

Cultivation, Collection, Processing And Storage Of Drugs Of Natural Origin

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Abstract

Drugs of natural origin, derived from plants, animals, and minerals, play a vital role in traditional and modern healthcare systems. The quality, safety, and therapeutic efficacy of these natural drugs largely depend on scientific cultivation, systematic collection, appropriate processing, and proper storage methods. Cultivation practices such as selection of suitable soil, climate, propagation techniques, irrigation, fertilization, and pest control help ensure high yield and optimum phytochemical content. Collection at the correct season and maturity stage minimizes loss of active constituents. Subsequent processing techniques—including cleaning, drying, size reduction, and preservation—are essential to maintain purity and prevent degradation. Proper storage under controlled temperature, humidity, and protection from microorganisms, insects, and light further ensures stability and prolonged shelf life. Therefore, adopting standardized procedures throughout the cultivation-to-storage cycle is crucial for producing high-quality herbal raw materials suitable for pharmaceutical use.

Keyword: Herbal drugs; Natural origin; Medicinal plants; Cultivation practices; Collection methods; Processing techniques; Drying; Storage conditions; Quality control; Post-harvest handling; Pharmacognosy; Standardization; Active constituents; Preservation; Shelf life.

Introduction

Drugs of natural origin, derived from plants, animals, and minerals, form a major foundation of traditional as well as modern medicine. To ensure the availability of safe, effective, and high-quality natural drugs, it is essential to follow a systematic approach that includes their cultivation, collection, processing, and storage. Each of these steps plays a crucial role in maintaining the therapeutic value and purity of the final crude drug.

Cultivation of medicinal plants involves the scientific growing of plants under controlled agricultural conditions to ensure consistent yield and quality. It includes the selection of suitable species, soil preparation, irrigation, pest control, and harvesting at the correct stage of maturity. Cultivation helps provide a reliable supply of genuine raw materials and reduces dependence on wild sources, thereby supporting conservation of medicinally important species.

Collection refers to the proper harvesting of plant or animal materials at the right season and time when active constituents are present in maximum concentration. Scientific collection practices prevent adulteration, contamination, and degradation of drug quality. Factors such as plant age, part used, environmental conditions, and correct identification are essential during collection.

Processing involves various post-harvest treatments such as cleaning, drying, size reduction, grading, and stabilization of crude drugs. Proper processing helps preserve active ingredients, remove unwanted matter, prevent

microbial growth, and prepare the drug for marketing or further pharmaceutical use. Techniques such as shade drying, mechanical drying, garbling, and packaging are often used to maintain quality.

Storage is the final and equally important step that ensures crude drugs remain stable and protected until they are used. Appropriate storage conditions—such as low humidity, controlled temperature, proper containers, and protection from pests—are essential to prevent deterioration, loss of potency, and contamination. Good storage practices ensure longer shelf-life and preserve the drug’s therapeutic efficacy.

In summary, the systematic cultivation, careful collection, scientific processing, and proper storage of natural drugs form the backbone of quality assurance in pharmacognosy. These steps help provide standardized, potent, and safe natural products for pharmaceutical applications and support the sustainable use of medicinal resources.

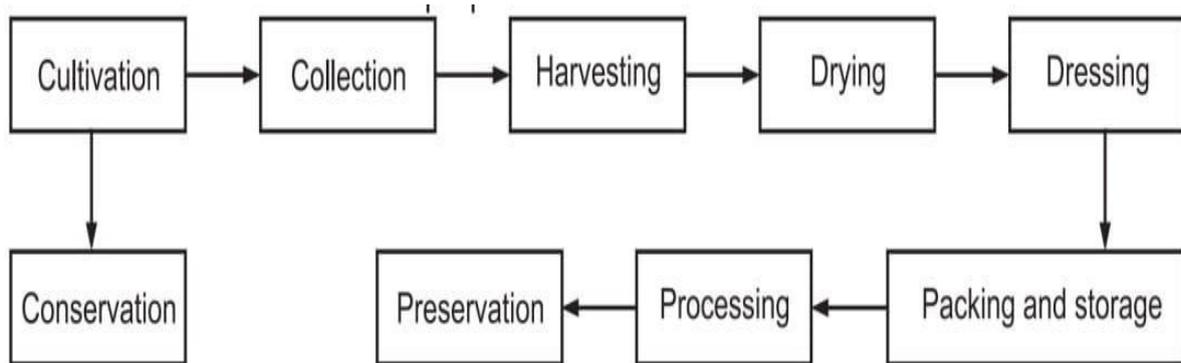


Fig: 0.1 Cultivation, Collection, processing and storage of drugs of Natural origin

