



INNOVATIVE INTEGRATED TRAINING IN
HEALING PLANTS
BUSINESS

IO3 - The Total Business Plants Training Material

Module No. 1

“Organic cultivation of medicinal plants”

Sofia University “St. Kliment Ohridski”

5. Unit 5 Benefits and social impact of MP organic cultivation – success stories

Summary

In Unit 5 the benefits and social impact of MP organic cultivation are discussed with an exemplary success story related to MP cultivation. The characteristic features of organic cultivation of MP and its economic and social advantages as well as the opportunities for MP organic cultivation are presented. The success story of *Aloe vera* cultivation is given as an example for positive social and economic benefit.

Learning outcome descriptors

By the end of the Unit, the trainee should be able to:

- ✓ **Knowledge, understanding and professional skills:**
 1. Specify the characteristic features of organic cultivation of MP and its economic and social advantages
 2. Outline the opportunities for MP organic cultivation
 3. List the benefits and social impact of MP organic cultivation
- ✓ **General and transferable skills:**
 1. Plan a research task.
 2. Work independently or with a minimal guidance where appropriate.
 3. Work in team with minimal guidance where appropriate.
 4. Show good written and oral communication skills.
 5. Demonstrate computer literacy
 6. Perform online (computer) search to develop information technology skills in order to retrieve information from a variety of sources.

5.1 Introduction

Herbal medicines are widespread and their consumption considerably increases. However, their harvesting from the wild plant populations, which are the main source of raw material, can cause loss of genetic diversity and habitat destruction. Domestic cultivation is a vital alternative and gives an opportunity to overcome the problems that are inherent in herbal extracts: misidentification, genetic and phenotypic variability, extract variability and instability, toxic components and contaminants. The control of the environmental conditions can help to overcome cultivation difficulties and could be a tool to change phenotypic variation in bioactive compounds and toxins. Conventional plant-breeding methods can improve both agronomic and medicinal traits, and molecular marker-assisted selection will be used increasingly. There has been significant progress in the use of tissue culture and genetic transformation techniques to alter pathways for the biosynthesis of target Medicinal Plants (MP) metabolites. Obstacles to bringing MP into successful commercial cultivation include the difficulty of predicting which extracts will remain marketable and the likely market preference for what is seen as naturally sourced extracts.

5.2 The advantages of organic cultivation of medicinal plants

The advantages of organic cultivation can be briefed as follows:

- It ensures the high quality and purity of medicinal plants. The crude drugs are recognized on the basis of the presence of the chemical contents in them and on their purity. The collection of crude drugs from cultivated MP gives a better yield and therapeutic quality. However, it requires some skills and professional expertise. Such practice can let to collecting drugs with higher therapeutic quality and yield. For example, these are the collection of latex from poppy capsules, oleo-resins from *Pinus* species, preservation of green color of *Senna* leaves and minimizing the deterioration of cardiac glycosides in freshly collected leaves of *Digitalis*.
- If in the process of cultivation, all the operations are uniformly maintained, a drug with the highest purity can be achieved like ginger, turmeric, and licorice.
- In the cultivation of rhizomes, an adequate supply of irrigation and fertilizers is necessary. Systemic cultivation can yield crops with higher purity.
- Cultivation ensures a regular supply of crude drugs and minimizes the problem of shortage of raw material by properly planning a crop-cultivation.
- The substantial result of the cultivation of MP is a greater extent of industrialization. For example, cultivation of coffee and cocoa has given rise to several cottage industries. The very important consequence is that cultivation of MP permits application of modern technological aspects such as mutation, polyploidy, and hybridization.

The major disadvantages of organic cultivation include the high cost of drugs as compared to wild varieties and loss due to ecological disturbances like storms, earthquakes, floods, droughts, etc.

