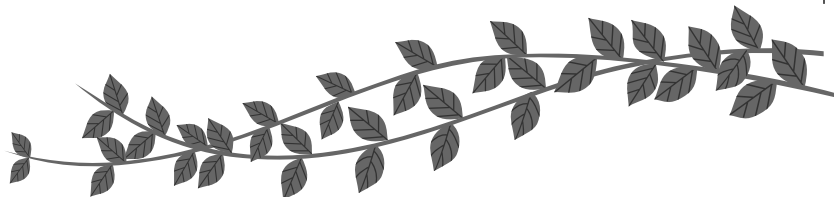
- I. Source of seed, propagation material, etc -----

To assess the appropriateness/suitability of cultivation and characteristics of seed/propagation material. Cultivation should be carried out according to the recommended cultivation practices.

- II. Photographs (3-5)

Plant and plant part material; also showing working methods/ equipment as appropriate





Annexure-II

Sample record for cultivated medicinal plants

1. Identification of cultivated medicinal plant

Scientific name _____

Pharmacopoeial name _____

Local name (language for) _____

Plant part for medicinal use & harvested _____

Identification of cultivation site _____

Field location _____

State/District/Village _____

2. Identification of cultivator

Name of cultivator _____

Contact address _____

Period of cultivation _____

3. Seeds and propagation materials

Source of the planted material _____

Physical description of the planted material _____

Commercially available (circle): Yes/No

If yes, name of cultivar _____ Name of supplier _____

4. Cultivation

4.1 Method of propagation materials establishment (circle): direct seed sowing/transplants

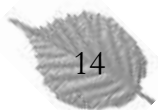
Date of sowing/transplanting _____ Percentage emergence _____

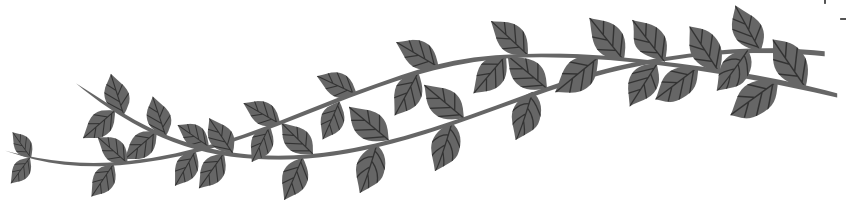
Date of re-sowing/replanting _____ Percentage stand establishment _____

4.2 Spacing

I. Row x Row (cm) _____

II. Plant x Plant (cm) _____ Covered area (m²) _____





Number of plants per unit area _____

Crop rotation _____

Soil and irrigation water analysis as per the standards methods:

4.3 Fertilizers and chemicals (if used)

Fertilizer applied before planting (circle): organic (composted animal manure)/chemical

Name _____ Method _____

Time/date (d/m/y) _____ Rate _____

Fertilizer applied after planting (top dressing): organic (composted animal manure)/chemical

Name _____ Method _____

Time/date (d/m/y) _____ Rate _____

4.4 Herbicides applied before planting, if any

Name _____ Method _____

Time/date (d/m/y) _____ Rate _____

4.5 Herbicides applied after planting, if any

Name _____ Method _____

Time/date (d/m/y) _____ Rate _____

4.6 Special operations done, if any

Name _____ Method _____

Time/date (d/m/y) _____ Rate _____

4.7 Plant protection chemicals applied, if any

Name _____ Method _____

Time/date (d/m/y) _____ Rate _____

5. Harvest/Collection

Date of harvest _____ Time of day _____

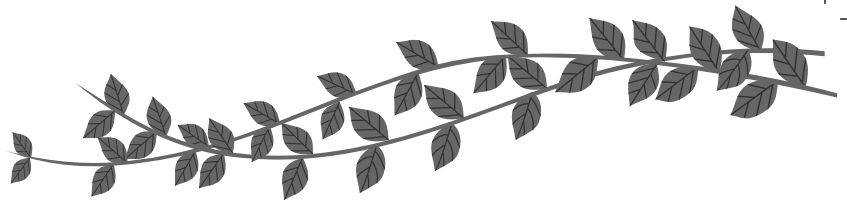
Conditions _____ Method _____

Yield _____

6. Drying practices

Drying method _____





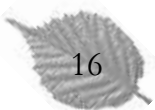
(Sun drying/Shade/Mechanical)

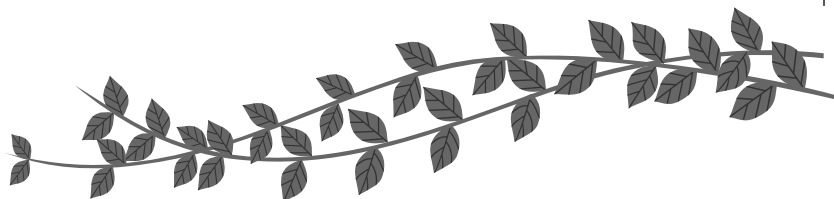
Duration of drying (days) _____

Moisture content (after drying) (%) _____

7. Unusual circumstances that may influence quality

(Extreme weather conditions, exposure to hazardous substances, pest outbreaks, etc):



