MEDWIN PUBLISHERS
Committed to Create Value for Researchers

International Journal of Pharmacognosy & Chinese Medicine
ISSN: 2576-4772

Modern Development in Medicinal Plant Cultivation

Nannar AR* and Ahire MD

Sanjivani College of Pharmaceutical Education and Research, India

***Corresponding author:** Ajay Ramdas Nannar, Sanjivani College of Pharmaceutical Education and Research, Kopargaon, India, Email: nannarajay@gmail.com

Review Article

Volume 7 Issue 2

Received Date: September 23, 2023

Published Date: November 10, 2023

DOI: 10.23880/ipcm-16000254

Abstract

Over thousands of years, nature has given us better environments for the growth and development of medicinal plants. Plants have been used as medicines since ancient times because people thought they were safe and had benefit. Even now, 80% of the world's population relies mostly on alternative medicine systems for their primary healthcare needs. Several kinds of secondary metabolites, also known as bioactive plant elements, are found in plants and are what give them their medical value in nature. For the growth of a greater quantity of secondary metabolites from the plants and their by-products, scientific agriculture allows the application of modern technical elements like mutation, polyploidy, and hybridization. Simple approaches are required for the cultivation, gathering, and preservation of medicinal plants in order to maintain their therapeutic potential. Alkaloids, glycosides, tannins, resins, volatile oils, and other bioactive phytochemicals are only a few examples of the phytochemicals that play a major role in the pharmacological actions of medicinal and aromatic plants. The physical environment, including sunshine, temperature, rainfall, and soil type, has a significant impact on the growth and development of medicinal plants as well as the secondary metabolites that result from those processes. The world's most significant sources of herbal goods are medicinal plants, yet they are vanishing quickly. We stressed the need for sufficient consideration of resource management and conservation techniques for the sustainable use of medicinal plant resources, including in situ and ex situ conservation and growing approaches. We advise applying biotechnological methods (such as tissue culture, micropropagation, synthetic seed technology, and techniques based on molecular markers) to increase production and alter the potency of medicinal plants. The numerous innovations employed in farming methods are described in this article.

Keywords: Grafting; Budding; Micropropagation; Cultivation; Monoculture; Hydroponics; Agricultural Technology; Harvesting

Introduction

Most people's main healthcare is based on medicinal plants, which are also a substantial source of income for many rural residents, especially those who live close to woods. For more than 80% of the populace in underdeveloped nations that rely on conventional medical practices, they provide primary healthcare. In recent years, herbal medications have also grown in popularity due to their rising acceptance in both developed and developing nations. The awareness of the negative side effects of many contemporary pharmaceuticals is the fundamental reason for the return of herbal medicines. Large-scale commercial harvest from the wild increased as a result of the continuously rising demand for herbal medicines [1].

The supply chain is negatively impacted by the steadily rising demand for medicinal plants, which results in destructive harvesting and adulteration for real medications. During the past 20 years, both industrialized and developing

nations have seen a marked surge in interest in traditional medical practices, particularly herbal remedies. Significant economic advantages are being obtained as the markets for therapeutic plants expand quickly on a national and international scale. Many studies reveal that the quality of the consumer-accessible herbal products varies, despite their widespread use. This variation in herbal preparation quality might be linked to the complexity of their manufacture. The safety and quality of a range of medicinal plants and their products have been recognized in recent years as being largely dependent on excellent farming and collection/ harvesting procedures [2].

Medicinal Crude Drug Production

Growing medicinal plants involves rigorous supervision and attention. Depending on the grade of medicinal plant components needed, different growing conditions and times are needed [3].

Cultivation of Medicinal Plants

We need to take greater care of medical care and mechanical management since the market demand for medicinal and aromatic plants has risen owing to their improved medicinal worth and pharmacological activity. Ancient agricultural techniques should be used if there is no scientific approach available. If not, scientific research must be done to design a method of cultivation [4]. The fundamentals of agricultural operations, including the right rotation step and an environment that is conducive for plant production, are adapted to meet source requirements. If appropriate, conversation agriculture (CA) competence should lag behind, particularly when it comes to the development of fertile matter and soil moisture [5]. These techniques are employed.

Cutting: These are the plant components (stem, root, or leaf) that, when cultivated under the right conditions, produce new plants. Typically, stem cuttings are used to create new plants. Examples are roses and sugarcane.

Layering: As long as the stem is still connected to the parent plant, roots are forced to grow there. Afterwards, the parent plant's portion of the stem is cut off, and the new plant is created from it.

Grafting: By fusing pieces of two separate plants, a new variety is created. The scion, or bit of a different plant's shoot, is attached to the stock, or rooted shoot, of one plant. Examples include rose, citrus, and rubber.