5.3 Opportunities for Medicinal Plants organic cultivation

There is a variety of prospects for MP cultivation from biological, medicinal, economic, etc. viewpoints. The most promising among them are focused on the:

- Extensive use of alternative medicine. Contemporary medicine is integrative - it combines conventional and alternative treatments, for which there is evidence of safety and effectiveness.
- Preference for natural products and chemicals from herbs. In the pharmaceutical industry, where the active medicinal substances cannot be synthesized economically, the product must be obtained from the cultivation of plants. Planned preservation and large-scale cultivation of the respected MP are of great interest. The versatility of biological actions can be attributed to the huge amount and wide variety of secondary metabolites in plant organisms, belonging to several chemical classes as alkaloids, coumarins, flavonoids, tannins, terpenoids, xanthones, etc.
- Dwindling of forest cover, reduced supplies from natural habitats, and threatened biodiversity. The majority of MP, even today, are collected from wild. The continued commercial exploitation of these plants has caused fading the population of many species in their natural habitat. There is some lack in the supply of raw plant materials necessary for the pharmaceutical industry and for the traditional practitioners. Thus, the cultivation of these plants has to ensure immediately their availability to the industry as well as to persons engaged with traditional medicine.
- Availability of markets (global/national). Market demands on MP are stable according to the economy statistics and forecasts (Eurostat). Apparently, cultivation of medicinal plants could only be promoted if there is a continuous market demand for the raw materials. On the other hand, it is equally important to prepare genetically stable planting material to ensure its uniformity and desired quality.
- Availability of high yielding varieties. Before beginning a regulated cultivation of MP, high yielding varieties have to be selected. When the wild plants are used, they need attentive refinement work. Varieties giving high yields also have to be prepared using selective breeding or clonally micro-propagation.
- Availability of agro-technologies. The regulated cultivation called for specific cultural practices and agronomic demands. They include specific plant strains as well as conditions depending upon soil, water and climatic circumstances. Taking into account the demands of the selected plants, a specific agro-technological package has to be prepared in order to match the existing infrastructural facilities. The necessary research and development work need to be performed in order to define Good Agricultural Practices (GAP).
- Availability of processing technologies. Cultivation and processing go hand in hand. Smart processing technologies and small-scale processing units have to be established to guarantee the sale of the raw material (cultivation product) and the supply of the processed goods.
- Profitable returns on sustainable basis. The resolution of the use of a closed scale of MP from wild sources has to stand on accurate schedule regarding the kinds of plant resources, abundance, feasibility of harvesting, and preserving the ecosystems.

5.4 Characteristic features of modern cultivation

When a cultivation process for MP production is initiated, it is important to take into consideration several parameters: production target, selection of suitable seed, yield and quality.

The management approaches, especially irrigation, fertilization and control against weeds, pests and diseases are also very important. In fact, the MP producers are obliged to apply specialized procedures for selection, harvesting as well as processing and commercialization. All these procedures and schedules should be linked to the requirements of the industry.

Quality of the product

The type of agriculture practices (conventional or organic agriculture) influences product quality. For instance, **organic agriculture production** is characterized with bypassing or excluding the application of synthetic ingredients like artificial fertilizers, pesticides, growth accelerators and fodder additives. Organic cultivation demands more manual and mechanical workforce that usually results in higher price of the final product.

Selection of species

The species selection strongly influences the future success of the MP use. For this reason, it is important to consider not only the climate and soil conditions but also disposable equipment, workforce and facilities, as a tool to obtain maximal yield and efficiency.

Market requirements

The industrial cultivation determines the types of species that are accepted since the MP production is linked to pharmacy, herbal industry, cosmetics and perfumery, as well as nutritional industry.

After admission of all necessary data and selection of suitable species, vegetal material must be obtained for performance of cultivation with technical and specific farm machinery, and afterwards processing of harvested material must be done.

5.5 Guidelines for harvesting and processing of MP

General guidelines

- Collect only mature parts.
- Do not collect the herbs from Roadsides, Sea Shores, Anthills, near Sewerage etc.
- Start drying process immediately after collection.
- Ensure complete drying before packing and storage.
- Dry aromatic herbs, delicate fruits etc. in shade.
- Store the herbs in properly constructed stores to minimize losses on storage.

Guidelines for collection of different parts of MP

I. Underground Parts & Whole Plants:

- Collect the whole plants after seed shedding.
- Collect underground parts when the mother plant is fully mature.
- Dry fleshy parts before packing and storing. Cut large parts into smaller pieces.

II. Bark and Stem

- Do not harvest from immature Plants.
- Collect from the Branches instead of Main Trunk.
- Strip the bark longitudinally & not all over the circumference of Trunk/Branches.
- Cut into small pieces to facilitate complete drying.
- Harvest only mature branches or stem.

