Traditional and wild

Promoting traditional collection and use of wild plants to reduce social and economic disparities in Central Europe

Background document

Trainings on plant collection and utilization activities, building up entrepreneurial skills and employment opportunities for local population in Central Europe

Compiled by: TRAFFIC and WWF Hungary

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This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

Traditional and wild

This document is developed within the Project *"Promoting traditional collection and use of wild plants to reduce social and economic disparities in Central Europe" (Traditional and Wild)* implemented through the CENTRAL EUROPE Programme co-financed by the European Regional Development Fund (ERDF).

This document and other materials related to trainings are available on the official website of the project: http://traditionalandwild.eu/en/

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The training materials on plant collection and utilization activities, building up entrepreneurial skills and employment opportunities for local population, is developed within the project "Traditional and wild" implemented through the CENTRAL EUROPE Programme co-financed by European Regional Development Fund (ERDF).

The development of the training materials was undertaken by project partners involved in the implementation of the project, i.e. Corvinus University of Budapest (Hungary), WWF Hungary/TRAFFIC (Budapest, Hungary), Village Local Authority Kunadacs (Hungary), South-Transdanubian Regional Resource Centre Nonprofit LTD (Hungary), Association for Development and Promotion of Podkarpackie Voivodeship "PRO CARPATHIA"(Poland), Development Agency Kozjansko (Slovenia), Institution Foundation BIT Planota (Slovenia), Mendel University in Brno (Czech Republic), and Regional Agrarian Chamber of the South Moravian Region Brno (Czech Republic).

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INTRODUCTION

Medicinal and aromatic plants (MAPs) are collected in Central Europe from the wild for traditional use, as well as an additional source of income, particularly important for vulnerable groups such as the Roma communities, women and elderly. Since the middle of the 20th century, traditional knowledge about the properties of these plants and their collection traditions are repeatedly reported as being under threat with urbanization, changes in land ownership (access to collection sites) and in lifestyles. Commercial plant collection that takes place is often done in an unsustainable manner leading to the decline of an important source of employment and income for vulnerable groups.

Project: *promoting traditional collection and use of wild plants to reduce social and economic disparities in Central Europe* (Traditional and wild) aims to prevent the disappearance of this historical knowledge and help improve the livelihoods of vulnerable groups in rural parts of Central Europe was implemented between May 2011 and April 2014. The project involved collaboration between nine organizations from Hungary, Czech Republic, Slovenia and Poland, including academic institutions, local authorities, chamber of commerce, and NGOs, bringing together a wide array of expertise to implement the project goals successfully.

This document is developed as the main background document handed out to trainees during the trainings on plant collection and utilization, building entrepreneurial skills, and providing employment opportunities. The trainings were conducted by project partners in 2013. The trainees include collectors from target communities: unemployed people, elderly, women and the Romas, in the four aforementioned countries. The present background document is accompanied by the powerpoint presentation slides, which can be downloaded from the project website.

The present document contains seven separate chapters related to various aspects of wild plant life. Chapter 1 developed by the *Corvinus University* (Budapest, Hungary) contains a historical overview of wild plant utilization. Chapter 2 by the *Institution Foundation BiT Planota* (Slovenia) describes use of wild plants in daily life followed by Chapter 3 on basic knowledge about plants by the *Association for Development and Promotion of Podkarpackie Voivodeship "PRO CARPATHIA"* (Poland). Chapter 4 developed by the *South-Transdanubian Regional Resource Centre Nonprofit LTD* (Hungary) describes general aspects of plant collection.

Chapter 5 by *WWF Hungary and TRAFFIC* specifically focuses on aspects of sustainable wild plant collection. Within the project, TRAFFIC and WWF Hungary lead on ensuring sustainability in wild-plant harvesting and trade through implementation of the FairWild Standard. TRAFFIC is among the organizations that developed the Standard, and promotes its use and further development through the partnership with the FairWild Foundation.

The purpose of the FairWild Standard is to ensure the sustainable use and long-term survival of wild plant species and populations in their habitats, while respecting the traditions and cultures, and supporting the livelihoods of all stakeholders, in particular collectors and workers. Use of the

FairWild Standard helps to support sustainable collection efforts and maintenance of wild plant populations, as well as sustainable social aspects of collection, and fair conditions of labour.

Chapter 6 by the partner from the *Village Local Authority Kunadacs* (Hungary) describes post harvesting and processing of wild plants. Chapter 7 by the *Regional Agrarian Chamber of the South Moravian Region Brno* (Czech Republic) summarises marketing, advertising, sales, and entrepreneurial skills required for setting up business related to trade on wild plant material.

1 HISTORICAL OVERVIEW OF WILD PLANT UTILIZATION

Corvinus University, Budapest, Hungary

1.1 Utilization of wild plant resources

Wild plant use is connected with mankind's evolution, as proven by archaeological remains of Neanderthal populations living in Europe about 60,000 years ago. Based on the analysis of their burial places, traces of fossilized foodstuff wedged between their teeth have revealed plentiful grains and other plants, supporting the theory that these humans were not solely meat-eaters. Some of the Palaeolithic foods seem to have included legumes, date palms and grass seeds. The grasses originated from the Triticeae group, which includes wild varieties of barley, rye and wheat. Furthermore, according to some scientists, these ancient humans used certain preparation methods including cooking. This culinary step represented a significant shift in human behaviour, by improving the nutritional quality of plant foods and potentially altering the social organization of human groups.

Remains originating from the Early Stone Age give us an exact idea of the lifestyle of primitive humans. Fossil as well as ethnographic evidence from groups of hunter-gatherers suggests that the diet of pre-agricultural humans was derived from both animal and plant-based foods. Large animal herds as the basis for the livelihood of Early Stone Age hunters disappeared by the end of the Ice Age, around 10,000 years ago. Thus, the importance of plant resources as food has increased. A number of different plants, plant leaves, berries, and fruits were used in the daily diet. Herbs such as basil, coriander, mint, thyme and sage were well-known by ancient people. According to pictographs in caves, some medicinal plants were used to treat wounds incurred during hunting. However, hunting and the collection of plants were determined by seasonal and annual differences and often led to starvation in human groups. Food shortages necessitated a change and with it the origin and development of farming.

1.2 Utilization of plant resources by ancient civilizations

In evaluating the European traditions, it should be considered that the territory of Europe has been a crossroads of different civilizations even from prehistoric times. These changes were managed by expansion of nations, conquest of neighbouring lands, and sometimes by the peaceful activity of merchants. It resulted in changes to whole aspects of life, including how plant resources were used, both wild and cultivated.

The activity of the ancient Greek civilization had a remarkable effect on ancient, medieval and modern use of useful European plants. More than 1000 wild medicinal plants were known and applied by the ancient Greeks. For example, Homer mentioned 60 wild plant species in his works, Herodotus - 63, Theocritus - 107, and Hippocrates, the follower of Aristotle, - 237 species. Theophrastus ("Father of botany") used 450 species in practice. Dioskorides in his work *De Materia Medica,* published in 77 AD, compiled information on 512 plant species used in daily life (Figure 1).

The Roman Empire had an enormous effect on the cultural life and utilization of wild plant flora of the occupied territories of Europe, including the Central European territory. For instance, the works of Pliny and Galen demonstrate a wide use of medicinal properties of herbs and wild plants.

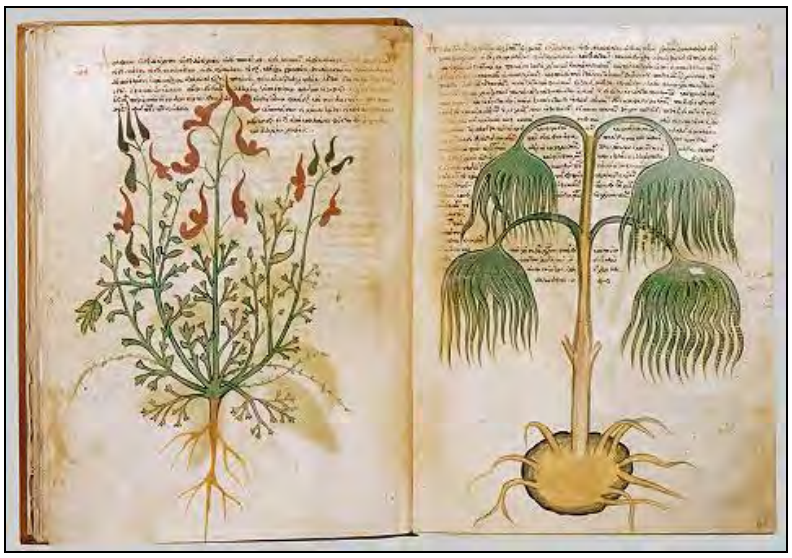

Figure 1. Plant illustrations of *De Materia Medica*[1]

Some of these plants have been collected in the Central European territories and were widely used for various purposes in the ancient world. For instance:

- Common yarrow (*Achillea millefolium*). Homer has a scene in his famous "Iliad" where Achilles treats his friend's wounds with Common yarrow.
- Garlic (*Allium sativum*). Galen mentioned that Garlic could cure diseases.
- Marshmallow (*Althea officinalis*). Pliny suggested that this herb can be used as an ointment or a cough syrup.
- Marigold (*Calendula officinalis*). Used as a fever reducer.
- Uva Ursi (*Arctostaphylos uva-ursi*). Galen wrote that he used the herb's leaves to treat wounds and stop bleeding.
- Tarragon (*Artemisia dracunculus*). Pliny suggested tarragon as a way to prevent fatigue following physical exertion.
- Borage (*Borago officinalis*). Borage leaves can be used to treat inflammation and bruises.
- Hyssop (*Hyssopus officinalis*). Hyssop was considered as protection against the plague and is a useful plant to treat coughing associated with colds and flu.

[1] Photo: http://phytotpe.voila.net/introphyto.html

- Chamomile (*Matricaria chamomilla* and *Anthemis nobilis*). Pliny recommended Chamomile as a cure for headaches, kidney, liver and bladder ailments.
- Horehound (*Marrubium vulgare*). Pliny and Celsus suggested it as a treatment for coughs.
- Parsley (*Petroselinum crispum*). Promote strength, cunning and agility.
- Plantain (*Plantago major, P. minor, P. lanceolata*). Wound healer, poison antidote.
- Blackberry (*Rubus fruticosus*). Pliny recommended drinking a decoction of blackberry leaves and bark to treat diarrhoea.
- Thyme (*Thymus vulgaris*). Could cure melancholy.
- Fenugreek (*Trigonella foenum-graecum*). It was widely used in the ancient world as a food for sick horses and cattle.

The European countries, including the Central European region, are strongly influenced by the Judeo-Christian tradition. The Bible, the main religious book of Christianity, contains descriptions of a number of edible plants as well as species used for curing, spicing or for decoration.

According to the Bible, Hyssop was often referred to as the herb used in purification (Figure 2). It was also used to prevent blood from coagulating, which may explain why the Jews in Egypt were told to use it at the time of the Passover. Peppermint (*Mentha piperita*) was well known as flavouring for food. Anise (*Pimpinella anisum*) is mentioned in the King James version of the Bible. Garlic is still the same garlic we use in daily life today; it was the favourite of kings of the times. Rue (*Ruta graveolens*) was mentioned by Jesus in his rebuke of the Pharisees. Plants mentioned in the Bible include: (for perfumes and bath) balm, frankincense, campfire, cinnamon, cassia, saffron; (herbs) wild gourd, rue, mustard, mint, melon, mandrake, mallow, hyssop, garlic, leek, onion, coriander, anise, cumin, flax, cucumber, bay leaf, chervil, cinnamon; (flowers) willow, water lily, violet, tulip, salvia, rose, peony, nigella, narcissus, meadow saffron, mallow, lupine, loosestrife, lily, larkspur, jonquil, jacinth, bedstraw, saffron; (foods) corn, wheat, lentils, millet, beans, barley; (fruits) pomegranate, palm, nuts, apple and olives.

1.3 Medieval Europe and Renaissance

After the collapse of the Roman Empire, Byzantium became the scientific and cultural centre of development. It was the place where Greek and Roman traditions were preserved and further advanced. After the fall of the Roman Empire, during the great migration period, monasteries were the only places in Europe where scientific activity and medication could be carried on. Monastery libraries played an important role in copying books by Greek and Roman scientists. In the hospital rooms of monasteries, patients were treated with medicinal plants collected from the wild or cultivated in small gardens.

Figure 2. Hyssop (*Hyssopus officinalis*)[2]

Food sources during this period were limited to what could be grown locally and what could be collected from the wild. The vast difference in living standards between the nobility, other landowners and the poor was enormous, and therefore the peasant diet was extremely limited. Wild roots and plants, such as burdock, onions, garlic and leeks were collected from the wild and consumed by peasants. Home-grown herbs used to flavour food included dill, thyme, and coriander. Opium poppy and summer savoury were also found in the diet. There is evidence from seeds discovered during excavations that many fruits were eaten: crab apples, cherries, plums and sloe, which are small wild plums. They made cider and added honey for sweetening.