Micro propagation: Cells, tissues, and organs are grown in culture using this technique. A container with an appropriate nutritional media and sterilized conditions is used to cultivate small fragments of plant organs or tissues. The tissue develops into a clump of immature cells called a callus, which subsequently differentiating into plantlets. Following that, they are put into nursery beds or pots where they can develop into complete plants.

Shifting Cultivation

It is a type of farming in which the land is only briefly farmed for two or three seasons. After that, they let the field to produce vegetables naturally. Farmers then relocate to a new location. As the soil loses its fertility or the area becomes overtaken by weeds, they move out. When the earth is allowed to recover fertility, the period required for agriculture is often shorter [6].

Characteristics of Shifting Cultivation

1. If enough land is restored for a long time (10 to 20 years), it is environmentally feasible.
2. There shouldn't be an excessive amount of food demand or requirement.
3. This method is appropriate for the hard climatic conditions and delicate tropical ecosystems.
4. As a result, we have had only sporadic success in identifying workable substitutes for shifting agriculture in India.

Advantages of Cultivation

From a variety of perspectives, including the following, growing medicinal plants is advantageous:

1. It guarantees that the medicine comes from the right natural source.
2. Under cultivation, the gathering and harvesting of the medications can be efficiently managed, meaning they can be gathered at the appropriate time and in the right way.
3. The drying and storage of medicines derived from farmed sources may be more tightly monitored and managed, enabling the manufacture of high-quality medicines.
4. During cultivation, the completed product's purity is ensured since weeds and other pollutants may be eradicated by meticulous weeding throughout the crop's growth.
5. The following practices can help with drug quality and production during cultivation:
6. The choice of disease-resistant and high-yielding seeds and cultivars.
7. The use of organic and inorganic fertilizers that boost plant productivity and the amount of their active ingredients, such as nitrogenous fertilizers that boost the alkaloid content of solanaceous plants.
8. The development of hybrid plants with high yields and disease resistance.
9. The cultivation of pharmaceuticals guarantees a steady and regular supply of real medications.

10. Cultivation can be used to regulate and minimize the monopolies on the manufacture of crude pharmaceuticals as well as their prices.
11. Controlled production of such drugs can help limit the illicit traffic in harmful substances like cannabis and opium.

The aforementioned factors make it clear that it is better to receive crude medications from sources that have been grown, or, to put it another way, sources that have been placed under cultivation in order to produce crude pharmaceuticals of high quality. However, there are several significant disadvantages to growing therapeutic plants [7].

Disadvantages of Cultivation

The main drawbacks of growing medical or pharmacological plants may be summed up as follows:

1. Crop failure as a result of unfavorable meteorological circumstances, such as flood, drought, frost, or heavy rain during the growing and harvesting seasons.
2. Crop failure brought on by viral and fungal infections that quickly spread among closely-growing plants of the same species, such as the assault of Phytophthora species on Belladonna.
3. Significant crop damage caused by rodents and insects (such as the flea beetle) in the field.
4. The increased production cost.
5. A certain medicinal plant cannot be grown because of the absence of the necessary environmental conditions. For instance, Indian hemp needs a typical tropical temperature to produce the drug-like resin.

These difficulties, which apply to other grown crops as well, should not deter people from growing drug plants, though, since the rewards far exceed the negatives [8].

Factors Relating to the Species Rarity of Medicinal Plants

Prior to beginning conservation efforts, species rarity is used to evaluate the extinction risk of medicinal plants and to identify those species most at risk of extinction. It is important to know how uncommon each species is as well as how rare species differ from one another. Pressures from harvesting do not have the same effects on all medicinal plants [9]. Overexploitation, indiscriminate collection, unchecked deforestation, and habitat degradation all impact species rarity, but they are insufficient to explain individual species vulnerability or resilience to harvest pressure. Many biological traits, including habitat specialization, distribution range, population size, species variety, growth rate, and reproductive system, are correlated with the danger of extinction [10].

Harvesting

To ensure the finest quality medical plant components and completed herbal products, it is important to harvest medicinal plants at the right time of year or season. Depending on the plant component that will be utilized, the harvest time may vary. National pharmacopoeias, standards that have been published, official monographs, and important reference books frequently provide comprehensive information on the ideal time for harvesting. It is well knowledge that the concentration of biologically active components varies depending on the stage of plant growth and development. This holds true for chemicals derived from native plants that are harmful or poisonous but are not targeted [11]. The quality and quantity of biologically active constituents, rather than the total vegetative yield of the targeted medicinal plant parts, should be used to determine the best time for harvest (quality peak season/time of day). During harvest, care should be taken to ensure that no foreign matter, weeds, or toxic plants are mixed with the harvested medicinal plant materials. Avoiding dew, rain, or unusually high humidity will help you pick medicinal plants in the best conditions possible.