III. Leaves Flowers, Fruits, Seeds and Floral Parts etc.:

- Harvest only mature parts.
- Do not collect from unhealthy plants.
- Do not collect parts manifested with insects, fungi etc.
- Dry flowers and floral parts in the shade. Fleshy flowers may be dried on Sun.
- Rotten and diseased fruits should be segregated from rest of the supply.

IV. Gums, Oils, Resins, Galls etc.:

- Make vertical incisions only on some portions of the tree. Do not collect the gums or resins from a tree continuously. Collect the gum/resin in the right season.

General requirements in storage of raw drugs

1. Convenient and well-designed space – dry and free from dampness or humidity;
2. Safeguard from rodents, insects, birds, etc.
3. Particular space for diverse grade of raw drugs, e.g. hygroscopic, volatile materials, etc.;
4. Particular space should permit free working of people and equipment;
5. Independent division for “approved”, “rejected” and “untested” raw drugs;
6. Specialized of physically alike looking raw drugs so that identity does not get mixed up.
7. Stamping the raw drugs as follow:
8. Preserve original samples as “reference standards” for each drug in stores;
9. Use raw drugs on a ‘first in - first out basis’ (FIFO);
10. Place packed raw drugs on wooden or plastic pallets; keep one raw drug in one pallet;

11. Use appropriate packing material for storing raw drugs.

5.6 Success story of *Aloe vera*

Cultivation

Aloe vera (*Aloe barbadensis*) is a popular medicinal plant. It belongs to *Liliaceae* family. It is a perennial plant. Its leaves are long and thick, juicy with a wheel like phyllotaxy. The two sides of the leaves have thorny structure with a thorny tip. The inner substance of the leaves is jelly like, with bad odor and bitter in taste.

It flowers during October to January and the long inflorescence has a large number of small pink flowers all around. Fruits are developed during February to April.

It is normally propagated vegetatively - the propagation is easy and convenient.

World trade of *Aloe vera* is about 80 million US\$ dollars exists now and this is likely to increase by 35-40 percent within 5 years. USA dominates the market (65%) other countries have a share of few percent, which could be enhanced by its commercial cultivation.



Soil and Climate

Aloe vera is growing in hot humid and high rainfall conditions. It is grown in all kind of soils, but well drained one with high organic matter, is most suitable. It grows well in bright sun light. Shady conditions results in disease infestation It is highly sensitive to water stagnation. Therefore, well drained high land should be selected for its cultivation. A rainfall ranging from 1000 – 1200 mm is ideal for *Aloe vera* cultivation.

Seedling Preparation and Planting

Seedlings are normally raised from the plants' roots. Sucker itself can be used as seedlings as well. Rainy season is ideal for sucker plantation.

**Land Preparation**

About 2-3 ploughings and laddering are done to make the soil weed free and friable. Land leveling is then followed. Along the slope, 45-40 cm apart drainage are made.

Application of Plant Nutrients

Before the last ploughing, 35 kg N, 70 kg P₂ O₅, and 70 kg K₂O/ha are added. In September – October about 35-40 kg N as top dressing may be applied. If the soil is rich in organic matter, N dose can be reduced.

Irrigation and Interculture

After 40 days weeding and earthing up are done. Earthing up is also practiced after top dressing of a fertilizer. *Aloe vera* is slightly tolerant to drought, but very sensitive to water stagnation. Therefore, proper drainage is more important than irrigation. As per need light irrigation during drought is enough.

Plant Protection

Aloe vera is infested by various insects and pests. Special care is needed for their control since *Aloe vera* juice of the leaves is directly taken as medicine. Clean cultivation, interculture operation, regular irrigation, and irrigation on demand, application of adequate organic manure, treatment of sucker before planting, and cultivation of *Aloe vera* in sunny conditions are conducive for the healthy growth of the *Aloe vera* crop. Use of organic materials for plant protection like raw garlic juice, neem oil (10,000 ppm) 2-3 ml / lit, tobacco extractant 20 ml/lit gave the good result.