During the 'Age of Discovery' the range of plant species used as food widened. Many species, such as tomato, capsicum, potato and beans, started to be used in cooking in Europe. These plants became cultivated crops. Other species, however, such as Jimson weed (*Datura stramonium)*, Giant goldenrod (*Solidago gigantea* and *S. canadensis),* being invasive weeds, were distributed throughout all of Europe. Because of their biologically active agents, these species became part of the European Pharmacopoeia, and their wild collection continues today.

1.4 Modern trends of utilization of wild plant resources

At present, the field of ethnobotany is making scientific efforts to describe indigenous uses of plants. Ethnobotanical surveys have revealed rather different forms of plant flora use. For instance, by analysing less well-developed regions of the Carpathian basin, ethnobotanists have identified many reasons for wild plant collection in the 19th and 20th centuries. During this period the buds of Silver birch (*Betula pendula*), Elder flowers (*Sambucus nigra*), fruits of trees, i.e. oak (*Quercus)* acorns and beech (*Fagus)* nuts, and wild fruits (*Vaccinium, Castanea, Trapa, Epilobium* etc.) were started to be collected for food. Collecting wild roots (*Glycyrrhiza, Chaerophyllum,* and

[2] Photo: http://upload.wikimedia.org/wikipedia/commons/thumb/6/6d/Hyssopus-officinalis-habit.jpg/1024px-Hyssopus-officinalis-habit.jpg)

Crambe) was also widespread. Collection of different mushroom species was known and has been practiced through to the present day. Juice from Silver birch was used in medicine and as a sweetener. The chewing of pine resin has been recorded, and it was also applied as an adhesive material. Flour made from the cortex of trees was consumed in periods of starvation. Tree cortices were also used for preparing shoes, tanning extract, flooring and vessels. Caps were prepared from polypore fungi. Mosses were collected to cover the roofs of houses, for horse-litter, and for compacting the walls of wooden houses. The dry twigs and boughs of trees were collected for heating. Willow twigs (*Salix)* were used to make baskets. Cane is used and applied even nowadays for roofing. Many species were used as dyes (*Isatis, Alkanna* and *Carthamus* etc.) Hundreds of species were used for medication, e.g. Chamomile (*Matricaria recutita)* (Figure 3), Common yarrow *(Achillea millefolium),* Small-leaved lime *(Tilia cordata*). Different wild species were collected for religious ceremonies (*Gypsophila, Rosa* etc.) Some toys were also made of wild species (*Capsella, Papaver,* and *Taraxacum*).

Figure 3. Chamomile (*Matricaria recutita*)[3]

Starting from the 1960s, the process of globalization started to accelerate, and it has affected nearly every part of our lives. Food is purchased in supermarkets, and medicine comes from international pharmaceutical companies. This has led to less dependence on wild plants for food and medicine, and less direct contact with nature generally.

But despite this fact, there is a kind of renaissance taking place in using wild resources. Even in Central Europe there are many small local markets where numerous local, plant-based products are being sold. For instance, Elderflower or Elderberry wine (*Sambucus nigra*) is sold at markets in Germany, Austria and Slovenia, and gourmet liqueurs and marmalades made from wild fruits such as elderberries, blackberries (*Rubus*), Blackthorn berries (*Prunus spinosa*) and Wild apples (*Malus sylvestris*) are sold.

These traditional treasures should be preserved. What is more, in the face of increased global competition for tourists and other markets, regional identities – characterized by regional foods, music, artefacts and products – are marketing tools for local economic growth.

[3] Photo: P.Radácsi, Corvinus University, Budapest (Hungary)

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2 WILD PLANTS IN DAILY LIFE

Institution Foundation BiT Planota, Slovenia

Several European languages have a word equating to the English "herb", denoting a green plant that dies at the end of the growing season, for example, Slovene – "*zelišča*", German – "*kräuter*", French – "*L'herbes*", and Italian – "*erbe*".

In the present document a herb is considered as any plant with leaves, seeds, or flowers used for flavouring, food, medicine, or perfume.

Due to their properties and active substances, herbs have played an important role throughout human history. Based on latest findings, many herbs are now known to be a source of minerals, vitamins and other substances. In this way herbs stimulate the activities of various organs as well as the immune system, and maintain balance in organism functioning. They are used to obtain natural dyes, and other household uses. Herbs are also used for repelling parasites and insects, and disinfecting and cleaning rooms and dishes.

2.1 Uses of herbs

Herbs and food

Culinary herbs and spices – such as parsley, basil and caraway, all have typical aromas which enhance the taste of food. The active substances in spices increase production of digestive fluids, allowing for easier digestion and nutrient absorption. Many also prevent the unwanted side effects of certain foods, such as flatulence. It is very likely that our ancestors began using particular herbs because of their medicinal qualities.

Aromatic culinary plants are highly diverse. Some have a strong flavour and are used sparingly, while others can be used in larger quantities and therefore function almost as vegetables. The important thing about using herbs in cooking is matching them with food. The amount of herbs used must also be proportionate. Culinary herbs typify common garden herbs and are rarely collected in the wild. In order to preserve the aroma and taste of herbs off-season, various preservation methods have been developed since ancient times.

Herbs and fragrances

One feature of many herbs is a pleasant fragrance such as with woodruff and flowering Small-leaved linden (*Tilia cordata*), which give off attractive scents from a distance in summer heat. Many semi-wild and garden herbs are similar, such as Rosemary (*Rosmarinus officinalis*), Peppermint (*Mentha piperita*), Balm (*Melissa officinalis*) and Lavender (*Lavandula*). Our distant ancestors used fragrant plant parts to perfume themselves, as well as also learning to preserve the fragrance to scent their living space and clothing. They developed the skill of collecting and drying flowers with just the right scent (such as Potpourri). People also learned to extract the fragrances as essential oil from flowers as well as green plant parts.

Herbs in housekeeping

Herbs once played an important role in housekeeping. The use of Horsetail (*Equisetum arvense*) was known for polishing dishes, as well as the sprinkling of herbs such as Rue (*Ruta graveolens*) and Thyme (*Thymus vulgaris*) on the living space floor for scenting and disinfection. These, as well as many other uses, have been lost, while using Lavender flowers as a moth repellent is still fairly common. Rubbing leaves and essential oils of certain herbs into the skin can be effective for repelling mosquitoes. It's known that plants such as Basil (*Ocimum basilicum*), Peppermint (*Mentha piperita*), and Verbena (*Verbena bonariensis*) repel insects. For repelling fleas and other parasites, powdered dry green parts of Pyrethrum (*Chrysanthemum* or *Tanacetum*) were used, which is grown today for the production of the natural insecticide pyrethrin. Herbs and their extracts have also been used by housewives for perfuming laundry while washing and ironing.

Herbs for beauty

Many active substances in herbs have a beneficial effect on the skin, such as moisturizing, tightening and nourishing. A large number of modern cosmetic products contain at least one herb-based active substance. Cleansing milk, shampoo, bath salts, bubble baths, herbal soaps, oils and creams are often full of artificial additives. Simple concoctions are becoming more and more common as natural cosmetics. They can be prepared in the home using ingredients of known origin, and can be adapted to personal needs.

Herbs are important in aromatherapy as a source of essential oils. Many essential oils are known to have beneficial effects on people. By rubbing and inhaling them, they relax and regulate the workings of the body. These positive effects were already known and described by the Egyptians, Greeks and Romans and in recent times aromatherapy has been growing in popularity.

Herbs and dyes

At some point in human development, man started paying attention to the external appearance of his dwellings and clothes. The first dyes were probably obtained from edible plants that stained the skin or clothing during food preparation or while eating. It's most likely that Blueberries (*Vaccinium myrtillus*) or Elderberries (*Sambucus nigra*) became the first source of dyes.

In time, experiments led to better plant recognition and technologies, to the point that dyes of various shades could be attained. In the Middle Ages, plant dyes were used by monks for preparing ink and in manuscript decoration. The dye trade used to be one of the most respected. Using the proper selection of plants and hardeners, they were capable of producing a wide variety of blue, yellow, brown, green and red shades of colour. Herbs were also used for food colouring. Potted marigold flowers have been used for colouring butter and cheese yellow. Even today, Elderberries (*Sambucus nigra*) are used in Portugal for dying red wine.

Herbs in the garden

Experience has shown that planting certain herbs in the garden enhances the growth of vegetables and other plants. Herbs are often either “good neighbours” or work as repellents. Pot marigold (*Calendula officinalis*) is known for preventing certain fungal infections in the garden, due to its

secretions. This knowledge has been put to good use by farmers and housewives for centuries. Much of this experience forms the basis for ecological, biological and biodynamic gardening, which follows the natural rhythm of mutual effect in plants, and avoids usage of artificial fertilizers and other protective substances. Herbs in the form of infusions and other concoctions are used for plant protection, fertilizing and aiding in the composting process. The most esteemed herbs for this are Comfrey (*Symphytum officinalis*), Common nettle (*Urtica dioica*) (Figure 4) and Common tansy (*Tanacetum vulgare*).

Figure 4. Common nettle (*Urtica dioica*)[4]

Herbs for relaxation and recreation

Working with herbs brings along with it other beneficial effects. Collecting herbs in the wild and cultivating them in the garden are interesting aerobic activities that strengthen basic bodily functions. In addition to the physical, both these activities have a beneficial psychological effect. They allow for relaxation in a natural environment and are a palliative to the stress of everyday life.

Herbs for health

By collecting and ingesting plants, man has learned that certain plants help with various ailments and injuries. An extensive knowledge base has emerged from this, which was incorporated into early medical systems. Initiates in these systems attained high status in society, often as priests or shamans.

Besides non-lignified plants, medicinal effects are also obtained from certain trees, shrubs, algae, lichens and fungi. Medicinal plant use dominated official European medicine up until the 19th

[4] Photo: G.Ruzickova, Mendel University, Brno (Czech Republic)

century. The aggressive – and at first glance successful – promotion of chemically-synthesized medication has pushed herbs out of prominent medical usage. Yet the knowledge of medicinal herb use perseveres among herbalists.

Phytotherapy uses active substances of medicinal plants singly or in combination. Homeopathy, aromatherapy and others like Bach flower therapy, where plants are the basic material for various treatments, are becoming more and more popular. People are also becoming more familiar with traditional Chinese medicine, the Indian Ayurveda, and other medical systems where medicinal herbs play an important role.

Ornamental use of plants

Herbs can be used to make a range of decorative items and gifts (Figure 5). They can be sewn into herbal cushions and charms. They can be used to make herbal soaps and potpourris. Dried herbs can be the basis for pictures, from multi-coloured herb fragments. Herbarium specimens can be used for framed pictures or on greeting cards. Herbs can perfume ink and provide uniqueness to handmade paper. Herbs can also be used to decorate candles, as well as for decorating when arranging gifts. Original gifts made from herbs can also be an interesting tourist souvenir.

Figure 5. "Folklore house" dedicated to preserving traditional knowledge about the use of wild plants (the village of Kunadacs, Hungary)[5]

Which medicinal plants may we use ourselves?

The term "medicinal herbs" is also misleading because most of them do not cure acute ailments. Plants and their concoctions can, based on modern findings, be used in prevention, alleviation of pre-ailment symptoms, and problems associated with chronic conditions, as well as to ease recovery after an ailment. But, in order to prevent or to cure disease dosage of herbs should be

[5] Photo: K.Rodina, WWF Hungary/TRAFFIC

carefully determined. All herbs that have a considerable effect, or cause side effects, as well as poisonous plants, should be used under appropriate medical supervision.

When using medicinal herbs, it is important to observe how the body reacts. The slightest suspicion of side effects should result in termination of the treatment. Because herbal active substances most often work in combinations, it is possible that the body will not react well to some of them. In such cases a substitute plant or mixture should be found with similar function. It is very important not to use synthetic medicine and herbal concoctions at the same time. In certain cases the combined effects can exacerbate existing problems. Besides, different people react to various chemicals in different ways (allergy and etc.).

Useful parts of medicinal herbs

Useful parts may include leaves (e.g. Peppermint (*Mentha piperita*), Balm), flowers, (e.g. Chamomile (*Matricaria recutita*), Small-leaved lime, roots (e.g. Comfrey), fruits (e.g. Rose hip (*Rosa canina*)), seeds (e.g. Chestnut (*Castanea*)), wood and bark (Black alder (*Alnus glutinosa*)). Pharmacists categorize the types of plant drugs based on what parts of plants they are made from (Table 1).