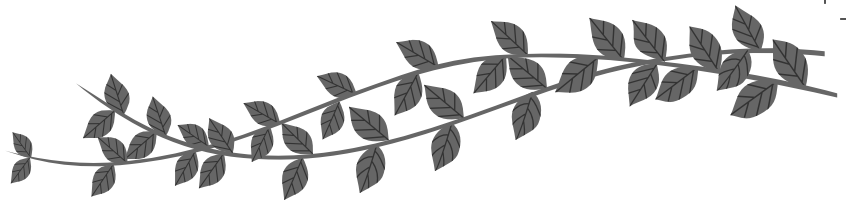


Annexure III

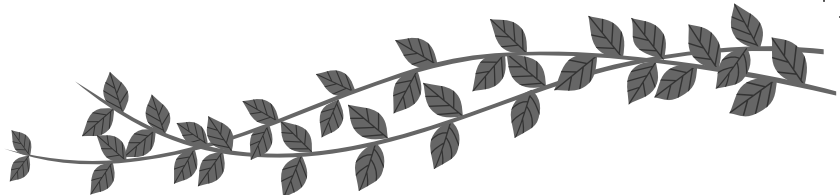
Terminology

- Chemotype** : It is a chemically distinct entity in a plant or organism, with differences in the chemical constituents.
or
Phenotypically similar species i.e. indistinguishable morphological, when distinguished through chemical constituents are called chemotype
or
Plants of the same species that is chemically different but otherwise indistinguishable.
- Genotype** : The genetic constitution (the genome) of a cell, an individual or an organism.
or
Phenotypically dissimilar species with minor mutation when identify through DNA profiling or genotypes
- Irrigation** : The application of water to soil to assist in the production of crops, especially during stress periods.
- Irrigation water** : Water which is artificially applied in the process of irrigation. It does not include precipitation
- Inter crop** : The crops raised in an orchard or other widely spaced crops for increasing the income from the same piece of land. e.g. short duration vegetables, pulses, oilseeds etc.
- Inter cropping** : Refers to growing of two or more generally dissimilar crops simultaneously on the same piece of land, base crop necessarily in distinct row arrangement. The recommended optimum plant population of the base crop is suitably combined with appropriate additional plant density of the associated crop, and there is crop intensification in both time and space dimensions.





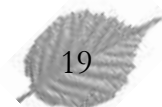
- Phenotype** : The physical appearance of an organism as distinguished from its Genetic make-up.
- Ploughing** : Operations carried out with the help of tractor drawn or bullock drawn implements known as plough, before the crops are sown.
- Pollution** : Contamination of natural environment by the addition to air or water of substances potentially toxic or otherwise harmful to man and animals for example, SO₂, CO₂, radio-active fall out insecticides etc.
- Rouging** : To remove weeds or off-type or diseased plants from a standing field crop.
- Seedling** : The juvenile stage of a plant grown from seed. Usually indicates plants which have up to and including about 4 true leaves.
- Seed certification** : A means to maintain and make available to the public, sources of high quality seeds and propagating materials of superior varieties so grown and distributed as to insure genetic identity. This is done by means of inspections of fields and seeds and by regulations for checking on the production, harvesting and cleaning of each lot of seed.
- Tillage** : The use of implements for mechanical manipulation to prepare seed beds conducive for field crop production

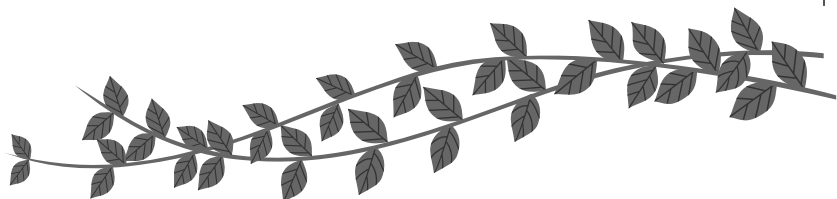


Annexure IV

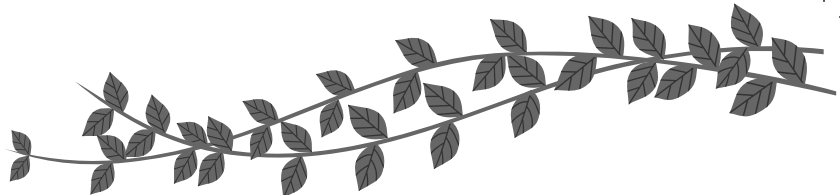
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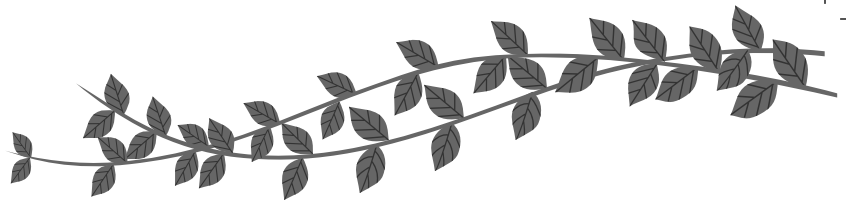


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