If harvesting takes place in wet conditions, the material should be moved right away to a facility for indoor drying to speed up drying and minimize any potential negative impacts from elevated moisture levels, which encourage microbial fermentation and mould [12]. To lessen damage and contamination from dirt and other materials, cutting tools, harvesters, and other machinery should be maintained clean and adjusted. They should be kept in a clean, dry location that is free of insects, rodents, birds, and other pests, and out of reach of both farm animals and domestic animals. Where necessary, big drop cloths, ideally made of clean muslin, may be utilized as an interface between the harvested plants and the soil in order to decrease soil contact and the microbial load on harvested medicinal plant components [13]. As soon as the medicinal plant materials are gathered, any clinging dirt should be removed if the subterranean components (such as the roots) are being used. The raw medicinal plant materials should be quickly transported in a clean, dry environment; they can be put in clean baskets, dry sacks, trailers, hoppers, or other well-aerated containers and taken to a central location for transportation to the processing facility [14].

All harvest-related containers should be maintained clean and clear of extraneous objects like previously gathered medicinal plants. Whenever plastic containers are utilized, special consideration should be given to any potential moisture retention that might promote the formation of mold [15]. While not in use, containers must be stored in a dry location away from cattle and other domestic animals, as well

as away from insects, rats, birds, and other pests. Avoiding mechanical damage or compacting the raw medicinal plant materials, which might happen as a result of, say, overfilling or stacking sacks or bags, is important to preserve quality. To prevent microbial contamination and a reduction in product quality, decomposed medicinal plant components should be recognized and removed during harvest, post-harvest inspections, and processing [16].

In Accordance with WHO Guidelines

1. Medicinal plants and herbal medicines should be collected at their peak quality for the intended purpose.
2. It is necessary to exclude damaged or incomplete plants.
3. The optimum circumstances for harvesting medicinal plants or herbal medicines should be avoided, such as moist soil, dew, rain, or very high air humidity. It's important to take precautions against any harmful impact that elevated moisture levels from harvesting in rainy weather may have on medicinal plants or herbal medicines.
4. Harvesting equipment or cutting tools must be modified to minimize soil contamination.
5. The gathered medicinal plant or herbal medicine shouldn't come into touch with the ground. It needs to be quickly gathered and transferred in dry, clean circumstances.
6. Caution should be exercised during harvesting to prevent the mixing of collected medicinal plants/herbal medicines with harmful weeds.
7. All harvesting-related containers must be clean and free of contamination from earlier harvests. While not in use, containers must be kept dry, pest-free, and out of reach of mice, rats, cattle, and domestic animals.
8. Harvested medicinal plants and herbal drugs must be protected against mechanical harm and compacting that might lead to unfavourable quality changes. In this regard, care must be taken to avoid (a) overfilling the sacks and (b) piling the sacks.
9. To avoid thermal deterioration, freshly picked medicinal plants and herbal medicines must be transported as soon as possible to the processing facility.
10. Pests, mice, rats, domestic animals, and cattle must all be kept away from the harvested crop. All pest control methods used should be recorded [17].

Future Prospects

The discovery of genetic engineering has made it feasible to produce desired bioactive chemicals on a large scale through biosynthesis of natural products, and improvements in medicinal plant fermentation and tissue culture have created new opportunities for this type of manufacturing. For the synthesis of uncommon and highly valuable secondary metabolites that are crucial for medicine, tissue culture including plant cell and transgenic hairy root culture is a viable option. In addition to making storage and transit easier, micropropagation by tissue encapsulation of propagules can also encourage faster rates of regeneration. Synthetic seeds, which are described as artificially encapsulated somatic embryos (or other tissues) that may be utilized for cultivation in vitro or ex vitro, are a viable option when the quantities of natural seeds are inadequate for multiplication. Moreover, breeding time may be greatly reduced and breeding enhancements can be made utilizing molecular marker-based methods used at the genetic level.

Discussion

A supporting case for the preservation of variety may be made using the cultural value placed on therapeutic plants. The cultural features pertaining to the employment of the plants and the cultural values pertaining to their cultivation must be distinguished from one another since these cultural values are not fundamentally the same for wild and domesticated plants. For the creation of many types of traditional medicinal formulations, traditional and Ayurveda practitioners employ medicinal plants and their components as raw materials. In contrast to contemporary medicine, historically validated methods of preparing medicinal and aromatic plants have not progressed enough.