Table 1. Latin names of plant parts

Part of plant used (English)	Part of plant used (Latin)	Pharmacological name	Common name of plant and plant part
Herb	Herba	Achilleae herba	Yarrow herb
Leaf	Folium	Malvae folium	Mallow leaf
Root	Radix	Gentianae radix	Great yellow gentian root
Rhizome	Rhizoma	Acori rhizoma	Calamus rhizome
Tuber	Tuber	Salep tuber	Orchid tuber
Bulb	Bulbus	Alii sativi bulbus	Garlic bulb
Flower	Flos	Sambuci flos	Elder flower
Fruit	Fructus	Cynosbathy fructus	Rose hip fruit
Seed	Semen	Hyppocastani semen	Chestnut seed
Bark	Cortex	Frangulae cortex	Buckthorn bark
Cone	Strobulus	Lupuli strobulus	Hop cone
Oil	Oleum	Olivae oleum	Olive oil
Essential oil	Aetheroleum	Chamomillae aetheroleum	Chamomile essential oil

2.2 Products from wild plants

Teas

Hot water infusion. This is the most common method of preparation, where boiling water is poured over a dry herb or mixture. A basic procedure is to pour 150 ml of water over a teaspoon of herbs. If not otherwise prescribed, tea should be left for five to ten minutes in a covered container and then filtered. Preparation time is shorter for herbs with volatile oils.

Cold water infusion. This is a method of preparation where herbs are put in cold water, which is then slowly heated to boiling point. As soon as it starts to boil, it's removed from the stove and left

to sit in a covered container for 10 minutes, or as long as instructions specify. This method is used for certain roots and whole herbs.

Decoction. This is a process of preparation where the dry herb is mixed with cool water. Water is then heated to boiling point and slowly boiled for 10 to 30 minutes. This method is used for roots and bark where extracting substances is more difficult. The ratio of preparation is two spoons of herbs per 1/4 litre of water.

Maceration. Substances sensitive to heat, such as mucilage or vitamin C, are best prepared by maceration, or cold extract. Cold water (1/4 litre) is poured over two teaspoons and left covered for at least six hours, or overnight. Before using, the tea should be heated to a suitable drinking temperature.

For tea preparation, a container made with heatproof glass or ceramic is used. Metal containers are not recommended because they can affect active substances in the tea. Medicinal teas should not be sweetened unless specified, and then may be sweetened with honey or fruit syrups. Artificial sweeteners are not recommended, except for diabetics. Teas for easing colds, coughs or for perspiration may be sweetened. Sweetening bitter teas for digestion and tart teas for diarrhoea decreases their effectiveness.

When tea is drunk for its curing effect, the time of drinking is also important. Sedative teas are drunk in the morning or evening, and sleep-inducing teas at least an hour before sleeping. Bitter teas for digestion should be drunk a half-hour before a meal, and teas against inflammation during meals. Teas for colds or coughs are drunk multiple times daily, and a fresh tea should be prepared every time.

Teas can also be used externally: for washing wounds, gargling, gum massage, washing skin on the face and neck, and so on. Tea can also be used in a bath or for inhalation.

Tinctures

A tincture is a form of extraction using alcohol. An advised amount is 20 g dried plant material in 100 ml of 70% alcohol. The mixture is kept in tightly-sealed containers, which must be shaken several times daily to accelerate the extraction. The process should last for at least three weeks. After that time, the tincture should be decanted and filtered, and should be stored in dark bottles. Traditionally, there is a common method of making tinctures from home brandy, which has an alcohol content of around 40–45%. Sometimes “spirits”, which can consist of more than 60% alcohol, can also be used, but only for external use. The process of making and using these is similar to that for a 70% alcohol tincture.

Tinctures can be used internally. The normal dosage is 15–20 drops of tincture, which is drunk in water or tea. It can also be eaten on a spoon or sugar cube. If not otherwise prescribed, it should be taken three times daily. Tinctures are also used externally for rubbing and massaging, disinfecting small wounds and the like. Watered down, they are used for gargling, washing the mouth, and in compresses. They are also used in production of certain cosmetics.

Oily extracts

To extract fat-soluble substances, various oils can be used. Oily extracts can be made in two ways. The more widely-used method is **cold decantation**. A suitable container is filled with the herb and then poured over with an adequate amount of oil. The container is closed and left in the sun for three to four weeks. The oil is then filtered and poured into dark bottles. The oily extract can also be made with a process of **hot decantation**. In this case the herb is mixed with oil and heated over steam for about three hours. This can be done at home using a pan with water and a suitable pot placed inside it. The mixture is then cooled and filtered, and the oil is poured into bottles for storage.

Juices

Traditional medicine has often included freshly-squeezed herbal juice, most often made from various juicy fruits and roots. Fresh juice can be made today by grinding the herb in a blender and then filtering the juice. Specialized kitchen juicers are also available. If the herb is dry, some water may be added. Juice can be stored for up to several days in a refrigerator. The usual prescription is one to two spoonfuls of fresh juice daily over the course of a several-day treatment.

Syrups

Syrup is a plant extract prepared with sugar. For example, syrup from spruce tips is prepared in a simple way. A layer of sugar is poured into a jar, cut up herbs are placed on top of it, then covered with another layer of sugar. This gets repeated until the jar is full. The jar is then left in the sun for four to five weeks. The liquid produced is then poured into appropriate bottles and stored in a cool space. It is used either by taking a spoonful of it or adding it to tea.

In some places syrup is also made out of black tea or dried herbs, by adding an equal amount of sugar or even honey to it. The honey adds medicinal properties to such syrup. Syrup prepared this way is stored in a cool space and used similarly to the above concoction. It is taken in one to two tablespoon doses, three times daily. Because it contains honey, it must not be added to a very hot tea. Above 40 °C the active substances in honey partially degrade.

Ointments

Ointments can also be made from certain herbs. In the past, animal fat was normally used as a basis of homemade ointments. The most appropriate is pig lard, which absorbs well into the skin. In the past deer fat was also highly valued. Today Vaseline is also used in making ointments. The preparation is simple: the fat must be carefully dissolved and the dried herbs mixed with it. The mixture is then left to cool and solidify overnight. The next day (or at minimum three hours later) the fat is dissolved again and, when warm, filtered and poured into suitable containers. It is very important that the temperature of the fat does not exceed 70°C. For better lubrication, some people add olive oil and/or bees wax. The unpleasant smell can be reduced by adding a leaf or two of a fragrant herb. Homemade ointments remain potent for several weeks, which can be increased by storing in a refrigerator.

Creams are made in a similar way, with the difference that creams have water or a watery herbal extract, combined with wax and oil, as an important ingredient. The procedure must be carried out in a water bath.

Herbal wines

In the Central European region, refreshing wines made with herbs have traditionally played an important role. Such preparations have used roots with bitters and restorative herbs. A litre of red wine is poured over a handful (40–50 g) of herbs. In Southern regions sweet muscat white wines are also used. This is how vermouth is made. The mixture is poured and then sealed in containers and stored in a cool space for at least two weeks. This gives the wine an additional aroma and causes the active substances to dissolve. Such wine is drunk as a medicine or for refreshment, one or two glasses a day. Herbal wines remain potent from a couple of months up to several years in duration.

Herbal brandy

Brandy with herbs has a similar role as a refreshing wine. Various roots and restorative herbs are soaked in brandy. The process is similar to making tinctures, with a smaller amount of herbs. Herbal brandies were sometimes drunk for treating health problems.

Medicinal baths

Baths are another way to use herbs for maintaining health and alleviating particular ailments. Both dried as well as freshly-collected herbs can be used. Most often one single plant is used at a time, but a combination of herbs having similar effect may be used instead.

For a single bath about 100 g of dry herbs are wrapped in gauze. The wrapping can be hung on the tap, so that the warm water pours over it, dissolving the active substances. The wrapping can also be put into the bath itself, or an infusion of a select herb can be made and poured into the prepared bath.

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3 BASIC KNOWLEDGE ABOUT PLANTS

Association for Development and Promotion of Podkarpackie Voivodeship "PRO CARPATHIA", Poland

3.1 The role of plants

Foundation of life

Green plants are able to synthesize organic compounds using sunlight and basic inorganic constituents. It is a mechanism relied upon by the entire living world. In the process of photosynthesis – using solar energy and with chlorophyll – plants break down water (H_2O) into hydrogen and oxygen, and consume carbon dioxide (CO_2). Then – in a long chain of chemical reactions – carbon dioxide combines with hydrogen to form organic compounds, mainly carbohydrates and fats. Acquired at the same time, an aqueous solution of mineral salts provides a plant with nitrogen (N), sulphur (S), phosphorus (P) and other elements necessary for protein production ((carbon (C), hydrogen (H), nitrogen (N), oxygen (O), phosphorus (P), potassium (K) and sulphur (S)). Secretion of oxygen in photosynthesis into the atmosphere or water provides a constant amount of this gas in the environment, necessary for respiration in plants, animals and humans. "Collected" during photosynthesis, solar energy is the source of all energy needed to perform vital functions in all living organisms.

Organic compounds which build the bodies of both plants and animals undergo continuous transformation. During breathing, they break down into carbon dioxide and water, and excreta and dead remains of plants and animals undergo mineralization performed by mainly bacteria and fungi. Non-green plants, feeding on ready organic matter, spread it as mineral components: carbon dioxide and water, ammonia and nitric acid, phosphorus compounds, sulphur, potassium and others. These products of inorganic decomposition go back into the soil and the atmosphere, where they can again be absorbed by green plants and used for new synthesis of organic compounds.

Apart from the basic, so-called primary components (proteins, fats), the chemical composition of plants includes secondary compounds such as terpenoids (among them e.g. volatile oils, saponines, and steroids), alkaloids, fatty oils, glycosides, polysaccharides such as mucilage, and phenoloids (e.g. flavonoids, coumarins and tannins). Besides these, plant material consists of vitamins and minerals. The role of these special compounds in plant life is only partly known, yet they may have a significant role in human health care.

Provision of shelter

Plants are nests and shelters for animals during bad weather and threats from other animals. They also form a part of the ontogenesis of certain animals. Conversely, animals affect the environment, continually altering the vegetation. Small insects and birds pollinate flowers and move seeds and fruits often over long distances. Plants such as grain crops, legumes, fruits and vegetables are the basis for human food. Plants also provide raw materials necessary for the construction, woodworking, food, distilling, beverage, wine, rubber, textile, paper and pharmaceutical industries. Energy resources such as coal, peat, oil and wood are also of plant origin.

Integral part of landscape

Plants are closely identified with the Earth's landscape. They are present almost everywhere: in the mountains and deserts, polar glaciers and hot springs, on the ocean floor, plains and bogs. They are found in various biotopes: cultivated fields, road edges and fallow fields, meadows, pastures and grasses, in waters (ponds, lakes, and rivers), and on their shores, in marshes and bogs, deciduous and coniferous forests, and various ruderal habitats. They normally form multispecies communities.

For decades, many plant species have been facing the process of extinction, especially those of a narrow ecological scale and the communities they create. The greatest danger is rapid loss of certain habitats, for example coastal, wet meadows and bogs, and grasslands.

Intensive agriculture is replacing traditional farming throughout all of Europe. Agriculture activity may threaten natural diversity. There is also land reclamation from river valleys and moors, straightening of rivers, plowing and afforestation of grasslands, claiming space for roads and constructions, as well as pollution of air, water and soil. All these factors pose potential threats to plants. Some species are endangered due to unsustainable collection as well.

3.2 Plant Systematics

Systematics as a science helps to identify taxa, and thus allows a better understanding of the rich and diverse world of plants. The basic systematic unit is the species, which brings together individuals with important shared features, inherited by offspring across generations, and creating a reproductive population. Related species, sharing many common features, are grouped into a genus, similarly-related genera are grouped into families, families into orders, orders into classes, and classes into phylum. Species are designated with two-word latinised names (binomials); the first word is the genus name and the second characterizes the target species (is known as the specific epithet). Plant nomenclature follows a set of carefully defined, and periodically revised, set of rules set out in the 'International Code of Nomenclature for algae, fungi and plants'.

Systematics attempts to organize the world of plants in a natural system which reflects their phylogeny and evolution. Therefore, plants are grouped from the oldest and simplest structures, such as bacteria, through ever-higher degrees of differentiation, to the youngest and most complex – angiosperms. The phylum *angiosperm* includes most vascular plants, both cultivated and wild. Within this phylum there are two classes: *dicotyledons* (embryo with two cotyledons), for example the following families: bean, buttercup, and rose, and *monocots* (embryo with one cotyledon), for example grasses, wheat, and rye.

3.3 Artificial divisions

Besides the natural taxonomic system, there are also so-called artificial systems, not based on phylogeny (development), but on similarities among taxa. These similarities may be simple morphological features, for example of flowers, leaves, and buds. Another method is grouping plants according to their life cycle or their ecological requirements.