1. Cultivation

- Selection of cultivation region depends on soil chemistry, altitude, temperature, and rainfall to maximize phytochemical yield.
- Use of organic manure and biofertilizers is preferred to avoid contamination with heavy metals or synthetic pesticides.
- Controlled irrigation schedules are followed to maintain proper moisture balance and prevent nutrient leaching.
- Crop rotation and mixed cropping are practiced to maintain soil fertility and reduce pest incidence.
- Cultivation under shade nets or greenhouse conditions is used for plants containing volatile oils or sensitive active constituents.



Fig: 0.1 Cultivation

2. Collection

- Collection is carried out at the **specific physiological stage** when active constituents reach peak concentration (e.g., roots in autumn, leaves before flowering).
- Harvesting tools and methods are chosen to prevent mechanical injury and enzymatic degradation.
- Collection during dry weather prevents microbial growth and lowers moisture load.
- Separate collection protocols are followed for poisonous, aromatic, and fragile plant parts to prevent cross- contamination.
- Ethical and sustainable wild harvesting techniques ensure conservation of endangered medicinal species.



Fig:0.2 Collection

3. Processing

- Cleaning, grading, and size reduction are performed immediately after collection to maintain therapeutic quality.
- Enzyme inactivation (blanching, steaming, or drying at controlled temperatures) prevents decomposition of glycosides, alkaloids, and volatile oils.
- Traditional processing steps such as fermentation, curing, or soaking enhance potency and reduce toxicity.
- Drying methods (sun, shade, mechanical drying) are chosen depending on sensitivity of constituents to heat and light.
- Packaging in moisture-proof containers protects from oxidation, insects, and chemical degradation.

4. Storage

- Storage areas are kept cool, dark, dry, and well-ventilated to maintain physicochemical stability.
- Use of airtight glass, tin, or high-density plastic containers prevents absorption of moisture and volatile loss.
- Hygroscopic drugs require desiccants, whereas aromatic drugs require tightly sealed, amber-colored bottles.

- Periodic inspection for infestation, fungal growth, and chemical deterioration is mandatory.
- Proper labeling with batch number, botanical name, date of collection, and shelf-life ensures traceability and quality control.

Conclusion (Short – Optional)

Proper handling of herbal drugs from cultivation to storage is crucial to preserve their therapeutic efficacy, safety, and market value. Standardized practices ensure high-quality raw materials for traditional and modern medicinal systems.

Plant Hormones and Their Applications

Plant hormones (also called phytohormones) are chemical messengers produced in plants that regulate growth, development, and responses to the environment.

There are five major plant hormones:

Auxins in Plants

- Auxins are the first-discovered plant growth hormones, primarily responsible for cell elongation in shoots and roots by loosening the cell wall and increasing water uptake.
- Chemically, most auxins are indole-derived compounds, with Indole-3-Acetic Acid (IAA) being the major naturally occurring auxin.
- Auxins exhibit polar transport, meaning they move in a single direction—from the shoot apex downward through living parenchyma cells, helping establish plant structural polarity.
- They play a critical role in apical dominance, where the main shoot suppresses the growth of lateral buds, ensuring upward vertical growth.
- Auxins regulate phototropism and geotropism, allowing plants to bend toward light and grow against gravity by unequal cell elongation on opposite sides.
- They promote root initiation and adventitious root formation, making them essential in vegetative propagation and cutting growth.
- Auxins influence vascular tissue differentiation, forming new xylem and phloem to support internal transport.
- They help in fruit setting and development in plants like tomatoes & apples, and prevent premature fruit drop.
- Synthetic auxins such as 2,4-D and NAA act as selective herbicides, killing dicot weeds without harming cereals and grasses.
- Auxins interact with other hormones such as cytokinin's and gibberellins to coordinate balanced plant growth, morphogenesis, and tissue culture responses.