At the herbal production and processing facility, conventional methods are still mostly employed, and very little has been updated. In order to acquaint part of the medicinal medicine crop, which is in high demand from the cosmetic neutraceutical, food, and pharmaceutical industries, a unique project may be undertaken. Such initiatives would significantly encourage farmers to take up the professional growing of aromatic and medicinal crops. The modern herbal medicine industry's key necessity for restarting the production of effective and genuine standard medications for humanity is the scientific growing, development, harvesting, and processing of medicinal plants.

Conclusion

Recent years have seen an increase in the value of medicinal plants due to their usage as food supplements and other pharmaceutical goods. The existence of the many important plant species and their habitats in the wild is being threatened by an over-reliance on forests for these high-volume raw pharmacological commodities. Many species, especially those that are endangered in the wild, can be cultivated as a viable alternative. With the genetic variety of these species preserved in their native environments, this would assist to assure a steady supply of them for human needs. The sustainable preservation of natural

stocks requires a variety of strategies, including cultivation. However only a small number of species of therapeutic plants are actually grown.

A situation that is extremely distinct from growing horticulture and other commercial crops is presented by the domestication or cultivation of the species. Domestication activities should be conducted in tandem with planned research to develop efficient species-specific POPs and coordinated efforts to create supportive regulatory and economic frameworks. It's also important to look at the best institutional setup for industry-farmer benefit sharing. These metrics have to be modified to account for unique socioeconomic and cultural conditions in the area. For instance, the choice of cultivating species, adoption of technology, and institutional setup may differ from a region where these factors are different in states where agroforestry practices are common, in localities where size of land holdings is smaller and labor costs are higher, and in locales where these factors are not.

Consent for Publication

Not applicable.

Funding

None.

Conflict of Interest

The authors declare no conflicts of interest, financial or otherwise.

Acknowledgements

I am thankful to all my co workers and my respected guide.

References

1. Nalawade SM, Sagare AP, Lee CY, Kao CL, Tsay HS (2003) Studies on tissue culture of Chinese medicinal plant resources in Taiwan and their sustainable utilization. Bot Bull Acad Sin 44: 79-98.
2. Chen SL, Yao H, Han JP, Liu C, Song JY, et al. (2010) Validation of the ITS2 region as a novel DNA barcode for identifying medicinal plant species. Plos One 5(1): e8613.
3. Chacko SM, Thambi PT, Kuttan R, Nishigaki I (2010) Beneficial effects of green tea a literature review. Chin Med 5: 13.
4. Hamilton AC (2004) Medicinal plants conservation and livelihoods. Biodivers Conserv 13: 1477-1517.
5. Balunas MJ, Kinghorn AD (2005) Drug discovery from medicinal plants. Life Sci 78: 431-441.
6. Cole IB, Saxena PK, Murch SJ (2007) Medicinal biotechnology in the genus scutellaria. *In Vitro* Cell Dev Plant 43: 318-327.
7. Pimm S, Russell G, Gittleman J, Brooks T (1995) The future of biodiversity. Science 269: 347.
8. Bentley R (2010) Medicinal plants Being Descriptions with Original Figures of the Principal Plants Employed in Medicine and an Account of the Characters Properties Their Parts and Products of Medicinal Value. Domville Fife Press, pp: 23-46.
9. Ross IA (2005) Medicinal plants of the world. 1st(Edn.), Chemical constituents traditional and modern medicinal uses, Humana Totowa, NJ, pp: 648.
10. Heywood VH, Iriondo JM (2003) Plant conservation old problems new perspectives. Biol Conserv 113(3): 321-35.
11. Hamilton AC (2008) Medicinal plants in conservation and development case studies and lessons learned. Plant life International, Salisbury, pp: 1-43.
12. Zerabruk S, Yirga G (2012) Traditional knowledge of medicinal plants in Gindeberet district Western Ethiopia. S Afr J Bot 78: 165-169.
13. Larsen HO, Olsen CS (2007) Unsustainable collection and unfair trade Uncovering and assessing assumptions regarding Central Himalayan medicinal plant conservation. In: Bull AT, et al. (Eds.), Plant conservation Biodiversity. Conserv Springer, Dordrecht, 16(6): 1679-1697.
14. Uprety Y, Asselin H, Dhakal A, Julien N (2012) Traditional use of medicinal plants in the boreal forest of Canada: review and perspectives. J Ethnobiol Ethnomed 8: 1-14.
15. Huang H (2011) Plant diversity and conservation in China planning a strategic bioresource for a sustainable future. Bot J Linn Soc 166(3): 282-300.
16. Rafieian KM (2012) Medicinal plants and the human needs. J Herb Med Pharm 1: 1-2.
17. Hamilton A (2003) Medicinal plant and conservation issues and approaches. International plant conservation unit, UK, pp: 29-33.