The following division was established by Raunkiaer: phanerophytes (phanerogams), chamaephytes (dwarf shrub), hemikryphytes (plants with buds at or near the soil surface) and terophytes (annuals), that do not set winter buds; cryptomonads (with resting buds lying either

beneath the surface of the ground as a rhizome, bulb, corm, etc., or a resting bud submerged under water), subdivided into geophytes, helophytes and hydrophytes, and epiphytes (living on trees).

Further differentiation of taxa is often made based on environmental requirements. In this context there are a few types of plant groupings, as follows:

Water demand

- hydrophytes- water-loving plants;
- hygrophytes - bog plants, prefer humid places;
- mesophytes - plants with medium or varying demand for water;
- tropophytes - plant climate variable, appearing periodically, halophytes;
- xerophytes - dry-loving plants, including succulents - succulent plants;

Light demand

- sun-loving plants - heliophytes;
- shade-loving plants - skiophytes;
- compass plant - for protection against strong southern light set the leafy lamina flat surface to the east and west (for example lettuce compass);

Soil requirements

- bazophytes - require alkaline soils;
- acidophytes - require acid soil;
- calcicole plants - kalcyphytes; nitrophilous; halophytes;
- calamine plants - grow on soil rich in heavy metal compounds (for example lead, zinc);

Utilization

- “maintenance” plants - human food: sources of sugar, honey, oil, fruit, vegetables, and cereals;
- “pseudo maintenance” plants - consumed for various purposes, but having no basic nutritional value: spices and stimulants;
- Industrial plants: fibrous; producing tannin; rubber; medicinal; oil, oilseeds, and trees which provide timber;
- Other: energy plants, forage, plants for land rehabilitation, and ornamental plants.

A common grouping is made based on the structure and durability of shoots. Depending on these, plants can be divided into woody and herbaceous categories.

Woody plants

- **Trees** are perennial plants, of large size, with a strongly woody stem, covered with hard bark. They have buds covered with scales, adapted to winter conditions. The main stem is called a tree trunk, which at a certain height splits into thick and thin branches, forming the crown of the tree. Trees live long and can grow to great heights. They bloom and bear fruit repeatedly during their lives.
- **Shrubs** live a shorter time than trees and differ from them in size. They are smaller and lack the main trunk. Shrubs branch at the bottom and develop many vertical stems, sometimes very dense root suckers, as in rose and lilac. **Low shrubs** are perennials with woody stems, often forming dense thickets, as in bilberry and heather.

Herbaceous plants

Herbaceous plants grow above-ground stems which are juicy and not woody. They die yearly at the end of a growing season owing to climate conditions. Herbaceous plants can be divided into annual, biennial and perennial plants. There are also plants of combined character. Annual and biennial plants bloom and bear fruit only once in a lifetime. They are called monocarpic plants.

Annual plants go through their life cycle, from seed germination to releasing their own seeds, over one growing season, and then die. They are seasoned through the winter as seeds. Most crops are annual plants. Among them, there are winter and spring forms. Winter plants require low temperatures for their full development. Therefore, their seeds germinate in autumn and young plants remain under the snow. They then further develop along with spring plants, which sprout in spring. If a winter plant is sown in spring, it will not bloom or bear fruit.

Biennial plants need two growing seasons to complete their biological cycle. In the first year they produce a rosette on the ground of assimilating leaves and storage organs in the form of modified roots and shoots, which gather resources. These resources are used in the second year to produce flowering stems and seeds, and then the plant dies.

Perennial plants live for more than two years. Perennial plants can be short-lived (only a few years) or they can be long-lived, as are some woody plants like trees. They include a wide assortment of plant groups from ferns and liverworts to the highly diverse flowering plants like orchids and grasses. Perennials, especially small flowering plants, that grow and bloom over the spring and summer, die back every autumn and winter, and then return in the spring from their root-stock, are known as **herbaceous perennials**.

3.4 Morphology

The smallest part of every organism, including plants, is a cell. A number of cells of the same shape and performing the same function create tissue, and many different tissues comprise an organ. The main organs of a plant are roots, stems and leaves. Each of these parts performs fully-defined physiological functions. Functional units connected with reproduction are flowers, fruits and seeds.

The shoot of a plant consists of a stem and leaves, from which buds, flowers and fruits are formed. Roots, stems, leaves and buds are involved in the process of nutrition and proper growing of the plant. Flowers produce fruits with seeds (in 'flowering' plants).

3.4.1 Structure and function of roots

Functions of roots:

- fixing the plant in the soil, where they take up water together with mineral salts and transmit these to the shoot;
- storage of materials;
- use for vegetative reproduction of plants;
- roots of certain plants are found in symbiosis (living together) with bacteria (such as warts in the roots of legumes) and fungi (mycorrhiza of trees). This facilitates a supply of nitrogen compounds for the plant, and has a positive influence on the soil.
- deep-reaching roots move minerals from a deeper to a shallower soil layer, and generally, roots contribute to loosening the soil and improving its structure.

Roots grow downward, toward the Earth's centre (Figure 6). The apex (tip) of the root is smooth and without root hairs, and the area of growth is situated here. Outside, it is wrapped in a cap, which facilitates the penetration of the roots into soil. The rear part is covered with a thin section of small roots (root hairs). They absorb water from soil as well as nutrient salts, which maintain living plants. The shape, size and structure of the root system are closely related to its function and largely dependent on habitat conditions in which the plant occurs. The underground plant organs are often much more developed than parts above the ground.

The primary root, which is thicker than lateral roots, is called a taproot. The taproot system is appropriate for most dicotyledonous plants. Monocots (for example grasses) have a diffuse root system without a primary root. Adventitious roots may be formed on the surface of underground rhizomes and creeping stems. They are important for the vegetative propagation of plants by rooting sections of shoots. On aerial shoots they transform sometimes into anchor roots, such as in ivy, or supporting ones, as in maize. Parasitic and hemi-parasitic plants produce suckers, which grow into the host plant tissue and accommodate themselves with food. The more developed a root system is, the better it supplies a plant with food, water, and minerals, and yields more crops.

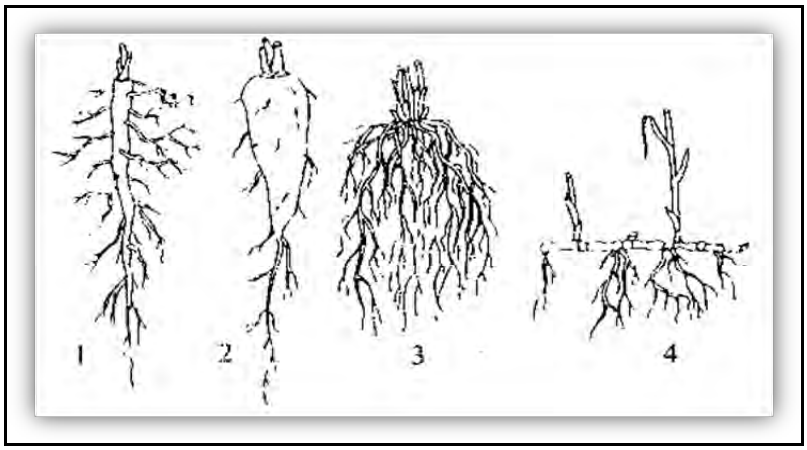

Figure 6. Root morphology[6]

3.4.2 Morphology and function of shoots

A shoot, in contrast to a root, is essentially an above-ground organ, growing upwards (negative gravitropism), although sometimes shoots develop as underground stems in the soil. The parts of a shoot are the axis, the stem and leaves, as well as buds, flowers and fruits. Leaves on aerial shoots are developed as for assimilating ones, while under the ground they are scarcely developed, like a scale.

The essential function of a shoot is assimilation of CO_2, transpiration, oxygen absorption, nutrient storage, generative and vegetative reproduction. Fully-developed plants have a primary shoot and side shoots, above-ground and underground stems, and elongated and shortened shoots. Elongated shoots have stems with long internodes. Short shoots have shortened internodes, with the leaves and buds embedded densely. Trees and shrubs grow buds from their tip, while lateral buds develop into lateral shoots the following spring. We can distinguish buds as *leaf buds* i.e. shoots, producing a leafy shoot, *flower buds,* which produce flowers, and *flower-foliage buds,* from which both develop. Shortened shoots of some trees and shrubs are transformed into thorns (e.g. blackthorn) or climbing shoots.

Rhizomes are perennial shoots in the soil, and may be thick and short, such as in Sweet Flag (*Acorus calamus*), or have elongated internodes, so-called stolons, as in Couch Grass (*Elymus repens*). Adventitious roots may grow from the nodes, scaly leaves and buds.

3.4.3 Morphology and function of stem

A stem develops from an embryo in the germinating seed and grows in the extension of a primary root. The place where the roots of a young seedling become a stem is called a root neck.

At the tip of the stem there is a terminal bud containing *meristematic* cells, from which growth starts. Leaves set in the internodes of a stem grow from a bud. The stem segments interrupted at nodes are called internodes. At the base of the internodes there is often meristem interstitial tissue, which affects the intercalary growth and elongation of internodes from their base, as in grass. In the angles, i.e. the leaf axils, lateral buds are formed. From lateral buds, lateral branching

[6] Legend: 1 - taproot, 2 - storage root, 3 - fibrous root, 4 - stoloniferous with rhizomes; Cervenka M. 1993. Świat roślin skał i minerałów. Oficyna Wydawnicza MULTICO, Warszawa, ss. 401

stems develop with their own terminal and lateral buds. Shoots branch repeatedly throughout the life of a plant. The stem functions as support for leaves, flowers and fruit and morphologically as well as functionally connects the principal nutritional organs of plants – roots and leaves. It conducts water and mineral salts from roots to leaves, buds, flowers and fruits, and from leaves – as products of assimilation –to the root and the other organs. There are woody and herbaceous stems.

3.4.4 Morphology and function of leaves

Leaves are the most important components of a shoot and have very important functions in the life of plants, such as CO_2 assimilation, water transpiration and breathing. These organs are usually flat, thanks to which they have a large contact area with the atmosphere and easy access to air and light. Plants absorb oxygen to breathe through leaves. As the principal organs of transpiration, they maintain the flow of water from root to shoot and supply plants with mineral salts. Leaves contain a lot of green assimilation pulp. Plants are important due to the process of photosynthesis and production of basic organic compounds as well as oxygen necessary for life on our planet. Leaves are also of great economic importance, as nutrients for humans and as pharmaceutical raw materials.

A leaf comprises: a leaf base, and a green, flat leaf blade, often situated on a petiole. Petiole leaves often have, at the base of a petiole, some small stipules. A leaf blade is supported by venation. The leaf stalk connects the blade with a shoot. There are also leaves devoid of a stalk. Inside the stalk there are vascular bundles which become the leaf veins. On the one hand, they distribute water and mineral salts throughout the leaf and cause turgor pressure, and on the other hand, distribute the products of photosynthesis to the roots. They strengthen the leaf blade and make it resistant to wind and rain. Diversity of shapes, arrangements on a stem, margins, tips, venation as well as types of leaf are all very important features which make it easier to identify plant species in flowerless condition (Figure 7).

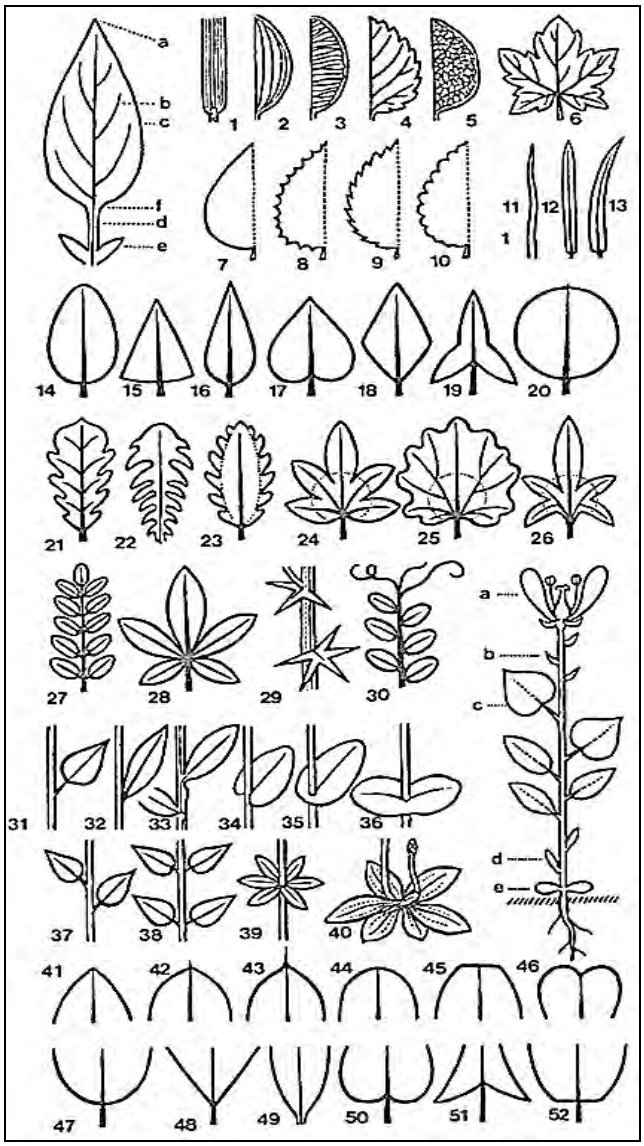

Figure 7. Types of leaves[7]

At the point of transition of leaf sheath into leaf lamina there is located a membranous outgrowth on the inner side of the leaf, a so-called tab, and on the sides there are spurs, which are ears. The tab tightly surrounds the stem and does not allow rainwater, dust or parasites into the sheath.