Short Summary

Gibberellins are vital growth hormones responsible for stem elongation, seed germination, flowering, and fruit development. Their regulation determines plant height, productivity, and stress response tuning.

Q Keywords for Exams

- Growth-promoting hormone
- Polar transport
- Apical dominance
- Tropism regulator
- Root induction
- Herbicidal application

Examples

Natural auxin	Synthetic auxin	Application
IAA (Indole-3-acetic acid)	NAA, 2,4-D, IBA	Rooting, weed control, fruit retention

Gibberellins in Plants

- **Gibberellins (GAs)** are a large group of plant growth-promoting hormones that mainly stimulate **cell elongation and cell division**, resulting in remarkable stem internode growth.
- They were first discovered **in the fungus *Gibberella fujikuroi***, which caused the “bakanae disease” in rice, characterized by abnormal excessive elongation of seedlings.
- Gibberellins play a crucial role in **breaking seed dormancy** by activating hydrolytic enzymes such as **α -amylase**, which convert stored starch into sugars to support embryo growth.
- They promote **bolting and flowering** in long-day plants by rapidly elongating the stem prior to flower formation (e.g., cabbage, beet).
- GAs contribute to **fruit development and enlargement**, especially in seedless fruits like grapes, making them commercially valuable.
- They enhance **enzyme synthesis during germination**, making them essential regulators for early seedling establishment.
- Gibberellins are key regulators of **juvenile to adult transitions**, helping plants enter reproductive maturity earlier.
- They antagonize **growth-inhibiting hormones such as abscisic acid (ABA)**, balancing growth and stress adaptation.
- **Dwarf and genetically modified short plants** often result from reduced gibberellin biosynthesis or signaling pathways and can be restored by external GA application.
- **Environmental cues** such as photoperiod and temperature regulate endogenous GA levels, allowing plants to adapt growth to seasonal changes.

Short Summary

Gibberellins are vital growth hormones responsible for stem elongation, seed germination, flowering, and fruit development. Their regulation determines plant height, productivity, and stress response tuning.

Examples / Applications

Application	Effect
GA treatment in sugarcane	Increases internode length & yield
GA in barley	Stimulates α -amylase during malting
GA in grapes	Produces larger, seedless berries
GA in horticulture	Induces flowering & breaks dormancy

Keywords

- Stem elongation hormone
- Bolting inducer
- Dormancy breaker
- α -amylase activator
- Fruit size enhancer

Cytokinins in Plants

- Cytokinins are adenine-derived plant hormones that primarily promote cell division (cytokinesis) in both roots and shoots.

- They delay leaf senescence by preventing chlorophyll degradation and promoting nutrient mobilization towards older leaves.
- Cytokinins maintain apical–basal polarity by balancing auxin activity, especially in shoot and root meristems.
- They enhance lateral bud growth and help overcome apical dominance, resulting in bushier plant morphology.
- Cytokinins stimulate nutrient remobilization, increasing nitrogen uptake and protein synthesis in growing tissues.
- They promote callus formation in plant tissue culture when used with auxins in specific ratios.
- Natural sources include coconut milk, maize endosperm, and young developing fruits, which contain high cytokinin levels.
- Help regulate stomatal opening under low-water stress conditions, improving osmotic tolerance.
- Cytokinins enhance chloroplast development and enzyme activation responsible for photosynthesis.
- Involved in sink-source regulation, directing sugars towards growing organs like young leaves and fruits.
- They support xylem and phloem differentiation, improving vascular development and internal transport.
- Synthetic cytokinins such as BAP (Benzylaminopurine) and Kinetin are widely used in micropropagation to improve plant regeneration.

💡 Short Summary for Exams

- Cytokinins are growth-promoting phytohormones that regulate cell division, delay aging, enhance shoot development, and play an essential role in tissue culture, nutrient distribution, and stress physiology.