Yield

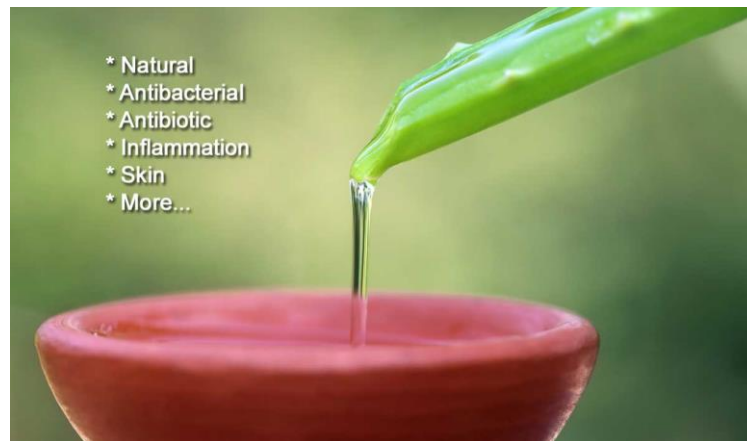
In a hot climate, harvesting of leaves starts after 7-8 months of planting. Sharp knife is used for harvesting. Efforts have to be taken to reduce the loss of juice from the cut parts. If harvesting is done once in a year, October – November is the best period. Second-year gives maximum yield and for

about 4-5 years, good yield could be harvested. After harvesting leaves, they are dried in shade and then in sun before storage. Flowers are collected in December – January and preserved after proper drying. Yearly 100 – 115 quintals raw leaves and 350 – 400 kg flowers/ha are obtained.



Medicinal Quality

Both the juice of leaves and flowers are used as medicine, but medicines are prepared from leaves. Intake of the juice of leaves improves hunger and helps in digestion. Juice when mixed with sugar cures cough and cold. It also cures nervous weakness, asthma, Jaundice, etc. The leaf flesh (about 7-8 g) mixed with honey, taken in morning and evening cures constipation. It contains various organic compounds of therapeutic value. Of these, the main use is alone. Besides, these it contains 12 types of vitamin, 20 kinds of amino acids, 20 kinds of minerals, 200 different types of polysaccharides, and various kinds of glycol proteins, which are used for human health.



- * Natural
- * Antibacterial
- * Antibiotic
- * Inflammation
- * Skin
- * More...

Economics

Expenditure to be incurred for *Aloe vera* cultivation normally amounts to a sum that after investment in cultivation provides a good net profit. In addition to monetary benefit, social benefit is very big as well. Better management can result in higher income and net profit.



Success story of an *Aloe vera* farmer

Three people with a family farm of about 3 ha.

To meet crop needs they used organic manures / vermicompost, etc. prepared by them.

Convinced about the profitability of *Aloe vera* cultivation, they decided to grow this crop. After a year of cultivation, they could get a good amount of profit. The produce is purchased by the local university, which provides technological advice for the cultivation of medicinal plants and their agro-processing. Since produce is purchased by the university, they have virtually no problem of marketing. They plan to start agro-processing unit of their own in future.

The method of cultivation adopted:

1. Land Preparation.
2. Application of about 8 tones vermicompost / ha during last plough.
3. No fertilizer or chemical was applied.

4. The application of $\frac{1}{2}$ kg vermicompost / sucker was applied after establishment of the sucker. The application was again repeated.
5. Hand weeding was followed.
6. Proper drainage facility was provided.
7. Irrigations were provided as and when needed.
8. Number of plants / ha - 2625.
9. Harvesting started after 8 months of planting.
10. In first year three cuttings were given.
11. Yield / ha was 39.4 tons of leaves.
12. From 2nd year on ward 5 cutting were expected.
13. In three years 13 cuttings are expected
14. In three years 170.62 tons of yield per ha is estimated.

5.7 The perspectives

Medicinal plants and their various products can be viewed as important commodity items for sustainable economic development of the country. There is also need for organized marketing and trade of medicinal plants and their various products. To meet the internal and international demands, it has now become imperative to produce the quality raw materials in significant quantities. This can only be achieved to promote the domestication and cultivation of medicinal plants, which have internal demand in large quantity and have export and import potential.

Pharmaceutical industry includes plant medicines for different kind of diseases and it is now steered up at global level because of its unique approach without side effects. Considerable countries are interested in herbal medicines and they are predicted to have promising future.

Two objectives can be achieved:

- i) Utilization of land for additional gain;
- ii) Conserving the important plant species, which are now neglected and under extinction due to deforestation. Future generation can be benefited by this kind of action. Some species are on the verge of extinction due to heavy exploitation by pharmaceutical industries. Deforestation resulted in losing the important treasure of unique medicinal plants. It needs now to be cultivated for harmless medicines.

5.8 References

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