[7] Legend: Parts of a leaf: a - tip b - venation c - margin, d - stalk, e - stipule, f – base; Venation: 1- parallel, 2 - arcuate, 3 - reticulate, 4 - dichtomous, 5 - cross-venulate, 6 palmate; Margin of a leaf: 7 - entire, 8 - serrate, 9 dentate, 10 – undulate Shape of a leaf: 11 - acicular, 12 - linear, 13 - subulate, 14 - obovate, 15 - deltoid, 16 - lanceolate, 17 - cordate, 18 - rhomboid, 19 - spear-shaped , 20 - orbicular, 21 - palmate, 22 pinnatipartite, 23 - pinnatifid, 24 - lobed, 25 - pinnately-lobed, 26 - palmate , 27 - pinnate, 28 - digitate, 29 - spikes of leaf origin, 30 – tendrils; Arrangement on a stem: 31 - petiolate leaf, 32– sessile leaf, 33 - decurrent leaf, 34 - clasping leaf, 35 perfoliate leaf, 36 -connate-perfoliate leaf, 37 – decussate leaf, 38 - opposite leaf, 39 – whorled leaf, 40 heart-shaped leaf; Tip of the a leaf: 41 - acute, 42 - acuminate, 43 - stubby, 44 - obtuse, 45 - truncate , 46 - obcordate Base of a leaf: 47 - rounded, 48 - wedge-shaped, 49 - auriculate, 50 - cordate, 51 - sagittate, 52 - truncate. Types of leaves: a - perianth leaves, b - bracts, c - regular leaves, d - scaly lower leaves, e - cotyledons. (Červenka M. 1993. Świat roślin skał i minerałów. Oficyna Wydawnicza MULTICO, Warszawa, ss. 401)

Spurs appear in just a few grasses, such as fescue and ryegrass. They embrace the stem and strongly attach the sheath of their leaves to it.

3.4.5 Morphology and functions of flowers, inflorescences

Flowers develop from buds, and are usually placed on the stalk or sitting. The beauty, colours and variety of shapes of the flowers ensure the species survival and growth (Figure 8). Brightly-coloured perianths surrounding the male and female reproductive organs of the plant fulfill two major tasks: pollination and fertilization. Most of the higher plants develop bisexual flowers, containing both male and female reproductive organs. However, in some species, these parts are located in separate flowers, and moreover, sometimes in separate plants.

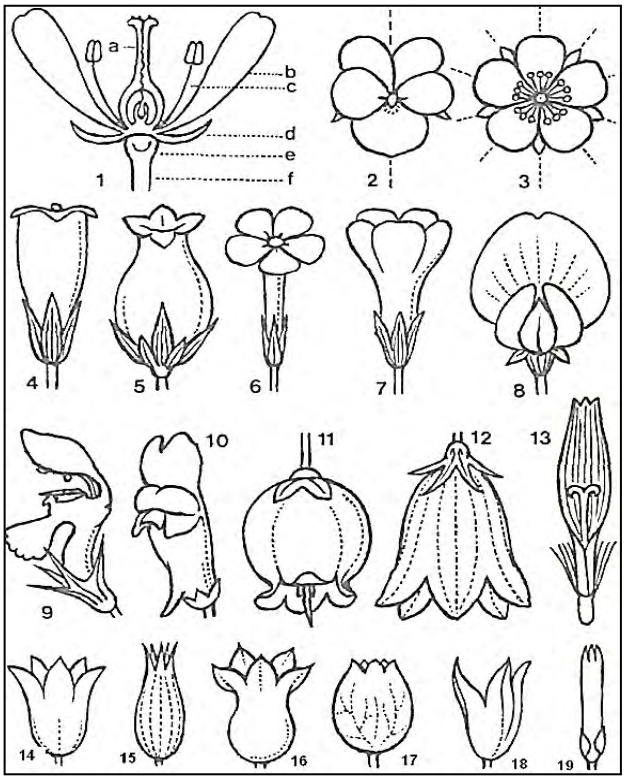

Figure 8. Types of flowers[8]

The male reproductive apparatus of the plant consists of a rod, usually long, thin, sterile strands and anthers standing on their summits containing pollen, mostly of yellow or orange colour.

The female reproductive apparatus consists of one or more stalks. The enlarged base of the stalk, called the ovary, contains one or more eggs. The mostly long, thin neck of the stalk links the ovary with a birthmark, receiving at the time of pollination the pollen grain and causing it to germinate.

[8]Legend: 1 - flower with perianth: a - top bar, b - petals, c - stamens, d - sepals, e - the bottom of the flower, f - stalk, 2 - flower with ridge symmetry, 3 - flower with radial symmetry. Shapes of the crown: 4 - tubular, 5 - bottle-type, 6 - rounded, 7 - funnel, 8 - butterfly, 9, 10 - lip-type, 10 - with a spur, 11 - baggy, 12 - campanulate, 13 - tongue-type. Shapes of the chalice: 14 - sepal, 15 - 16 - campanulate, 17 - barrel-type, 18 - lip-type, 19 - tubular. (Červenka M. 1993. Świat roślin skał i minerałów. Oficyna Wydawnicza MULTICO, Warszawa, ss. 401)

Flowers grow on the ends of shoots or sheathed leaf, singly or grouped in various inflorescences. Flowers and inflorescences are the best indicators of plants species.

3.4.6 Pollination

Wind, water and insects, birds and other animals contribute to the spread of plants, facilitating pollination, and spreading pollen. Many insects (bumblebees, butterflies) come to the flowers looking for nectar produced by plants. Touching the stamens, they move pollen on their bodies to another flower of the same kind where it is pollinated.

A variety of colours, eye-catching shapes and fragrance of certain flowers are only to attract those species of insects, which in this case have been provided by nature for pollination and fertilization of the plants. This task can also be accomplished by the wind, especially with plants having inconspicuous flowers that produce large amounts of pollen (e.g. grass).

3.4.7 Fruits

Immediately after fertilization the ovary walls begin to change. They become woody or fleshy and form fruit or pericarp. At the same time the fertilized embryo develops in the plant, it accumulates an additional reserve of food to form the seed. There are dry fruits and juicy ones.

The dry fruits may be cracking or non-cracking. Juicy fruits are pulpy, filled with juice, rich in sugars, organic acids and vitamins, also containing starch, protein and fat. They constitute an important source of food and fodder. These are drupes, which contain one seed enclosed in a hard pit (cherry, plum), and berries, completely pulpy and containing many seeds (bilberry). Juicy collective fruits have a pulpy flowerbed, for example, strawberries and roses, or are multi-seed, such as blackberries and raspberries.

Fruits serve as a propagation medium for the plants and are nutrients for animals.

3.4.8 Seeds

Seeds are the main organs of reproduction and spreading of the plant. A typical seed consists of a new plant embryo, endosperm containing reserve food material, and seed husks. The bud contains root and shoot primordia formed with two cotyledons (dicotyledonous plants) or one cotyledon (monocots). Due to the nutrients accumulated in seeds of many plants they are an important source of food and fodder, as well as industrial raw material, such as for cereals.

Fruits and seeds develop variable devices facilitating plant dispersal and expansion. Due to a diversity of fruits and seeds, plant species can be recognized when they no longer have flowers, even sometimes leaves (Figure 9).

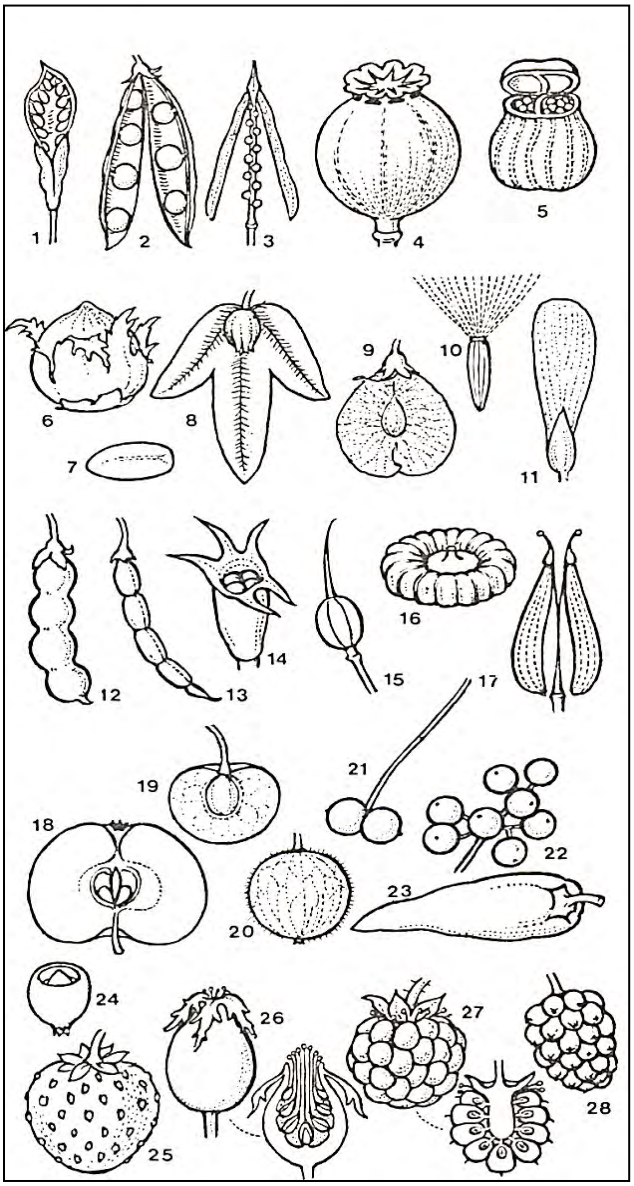

Figure 9. Types of fruits[9]

3.4.9. Germination

Seeds enclosed in fruit contain the shoot – the embryo of the plant. Once the seed gets into the proper soil, the shoot wakes up from a stage of dormancy, which can sometimes take years or even decades, and begins to develop – i.e., sprouting begins. Under the outer protective layer, called the seed coat, the shoot primordia can be recognized: the pedicle, the tiny leaves called cotyledons rich in nutrients, a small root and a growth cone. Germination occurs in several phases.

[9] Legend: Dry fruits, cracking: 1 - follicle, 2 - pod, 3 - silique, 4 - bag, 5 - box. Dry fruits, non-cracking: 6 - walnut, 7 - granuloma, 8 - nut, 9, 11 - samara, 10 - achene with fluff. Schizocarp: 12 - silique winding, 13 - silique cracking, 14, 16 - schizocarps, 17 - double schizocarps. Fleshy fruits: 19, 22 - drupes, 20, 21 - berries, 23 - membranous berry, 24 - parchment, collective fruit: 25 - strawberries, 26 - wild rose, 27 - raspberries, 28 - fructification of mulberry. (Červenka M. 1993. Świat roślin skał i minerałów. Oficyna Wydawnicza MULTICO, Warszawa, ss. 401)

Initially, the root, growing along, heads towards the bottom, then the growth cone extends towards the apex, and cotyledons open and give away their nutrients. Soon the essential components of young plants are recognizable.

3.5 Appearance of plants in association (plant communities)

Not each plant and not always can be found in association in the wild. There are several factors which influence the appearance of a plant species at a certain place. The factors are as follows:

1. The **ecological characteristics** of the growing site. The main ecological factors are the soil, the light, the temperature and the water supply.

- The soil characteristics include: the particle size (sandy - loamy), the acidity (pH), and the content of nutrients, especially nitrogen, phosphorous and potassium. Different species prefer different types of soils, where sometimes others cannot even grow. For example, centaury and cowslip prefer acidic soils, while thyme grows abundantly on calcareous, rocky places. Too much water in the soil may destroy the life of e.g. yarrow, while tansy and willow trees can only develop in places where natural water stays high. Further important factors are the thickness of the soil layer and the relief of the habitat. Many plants can live only in a small soil layer, such as iris and chamomile, while others require a thicker place for their roots, such as comfrey, marshmallow etc.
- The light is a prerequisite for the life of each green plant. Plants build up the materials of their body with the help of sunshine, water and CO_2, which means that all of these elements are absolutely necessary. Plants need light also to develop flowers and fruits. However, there is a special requirement for every species concerning the intensity of the light and the length of illumination. In meadows and cultivated fields the light intensity is the highest, as direct sunshine. If plants which grow under direct sunshine are planted under a tree, their growth and development will be damaged, their shoots weakening and their colour pale. After a while they die. On the other side, plants which grow in a forest as canopy and are not used to direct sunshine cannot use it effectively, and may be damaged and burnt if they are suddenly planted in open places with direct illumination.
- The temperature is determined basically by the climate. It means that temperature regimes are more or less the same in a given area. In Central Europe, the four seasons determine the major differences, although severe fluctuations may occur even during a single week.