- 📝 Keywords to Add
- Cell division hormone
- Anti-senescence factor
- Apical dominance breaker
- Tissue culture regulator
- Meristem activity enhancer

📄 Summary Table

Hormone	Main Function	Applications
Auxin	Cell elongation	Rooting powders, weed control, parthenocarpy
Gibberellin (GA)	Stem elongation	Break dormancy, fruit size increase
Cytokinin	Cell division	Tissue culture, delay senescence
Ethylene	Fruit ripening	Artificial ripening, pineapple flowering
Abscisic Acid (ABA)	Stress response	Drought resistance, seed dormancy

✅ Mutation and Medicinal Plants

❖ Mutation in Medicinal Plants

• Definition

Mutation is a sudden, heritable change in the genetic makeup of a plant, leading to variation in traits.

• Types

- a. Spontaneous mutation
- b. Induced mutation (gamma rays, EMS, UV, sodium azide)

• Methods Used

- a. Gamma irradiation
- b. Chemical mutagens
- c. In vitro mutagenesis

• Uses in Medicinal Plants

- a. Increase secondary metabolites
- b. Improve essential oils
- c. Enhance antioxidant activity

• Examples

- a. *Catharanthus roseus* → Higher alkaloids
- b. *Ocimum sanctum* → Higher eugenol content

❖ Mutation in Medicinal Plants

1. General Mutation Breeding in Medicinal Plants

- a. Jain, S.M. (2001). Tissue culture–derived variation in medicinal plants. *Acta Horticultural*, 560, 127–139.
- b. Ahloowalia, B.S., Maluszynski, M., & Nuechterleins, K. (2004). Global impact of mutation-derived varieties. *Euphytica*, 135, 187–204.
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❖ Gamma Radiation Mutations in Medicinal Plants

2. *Ocimum sanctum* (Tulsi)

- d. Kishore, K. et al. (2012). Gamma radiation–induced variability and phytochemical changes in *Ocimum sanctum*. *Journal of Medicinal Plants Research*, 6(13), 2605–2610.

3. *Withania somnifera* (Ashwagandha)

- e. Kumar, R., et al. (2013). Gamma-ray induced mutations and biochemical changes in *Withania somnifera*. *International Journal of Pharma and Bio Sciences*, 4(3), 123–129.

❖ Chemical Mutagenesis (EMS, Sodium Azide, etc.)

4. *Mentha arvensis* (Mint)

- f. Pandey, A.K., et al. (2014). EMS-induced mutations to enhance essential oil content in *Mentha arvensis*. *Journal of Essential Oil Research*, 26(5), 379–385.
- g. Sasidharan, N., et al. (2018). Chemical mutagen-induced variability in secondary metabolites in *Curcuma longa*. *Industrial Crops and Products*, 112, 141–147.

❖ UV & In Vitro Mutagenesis in Medicinal Plants

5. *Aloe vera*

h. Adhikari, J., et al. (2016). In vitro UV and chemical mutagenesis in *Aloe vera* for growth and gel content improvement. *Plant Cell Biotechnology and Molecular Biology*, 17(1–2), 57–64.

8. *Stevia rebaudiana*

i. Yadav, A.K., et al. (2012). UV-B induced mutations affecting stevioside content in *Stevia rebaudiana*. *Industrial Crops and Products*, 36(1), 1–5.

❖ Mutation Effects on Secondary Metabolites

j. Goyal, S., et al. (2015)

Induced mutations enhance secondary metabolite production in medicinal plants. *Journal of Applied Research on Medicinal and Aromatic Plants*, 2, 15–24.

k. Sangwan, N.S., et al. (2011).

In vitro mutagenesis for enhanced secondary metabolites. *Phytochemistry Reviews*, 10, 431–448.

🌿 Conversation on Medicinal Plants (Teacher–Student Dialogue)

1. Basic Introduction

Student: Sir, what are medicinal plants?

Teacher: Medicinal plants are plants that contain bioactive compounds used to treat diseases or promote health. They are the natural source of many modern medicines.



2. Examples

Student: Can you give some examples?

Teacher: Yes, *Tulsi*, *Neem*, *Aloe vera*, *Ashwagandha*, *Turmeric*, *Ginger*, and *Peppermint* are commonly used medicinal plants.

3. Importance

Student: Why are medicinal plants important?