  However, for plant life, the highest and lowest temperatures are more critical than moderate fluctuations. Very high temperatures do not cause too much problem, but more dangerous may be the drought which is usually associated with heat.

  On the other side, minimum temperatures include those below zero, which means frosts. Frost tolerance depends on the characteristics of the plants. Species which regularly and naturally grow on higher hills or in desert may tolerate low temperatures better than those from warmer regions. However, the rate of cooling plays a major role in frost tolerance. If weather change is very quick, plants may be not able to prepare for the cold, as they cannot harden.

- The water supply is a basic factor determining appearance of the species. Each plant requires water like sunshine for assimilation (building of the body tissue). Besides, water makes up the majority of the plant body, it is carrier of many nutrients and hormones, and is a solvent for the life processes. Thus, without water, plants cannot live.

  However, the duration, how long a plant is able to stay without water, depends on the species to a large extent. The most tolerant species develop thick cuticle to decrease transpiration, and deep roots to reach water reserves in the soil. Other species are very sensitive and die even in a week without precipitation. Perennial species let their leaves dry out and try to survive with the underground parts (e.g. celandine nettle). There are especially sensitive periods in plant life when the majority cannot do without water (germination, sprouting, flowering, etc.).

Very often, the above-mentioned factors, as complex determining background, contribute to the appearance or disappearance of a species in a habitat and are in tight connection with each other. For example, in loose, sandy soils water remains for less time, in a slope of a hillside precipitation flows away easily while sunshine is more intensive, and in a wet place temperature is usually lower, and so on. If circumstances change due to changes in these factors, plant communities react with changes too: some species would disappear, and others propagate. Changes happen also in shorter times, from year to year. Plants which can be found and collected abundantly in one year may be very rare or can hardly be found the next year at the same place. Such changes, which are hardly anticipated, are due to weather conditions and may confuse collectors.

2. Wild plants live in **natural ecosystems**. Such associations are composed of different plant species. Certain species prefer others to live with, while other species are not demanding from this point of view (association-indifferent species, e.g.: St. John's Wort (*Hypericum perforatum*), Elderberry (*Sambucus nigra*)). In plant associations, there is always a competition for natural reserves. That is why the abundance of individuals on a certain growing place is restricted. Some plants may form quite dense stands such as nettle and blackberry, while others do not endure thick populations. These latter are less effective to collect, as individual plants stand at broader distances from each other (e.g. Hairy mullein (*Verbascum thapsus*), Valerian (*Valeriana officinalis*). The pure appearance of a plant may be in connection with its competition ability too, e.g. Chamomile (*Matricaria recutita*) does not like but tolerates salinity and is weak in competition with other plants, therefore, it grows mainly on places where the soil is saline, where other species are not able to grow.

Animals play an important role in ecosystems as well. They graze some plants, while others are bypassed or even propagated by faeces.

3. Presence of a plant at a growing site depends also on the **time** when we are looking for it. Many plants have a shorter vegetation cycle than others, flower and ripen earlier, and disappear afterwards. These species, such as Blackthorn (*Prunus spinosa*), Cowslip (*Primula veris*), and Woodruff (*Galium odoratum*) can be found and collected only in early spring in Central Europe. Some other species are found all year round and only frosts stop them, such as Common yarrow (*Achillea millefolium*), Dandelion (*Taraxacum officinale*), St. John's Wort, etc. However, even in these cases the quality might change depending on the collection time. Chestnut leaves (*Castanea*) are to be collected when young in May, European goldenrod (*Solidago virgaurea*) provides good-quality raw material only at the beginning of flowering, etc. Trees and shrubs are

present always but their useful parts are mostly available only at a given period: Elderberry (*Sambucus nigra*) and Small-leaved linden (*Tilia cordata*) flowers in June, Rosehips (*Rosa canina*) and Juniper (*Juniperus communis*) berries in September, etc.

4**. Human induced factors**. Anthropogenic influence may cause loss of plant diversity, leaving many plant niches empty and creating plant communities dominated by weedier species (poor competitors but good dispersers). Overall, anthropogenic threats include activities that influence population of wild plant species in different habitats. These threats include plants harvesting (e.g. for food or medicine), logging and wood extraction, residential and commercial development and tourism, climate change, commercial large-scale agriculture, wood plantations, mining and transportation, pollution.

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4 GENERAL ASPECTS OF PLANT COLLECTION

South-Transdanubian Regional Resource Centre Nonprofit LTD, Hungary

Among the wild species collected in Central Europe, the majority is harvested at present as medicinal plants. Experiences and best practices are known mainly for these species; the following is a summary of current knowledge.

The aim of collecting wild herbs is – whether for own use or for sale – to produce the best quality drugs, free of microbiological and physical contamination and residues, with adequate active ingredients and appropriate external characteristics. The processed material, which is put up for commercial sale, is preferably tested in a specialised laboratory; compliance with rules is in a collector's interest.

Quality assurance should begin from the starting point of collection activities. Collectors must be informed before they start the work about the most important relevant requirements. This is important because if raw material quality differs notably from requirements it cannot be purchased.

During the collection process, efforts should be made at each step in order to achieve the best quality drugs. Harvesting methods, tools, and harvesting personnel must be checked, the material to be handled and dried properly, and the drug (the dried plants) should be packed and stored adequately. Any errors in the process will adversely affect drug quality.

4.1 Criteria of professional collection

Collection of wild plants is regulated in each country differently; there is no common practice for this in Central Europe. Therefore, collectors should be aware of regulations and needs for authorisation regarding any planned activities.

4.2 Knowledge of the habitat, local knowledge

Useful plants can be found in a variety of natural habitats. Before collecting, the habitat conditions should be examined. Plants should only be collected free of dust and dirt, possibly from an untouched and clean habitat. For example, habitats next to large-scale agricultural sites should be avoided, as chemicals (fertilizers, pesticides) may drift and contaminate sites in the immediate vicinity. Furthermore, polluted roadsides with traffic smog (heavy metal deposition) and residential areas should be avoided. It is not advisable to collect wild plants in permanently grazed areas either, because of the high probability of microbiological contamination. Attention should be given to the protected areas, for example: conservation areas, protected landscape areas, and national parks, where collection requires official and public licenses, which limit the place and period of plant collection.

4.3 Trustworthy knowledge of species

Trustworthy knowledge of wild plant species is a crucial factor when harvesting, because in the Central European region there is a number of species that can be mis-identified during harvesting.

Correct morphological knowledge is very important for collectors, because they must be able to recognize characteristic features of the collected species. With this they can identify and collect valuable raw material and isolate it safely from similar plants which yield lower-quality or even toxic material. Some examples: Meadow yarrow (*Achillea collina*) from other yarrow species; Elder berry (*Sambucus nigra*) from "Foot elder" *(S. ebulus*) (Figure 10).

On the other hand, there are some species which can be gathered together as part of the same drug, because they are of equal value, for example big Giant goldenrod (*Solidago gigantea*) Grass and Canadian goldenrod grass (*S. canadensis*), or Small-leaved linden (*Tilia cordata*) and Large-leaved linden (*T. platyphyllos*).

Figure 10. Elderberry (*Sambucus nigra*)[10]

4.4 The knowledge of protected and endangered plants

The law in Central European countries stipulates that protected plants may not be collected; otherwise a penalty may be imposed. In some European countries there is a Red List which contains plant species prohibited for harvesting. In other European countries, there is a separate legislation providing a list of plant species that cannot be harvested.

In addition, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), aims to ensure that international trade in wild animals and plants does not threaten their survival. CITES-listed plant species are included in either of three Appendices, which stipulate the degree by which their trade is regulated. In the European Union, trade in species listed in the

[10] Photo: J.Bernath, Corvinus University, Budapest (Hungary)

Appendices of CITES is regulated under the EU wildlife trade regulations (http://www.eu-wildlifetrade.org/html/en/wildlife_trade_regulations.asp), which are, in some cases, more stringent than CITES, and which are further reflected in laws of each Member state.

For many listed species collectors should avoid harvesting the plants and even their parts – or they should take care if, in exceptional cases, permission can be obtained.

4.5 Knowledge of collected plant part

It is extremely important to know which part of the plants and in which developmental stage the desired product is obtained. It is vitally important that the target plant species or its parts be collected completely separated from any other species or parts thereof. The raw material cannot be used if any parts of plants are mixed with extraneous plant material.

Flowers usually should be collected in full-bloom state. However, there are differences in individual cases. Sometimes the bud is needed, or harvesting should take place at the beginning of flowering because of later post-blossoming during the drying process. Whole flowers or different parts of the flowers should be collected, depending on the species. They are gathered in the morning, after the dew is gone. Some flowers close for the night or in great heat. These are gathered when they are opened. Since flowers are normally very delicate, care should be taken with their handling, so that unwanted processes do not occur before being moved to a drying area.

Leaves should be collected when sufficiently mature, but not too "old". Sick leaves, or leaves chewed by insects should be avoided. The leaves should be picked one by one, and long-stemmed leaves should be taken with a 2-3 cm handle. In some cases, e.g. Common nettle (*Urtica dioica*), special gloves help in pulling off all the leaves from the stem at once.

Flowering shoots: while collecting, stems should be cut off below the place where they are immature (young) and abundantly leafy. The upper part of the stems, up to 40-50 cm, must be collected because the lower parts of the stem do not usually contain active ingredients. From shrubs, one must collect the herbaceous shoots without the lower stem parts. Never pull out the whole plant with roots. The time for gathering of entire herbs or their leaves is most appropriate in the early morning, after the dew has already evaporated, but before the sun is particularly strong. The gathered herbs are put in an airy basket or tray in a very thin layer, so that fermentation and heating of the collected plant mass does not accelerate. The gathered herbs must be prepared for drying as soon as possible.

Fruits are gathered when they fully ripen. Most change their colour and aroma at that time. This also applies to seeds. The ripened **seed** is shed by many plants. That's why the seeds should be observed, and when they attain their typical colour and a smaller part of them already shed, the plants or their seed-filled parts are collected. This is done in the early morning, when there is still dew, since at that time the danger of shedding is low. The fruits and seeds should be dried as soon as possible.

Roots and rhizomes can be collected from autumn to spring. Excavated roots should be cleansed of contaminants; the remaining unwanted and decaying plant parts should be removed. Freshly dug up roots should in many cases be washed in running water.

4.6 Knowledge of collection dates, collection calendar

The herbs should be collected in a state known as their "technological maturity" stage. It means the developmental phase when the active material content in the plant is highest during the year. In the case of many wild plant species, scientific knowledge is still incomplete in this respect; therefore, for the practice there are rules and traditions to guide us. In general, sunny, dry weather, on days without dew are considered ideal.

The optimal time of collection depends also on the part of plant collected:

- parts in the ground: during the resting period (from October until March),
- bark: in early spring, after the start of sap circulation,
- buds: before the buds open,
- leaves: in the fully-grown state, when the petiole "pops when it breaks"
- flowers and shoots with flowers: in the first half of blossoming

In Central Europe, there is a characteristic succession of collected species around the year. For example, in early spring Wild garlic (*Allium ursinum*), Hawthorn flower and branch tip (*Crataegus monogyna*), Elderflower, and Large-leaved linden flowers can be collected. In summer, Yarrow (*Achillea collina*), Goldenrod grass (*Solidago canadensis*) and Common tansy (*Tanacetum vulgare*) can be collected. There are herbs such as Common nettle which can be collected during the whole year. In autumn, various berries, such as Rose hip (*Rosa canina*) and European blueberry (*Vaccinium myrtillus*) are good for harvesting.

Plant collection times are summarised in the following "collection calendar" (Table 2). For each area where collection takes place it is important to make a collection calendar for organising the work with wild plants.

Table 2. The most frequently collected and well-known herbs of the Central European region[11]

Name of plant	Collected parts	Date of collection	Rate of drying
(Solidago gigantea) Giant goldenrod	Flowering sprout	July - October	4 : 1
(Juniperus communis) Common juniper	Crop	August - October	1.5:1
(Achillea millefolium) Common yarrow	Flowering sprout	June - October	4 : 1
(Juglans regia) Common walnut	Leaf	June - August	4 : 1
(Robinia pseudo-acacia) Black locust	Leaf sprout	November - April	3 : 1
(Sambucus nigra) Common elder	Inflorescence	May	6 : 1
	Crop	August	5 : 1

[11] Source: Rápóti-Romváry: Medicinal plants (1999)

(Populus nigra) Black poplar	Bud	January - March	2-2.5:1
(Artemisia vulgaris) Common wormwood	Flowering sprout	July - October	5 : 1
(Salix spp.*)* Willow	Crust	April - August	3:1
(Crategus monogyna) Common hawthorn	Flower with leaves	May - June	4 : 1
	Crop	September - October	2 : 1
(Tanacetum vulgare) Common tansy	Inflorescence	June - September	3-4:1
(Rosa canina) Rose hip (or Dog rose)	Sham crop	September - October	2 : 1
(Taraxacum officinale) Common dandelion	Leaf	April - June	6 : 1
	Root with leaves	September - April	5 :1
	Root	September - April	5 : 1
(Rubus caesius) Dewberry	Leaf	May - August	4:1
(Tilia cordata) Small-leaved linden	Inflorescence	May - June	4 : 1
(Tilia argentea) Silver lime	Inflorescence	June	3.5-4 : 1
(Thymus serpyllum) Breckland thyme	Flowering sprout	May - June	3:1
(Galega officinalis) Goat's rue	Flowering sprout	June - August	4-5:1
(Polygonum aviculare) Common knotgrass	Leaf sprout	May - August	3:1
(Humulus lupulus) Common Hop	Garlands of crops	September	4:1
(Prunus spinosa) Blackthorn	Flower	April	5:1
	Crop	October - November	3:1
(Fraxinus excelsior) Common ash	Leaf	June - August	4:1
(Frangula alnus) Alder buckthorn	Crust	April - August	3:1
(*Rumex acetosa*) Common sorrel	Crop	June - July	4:1
(Cichorium intybus) Common chicory	Flowering sprout	July - August	3 : 1
	Root	October - April	3 : 1
(Corylus avellana) Common hazel	Leaf	June - July	4:1
(Urtica dioica) Common nettle	Flowering sprout	May - September	4 : 1
	Leaf	May - September	5 : 1
	Root	Spring, Autumn	3 : 1
(Polygonatum odoratum) Angular solomon's-seal	Rootstock	October - April	3:1
(Althea officinalis) Common marshmallow	Leaf	June - August	4:1
	Root	October - April	4-5:1
(Capsella bursa-pastoris) Shepherd's-purse	Flowering sprout	April - June	4-5 : 1
(*Galium aparine*) Cleavers	Flowering sprout	April - May	3-4 : 1
(Eupatorium cannabinum)	Flowering sprout	June - August	4:1

Hemp-agrimony			
(Galium odoratum) Woodruff	Flowering sprout	May - June	5:1
(Agropyron repens) Couch grass	Rootstock	October - April	3:1
(Quercus robur) English oak	Leaf	June - August	4:1
	Crust	April - August	2-2.5:1
(Chelidonium majus) Tetterwort	Flowering sprout	May - June	5-6:1
	Root	October - April	5:1

Base herbal materials must be collected with clean hands, wearing clean clothes. The tools used for transport and harvest, for example: knives, scissors, baskets, receptacles, transport pots, also need to comply with basic hygiene requirements. With all these conditions it is possible to minimize microbiological contamination.

The collection tools and containers used for collection may also affect the quality of herbal material. Flowers are most sensitive to injuries. In order to avoid their browning, discolouration and sticking, they should be collected in baskets and put in boxes. Juicy fruits should be picked in buckets; the less delicate plant parts, such as seeds and roots put in bags. It is important not to use plastic bags for harvesting. Collected roots should be washed, desiccated, cleaned and, depending on the purpose, peeled and chopped.

The choice of an appropriate collection method increases the chances of a resulting high quality drug. It is important to keep in mind that the ecological balance of live plant communities should not be disturbed so that on the next occasion they can again be collected.

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5 ASPECTS OF SUSTAINABLE WILD PLANT COLLECTION

WWF Hungary/TRAFFIC

Medicinal and aromatic plants (MAPs) have been an important resource for human health care since prehistoric times. According to the World Health Organization (WHO), most of the world's human population depends on traditional medicine based on MAPs (WHO 2002). Globally, an estimated 60,000 plant species are used for their medicinal properties. The great majority are wild-collected (Schippmann *et al*. 2006).

Harvesting medicinal plants from the wild still plays an important role. Wild collected resources ensure valuable income for many rural communities, may provide incentives for conservation and a sustainable use of forests and other important plant areas as well as constituting a significant factor in the source countries' local economies (Bogers et al. 2006). Not all wild plants can be cultivated or sometimes it is not economically feasible to cultivate them. Therefore, collection of wild plant resources will remain an important option for sourcing plant ingredients.

Central Europe has been an important source region of useful plants for medicinal, aromatic and culinary uses since ancient times as mentioned in Chapter 1. Since the late 1800s, collection of MAPs has become an additional source of income, particularly important for vulnerable and economically marginalized groups, such as women, elderly people and ethnic minorities. Nowadays, approximately 2000 plant species are traded commercially, of which 60-70% are native to Central Europe (http://www.plantaeuropa.org).

The traditions of wild collection and the knowledge of the properties of medicinal plants are however deteriorating in Central Europe. Causes include urbanization, changes in land ownership and lifestyle. In many cases, wild plant collection is done in an unsustainable manner and leads to the decline of an important source of employment and income for vulnerable groups. For these reasons, approaches to wild plant collection that engage local, regional and international collection enterprises and market stakeholders in the work of the conservation and sustainable use of MAPs are urgently needed (Bogers *et al*. 2006).

Both compulsory and voluntary measures can be applied to conservation and sustainable use of wild plant resources. Internationally, trade in plants threatened because of trade is regulated through the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on Biological Diversity (CBD) provides the international framework for sustainable use of plants. At the national level, resource management is regulated through relevant legislation. In addition to this, a number of voluntary standards exist that provide an opportunity to companies/organizations to demonstrate their commitment to sustainability through compliance with voluntary mechanisms.

5.1 FairWild Standard

The last few decades showed a growth in global demand for herbal products. This has provided valuable opportunities to generate income from the collection of wild plants, especially medicinal and aromatic plants, to an increasing number of people in rural areas around the world. But,

majority of collectors nowadays remain disadvantaged and do not receive adequate payment for their labour.

At the same time, the growing demand for herbal medicines has also resulted in concerns about the detrimental (or negative) impact of collection from the wild. **Wild plant populations are declining the world over.** One in five of the world's plant species is likely to be threatened with extinction in the wild, with unsustainable harvest a major contributing factor. Despite the critical importance of these plants, relatively little investment has been made in improving sustainability of harvest and trade practices, or in increasing benefit flows to harvesters. Therefore, applying meaningful tools related to sustainable collection practices is essential to preserve wild MAP species and guarantee their sustainable collection.

To address this gap, the FairWild Standard was developed by TRAFFIC, WWF, IUCN, the Swiss Import Promotion Programme (SIPPO), the German Federal Agency for Nature Conservation (BfN), Forum Essenzia, the Institute for Marketecology (IMO), the Foundation for Revitalization of Local Health Traditions (FRLHT), Traditional Medicinals Inc. and other partners. The Standard was created through a global multi-stakeholder consultation process involving experts from community groups, businesses, governments, scientific and social purpose organizations, to support efforts to improve conservation and development outcomes related to the trade in wild plant species.

The FairWild Standard is the best practice allowing the assessment of harvest and trade of wild plants against ecological, social and economic requirements. Use of the FairWild Standard helps to support efforts ensuring sustainable collection and maintenance of wild plant populations, as well as sustainable social aspects of collection, and fair conditions of labour (FairWild Standard, *Version 2.0* 2010).

The FairWild Standard: Version 2.0 applies to wild plant collection operations wishing to demonstrate their commitment to sustainable collection, social responsibility and fair trade principles. The purpose of the FairWild Standard is to ensure the continued use and long-term survival of wild species and populations in their habitats, while respecting the traditions and cultures, and supporting the livelihoods of all stakeholders, in particular collectors and workers (FairWild Standard, *Version 2.0*, 2010).

The FairWild Standard is being used in practice as the basis of a third-party audited certification scheme, under implementation by a growing number of wild-plant collection operations worldwide. The scheme is implemented in locations across Europe and further afield, such as Kazakhstan, and new applications are being received from groups in countries such as India, Bolivia, Nepal and Kenya. The first inspections of wild-collection operations were carried out in 2007, and products containing FairWild-certified ingredients have reached markets in USA, Canada, Japan and the EU.

In addition to the certification scheme, the FairWild Standard principles are being used as a reference in other scenarios such as community based management systems, voluntary internal business standards and legal frameworks. An earlier version of the Standard (the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants, ISSC-MAP), was tested for applicability to community resource management in pilot projects in six countries during 2008-2010: Bosnia and Herzegovina, Brazil, Cambodia, India, Nepal, and Lesotho. Lessons learned were published in the TRAFFIC report "Wild for a Cure" (http://www.traffic.org/species-

reports/traffic_species_plants14.pdf), launched in September 2010. FairWild sustainable use projects continue in various regions around the world

The FairWild Standard contains 11 principles, which ensure ecological, social and economic sustainable collection practices of wild plants. They are as follows:

Principles for collection operations

Section 1. WILD COLLECTION AND CONSERVATION REQUIREMENTS

- Principle 1. Maintaining wild plant resources
- Principle 2. Preventing negative environmental impacts

Section 2. LEGAL AND ETHICAL REQUIREMENTS

- Principle 3. Complying with laws, regulations and agreements
- Principle 4. Respecting customary rights and benefit-sharing

Section 3. SOCIAL AND FAIR TRADE REQUIREMENTS

- Principle 5. Promoting fair contractual relationships between operators and collectors
- Principle 6. Limiting participation of children in wild-collection activities
- Principle 7. Ensuring benefits for collectors and their communities
- Principle 8. Ensuring fair working conditions for all workers of wild-collection operations

Section 4. MANAGEMENT AND BUSINESS REQUIREMENTS

- Principle 9. Applying responsible management practices
- Principle 10. Applying responsible business practices

Principle for buyers of wild-collected products

- Principle 11. Promoting buyer commitment (FairWild Standard, *Version 2.0* 2010).

5.2 Sustainable wild plant collection

5.2.1 Harvesting Methods

Sustainable harvesting methods ensure that plant populations and species are maintained in the long-term. Sustainable collection methods do not damage the environment and provide for optimum conditions for the regeneration of the wild plant species harvested. Regeneration is ensured when enough flowers, seeds, leaves or roots stay untouched, so that they can reproduce.

Sustainable wild plant collection should be conducted in non-polluted areas (Figure 11). Sustainable collection is to be implemented in accordance with the collection instructions provided by the collection operator (IMO 2010).

Collection instructions usually contain:

- information about a collection site of a target plant species,
- harvesting methods for each target plant/part of plant,
- maximum collection quantities allowed,

- minimum biological age/size classes allowed for the collection of a target plant species and a collection site,
- sustainable traditional collection practices for all target species.

Adequate collection instructions are based on site and species-specific resource assessments and monitoring information, including information on any sites excluded from collection (FairWild Performance Indicators, 2010).

Figure 11. Collection area of European blueberry (*Vaccinium myrtillus*) in the Podkarpackie Province (Poland)[12]

5.2.2 Plants to collect

In accordance with the IMO Guidance Manual for Sustainable Wild Collection Practices (2010), there are several pieces of advice in relation to the plants/plant parts to be collected from the wild. Plants that do not grow naturally, such as plants from fields, settlements, gardens, paths, roadsides, industrial sites or similar areas, are not recommended to be collected. Rare and endangered species or species protected by law should also not be collected. Species which may be destroyed or damaged through collection need special care (for example, species which do not reproduce easily or grow slowly).

The most important principle of handling a plant before collection is its **correct identification**. Sometimes different medicinal plant species may look very similar (Figure 12), or they may share the same common name. As a result, wrong species can find their way into herbal medicines, potentially leading to serious health risks for the consumer. Rather than identifying medicinal plant species by their local or common names, which may vary significantly from place to place, plants should always be identified by their botanical name (GACP, FAO 2010).

The IMO Guidance Manual also recommends harvesting adult plants. Plants should be harvested at the appropriate time and stage of development to ensure the best possible quality. Damaged plant material should generally be excluded. Only target plant parts should be collected and each time collection should be conducted in a different place within the collection area.

[12] Photo: C. Trąba, Association for Promotion and Development of Podkarpacie „Pro Carpathia", Poland

Not all plants of a collection area should be collected, and the same site should not be used more than once in a season. When collecting herbs, roots, flowers or leaves in the next season, a different part of the area or a completely different section should be used to collect the same plant (IMO 2010).