Teacher: They provide safe, effective, and affordable remedies. Around 80% of the world's population still uses herbal medicine for primary healthcare.

4. Active Constituents

Student: What type of chemicals do medicinal plants contain?

Teacher: They contain secondary metabolites such as alkaloids, glycosides, tannins, flavonoids, terpenoids, and essential oils. These compounds give therapeutic effects.

5. Uses

Student: How are medicinal plants used?

Teacher: They are used in Ayurveda, Homeopathy, Siddha, as well as in modern pharma for making drugs like morphine, quinine, atropine, and vincristine.

6. Cultivation

Student: Why is the cultivation of medicinal plants important?

Teacher: Because wild collection may lead to overexploitation and poor quality. Proper cultivation ensures standardized, high-quality raw material.

7. Processing & Storage

Student: How are medicinal plants stored?

Teacher: They are dried, powdered, stored in airtight containers, and kept away from moisture, sunlight, and insects to maintain potency.

8. Safety

Student: Are medicinal plants safe?

Teacher: Mostly yes, but improper dose or contamination can cause side effects. Therefore, standardization and quality control are important.

9. Research & Modern Use

Student: Are medicinal plants used in modern research?

Teacher: Yes, many anticancer, antidiabetic, and antimicrobial drugs are developed from medicinal plants. Research continues to discover new phytochemicals.

Summary

The cultivation, collection, processing, and storage of drugs of natural origin form the essential framework for producing high-quality crude drugs used in herbal medicine. Cultivation ensures a sustainable and controlled supply of medicinal plants with uniform phytochemical composition by selecting suitable soil, climate, propagation methods, and cultivation techniques. Collection involves harvesting plant parts at the appropriate season and maturity stage to preserve their maximum therapeutic value. Processing steps such as cleaning, drying, sorting, size reduction, and packaging help maintain purity, prevent contamination, and prepare the drugs for storage or further use. Proper storage under controlled conditions of temperature,

humidity, and light protects crude drugs from deterioration, microbial growth, insect attack, and loss of active constituents. Overall, integrating systematic methods in each stage ensures the production of safe, effective, and stable natural-origin drugs that meet pharmacopoeia standards.

Conclusion

The cultivation, collection, processing, and storage of drugs of natural origin are critical steps in ensuring the quality, safety, and efficacy of herbal and plant-based medicines. Proper cultivation practices maintain the genetic and phytochemical integrity of the plants, while careful collection ensures sustainable harvesting without damaging the natural resources.

Standardized processing techniques preserve the active constituents, and appropriate storage conditions prevent degradation and contamination. Together, these practices form the foundation for producing reliable and effective natural drugs, supporting both traditional medicine and modern pharmaceutical applications. Emphasizing quality control and adherence to good practices is essential for maximizing therapeutic benefits and promoting sustainable use of medicinal plant resources.

Result

The study of cultivation, collection, processing, and storage of drugs of natural origin shows that the quality and therapeutic effectiveness of crude drugs depend heavily on how they are grown, harvested, handled, and preserved. By applying scientific agricultural practices, selecting the right harvesting time, using proper processing techniques, and maintaining ideal storage conditions, the natural drugs retain their purity, potency, and stability.

The result highlights that a well-organized approach at every stage—from field to storage—ensures the production of high-quality herbal drugs that comply with pharmacopoeial standards and support reliable medicinal use.

Reference

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“Pharmacognosy,” Nirali, Prakashan.

(Chapters: *Collection and Preparation of Crude Drugs, Processing, Storage, Quality control.*)

2. Trease & Evans

“Pharmacognosy,”

16th/17th

Edition,

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(Topics: *Collection of drugs, Post-harvest handling, Drying, Storage.*)

Journal References (Optional for Projects / Review Papers)

3. *Journal of Pharmacognosy and Phytochemistry*

Articles on harvesting, processing, drying techniques, and storage of medicinal plants.

4. *Journal of Herbal Medicine* (Elsevier)

Papers on quality control, collection practices, and post-harvest technology.

5. *Ayurveda Research Papers (AYU Journal)*

Studies related to processing and conservation of crude drugs.

How to Write Reference Section in Your Assignment You can write them like this:

References

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