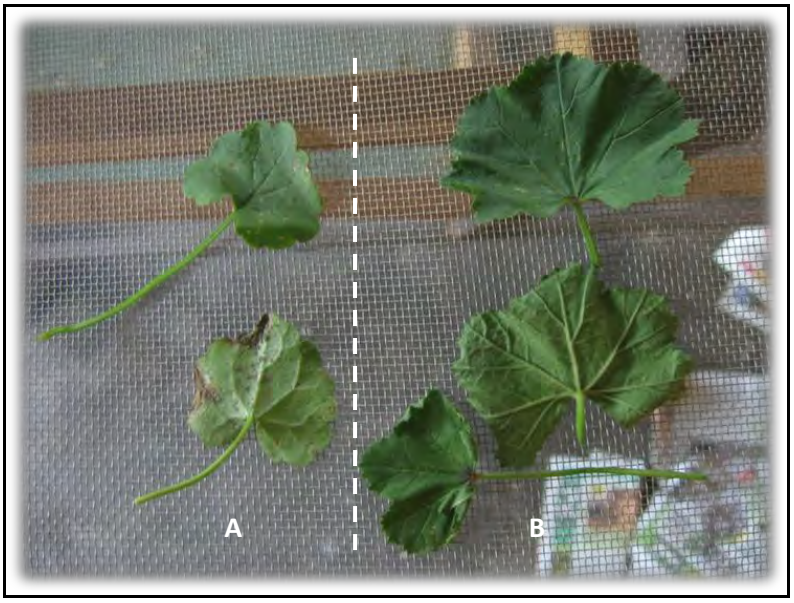

Figure 12. Ground-ivy (*Glechoma hederacea)* (A) and Common Mallow (*Malva neglecta)* (B)[13]

5.2.3 Aspects of social and fair trade requirements

Aspects of social and fair trade requirements should be taken into account while collecting wild plant resources. FairWild Standard, being the best current practice for sustainable wild plant collection, contains a particular section on social and fair trade requirements described by four following principles.

Principle 5 recommends for collectors to have the structures and access to information needed to represent their interests and participate in FairWild Premium decisions (Box 1). There should be no discrimination against particular groups of collectors.

Principle 6 focuses on limiting participation of children in wild collection. Collection and processing by collectors is done without substantial work contribution of children.

Principle 7 ensures benefits for collectors and their communities. Trade intermediaries should be minimized, collectors are ensured a fair price for the collected goods is paid, and community social development is supported through a FairWild Premium Fund (Box 1).

Principle 8 ensures fair working conditions for all workers of wild collection operations. The collection operation ensures good working conditions for all workers of the wild-collection operation (FairWild Standard, *Version 2.0* 2010).

[13]Photo: P.Varga, Corvinus University of Budapest

FairWild Premium

Amount of money paid to the collectors/collectors' associations reflecting the efforts made by the collectors and all other actors in the supply chain to arrive at sustainable wild collection, production and sales of the respective final products.

It is usually 10 % over the individual collector's selling price. If a lower Premium is negotiated a written justification and demonstration of adequate social impact of this FairWild Premium must be prepared, e.g. if prices are much above the current five-year price average, or, for very highly priced products, already provide a high overall income to the collectors.

It is usually paid by the next partner in the supply chain (collection centre, trader, company). If the amount is charged upstream to the final buyer (e.g. finished product manufacturer), this must be indicated in the invoices or sales contracts. The Premium can be paid as a single annual contribution to the wild collection enterprise's fund or it could be a fixed agreed-upon amount that is added to each invoice as a separate line item(http://www.fairwild.org/publication-downloads/otherdocuments/FairWild_Industry_Guidance_final_FAQs.pdf)

FairWild Premium Fund

The producer group and the buyer should agree on the FairWild Premium Fund amount each year, how it will be disbursed, who is responsible for managing the fund, and what the specified uses will be. The independent inspector will, each year, request to see evidence that the contribution was made and that it was managed and utilized for the express purposes that were agreed upon by the producer group and buyer(s).

It is possible that the fair trade buyers may participate in the agreement with the producer group concerning the Premium Fund amount and what it will be used for.

The FairWild Premium is intended for social development projects in the collectors' communities, and in the first five years of certification may also be used to improve the sustainability of collection (http://www.fairwild.org/publication-downloads/otherdocuments/FairWild_Industry_Guidancefinal_FAQs.pdf)

Box 1. FairWild Premium and FairWild Premium Fund

5.2.4 Legal and ethical aspects of sustainability

Legality and ethics also play an important role for sustainable wild plant collection. According to *FairWild Principle 3*, collection and management activities should be carried out under legitimate tenure arrangements and comply with relevant laws, regulations and agreements. Besides, local communities' and indigenous peoples' customary rights to use and manage collection areas and wild-collected target resources should be recognized, respected and protected (*FairWild Principle 4*) (FairWild Standard, *Version 2.0* 2010).

5.3 Good Agricultural and Collection Practices

Good Agricultural and Collection Practices (GACP) for Medicinal Plants are a general framework set of guidelines for collectors and producers on how to collect wild growing medicinal plants in a

sustainable way and to produce high quality raw materials for industry. These guidelines also apply to other wild growing plants.

According to the World Health Organization Guidelines on GACP for medicinal plants (2003) and GACP developed by the Food and Agriculture Organization (2010), there are a number of principles of good collection practice that collectors should implement to protect wild plant species for themselves and future generations. These principles are as follows:

- **Sustainability.** Collectors should collect MAPs in a manner that ensures that the rate of regeneration is higher than the rate of extraction. In this way, the plants will continue to grow year after year and provide the collector with a regular source of income. This will help to ensure the sustainable harvesting of MAPs.
- **Collection regulations.** Wild plant collection usually happens on public land that is either owned by the government or the local community and is subject to local regulations stating who has collection rights and which species are permitted to be collected. Wild plant collection also depends upon national and international regulations, especially regarding the collection of threatened and endangered species.
- **Prevention of contamination, degradation and damage.** Potential risks during harvesting and transportation of MAP material to the processing site can be minimized through careful planning to ensure that all materials required for hygienic collection and transportation are packed before setting out to the collection site.
- **Optimization of active ingredients.** The collection site, collection time and plant maturity should be taken into consideration in order to enhance the effectiveness of MAPs harvested from the wild. Factors such as altitude, soil type, and climate can also have a substantial effect on the active ingredients of the plants.
- **Documentation and traceability.** Documentation during wild plant collection is essential for the harvested plant material to be traceable. It is necessary to record the location of collection and the quantities collected, as well as observations while collecting (FAO 2010).

5.4 Product handling

5.4.1 Handling plant material before collection

Maintaining a hygienic production system is very important for every stage of a medicinal plant's journey, from the collection through processing, transportation and manufacturing of the final product. Anything that the medicinal plant material comes into contact with must be spotlessly clean. This includes hands, tools, containers, sacks, tarpaulins, washing tubs, drying racks, and so on (GACP, FAO 2010).

According to the GACP (FAO 2010), the main rules applied to handling of plants before collection are:

- Washing hands, preferably using soap under flowing clean water, before handling any medicinal plants;
- Maintaining personal cleanliness and hygiene while handling medicinal plants, e.g. clean clothes, clean body, regular bathing, well-cut nails etc;

- Washing all tools before they come into contact with medicinal plants;
- Cleaning all surfaces that the medicinal plant parts will come into contact with during and after harvest;
- Promoting and helping maintain cleanliness in the community (GACP, FAO 2010).

5.4.2 Handling plant material during collection

Collection of wild plants is best completed in the mornings, when there is no dew on plants and when it has not rained the night before. Collection methods prohibited are beating of plants with sticks, tearing out plants with their roots, and the use of axes, saws, chain saws for cutting whole branches. There are some exceptional cases in which the sustainability of such practices is confirmed, but these cases should be carefully examined.

Cutting tools, such as scissors, knives, and sickles must be cleaned and disinfected to reduce contamination. All containers used during harvesting must be new or well cleaned and free of contamination including leftovers from previous material. When containers are not in use, they must be kept dry, free of pests and inaccessible to mice and rodents, livestock and other domestic animals.

The harvested plant material should not come into direct contact with the soil or be exposed to direct sunlight, rain, dust, insects or animals. Plants must be promptly collected and transported in a dry and clean condition. During harvesting no other plant species growing in the collection area should be mixed with collected plant material, and collected material should be free of other plant parts from the same plant.

Mechanical damage and compacting of the collected fresh plant material must be avoided. Transport containers must not be overloaded. Freshly harvested plant material must be delivered as quickly as possible to the processing facility. Damaged plant material must be separated from collected plant material of good quality. All containers with collected plant material should be correctly labelled with the botanical name of the collected plant, collection area, collector name, date of collection, and weight.

5.4.3 Handling plant material after collection

Post harvest processing is usually the most critical stage in determining the final quality of the medicinal plant material. Once the plants have been harvested, there are many potential risks. It is possible that they will be handled by many different people, placed on different surfaces, transported on polluted roads or stored for days or weeks in people's houses. All of these factors involve considerable risks of contamination, degradation and/or damage to plants (GACP, FAO 2010).

Primary sorting

A clean surface, preferably a cemented floor or a tarpaulin sheet in good condition, should be used for laying out the collected plant material. All weeds and other extraneous physical matter should be removed. Unwanted plant parts should be carefully removed. Pathways to walk between the herbs should be clear. Different species should be dried with sufficient physical separation between them to avoid cross-contamination.

Washing

Medicinal plant parts should be washed in clean water. After the initial wash, a number of different tubs should be applied for further rinsing. Before drying, the water from the herbs should be drained off. A high-powered spray nozzle to clean off mud from roots and rhizomes should be used (GACP, FAO 2010).

Drying

On arrival at the processing facility (collector's home, purchase centre or collection company) the harvested plant material should be promptly unloaded and unpacked. Material should not be exposed directly to the sun and has to be protected from additional humidity and rainfall. Drying directly on the ground should be avoided. Clean tables, scaffoldings, canvas covers or similar materials should be used for drying. Drying next to roads should be avoided because the dust and pollution from traffic contaminates the plant material.

Uniform drying of the fresh plant material to avoid formation of mould and fungi should be achieved. Turning twice a day and spreading the plants in thin layers should be applied. Pest control has to be done mechanically with the help of closed doors, fly screens, lime strips etc. Any pest control measures taken should be well-documented. When using artificial dryers, the drying temperature should not be too high to avoid damage to the material.

Packaging and storage

After the drying process, only packing material provided or authorized by the Collection Company (e.g. clean paper bags) should be used. Old fertilizer bags or similar contaminated material should not be used when packaging. In order to protect the product and to reduce the risk of pest attacks, early packaging is advisable.

Labels must be filled out and attached to each storage container, with information about collected plant, collection area, collector or purchase centre name, date of collection, and weight. Until collected by the company, containers should be stored in a clean and dry place (Figure 13).

Figure 13. Storage of dried plant material in Baksa (Hungary)[14]

[14] Photo: P.Radácsi, Corvinus University, Budapest (Hungary)

Documentation and traceability

All processing activities should be documented in a diary. The type, quantity and date of harvesting should be recorded. The geographic location of the collection area should be described as precisely as possible. The activities should also be documented on a label or harvest tag, remaining attached to the sacks wherever they go. All records should refer to the batch number allocated to the material at the time of harvesting (FairWild Standard, *Version 2.0* 2010)..

5.5 Organic Production

European Union Council Regulation (EC) No 834/2007 of 28 June 2007 *on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91* indicates that the collection of wild plants and parts thereof, growing naturally in forests and agricultural areas, can be considered as an organic production method provided that:

> (a) those areas have not, for a period of at least three years before the collection, received treatment with products other than those authorized for use in organic production under Article 16;
>
> (b) the collection does not affect the stability of the natural habitat or the maintenance of the species in the collection area (Article 12).

The Regulation allows wild harvesting operations to become certified, but gives no specific guidance and remains non-specific regarding the implementation of wild harvesting (Article 12 (2) and Article 13).

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Further reading

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6 POST-HARVESTING AND PROCESSING OF WILD PLANTS

Village Local Authority Kunadacs, Hungary

A high value end product meeting quality requirements may be extracted from the plant parts richest in valuable substances. However, quality may also depend on how they are utilized. The most appropriate processing and production technology depends on market needs and the technological background available. Thus, technology largely depends on further utilization.

6.1 The preservation and enhancement of the value of herbs

Collecting herbs must happen at the optimal time: Collection should be timed to technical maturity.

Choosing what to collect: Only valuable plant parts should be collected;

Fast and careful transportation of raw materials: Raw materials must be spread out in a thin layer in a concrete-padded storage room. The transportability of the raw materials must also be seriously considered: in case of flowers and leaves it is as short as 3 to 5 hours after picking.

Classification of raw materials: All transported raw materials must be classified before reception on the basis of the health and intactness, the content of foreign matter, colour, smell, etc.

Storage before processing: Raw materials must be separately stored according to species and other aspects like whether they are poisonous or non-poisonous and whether they have a strong fragrance. Flowers, leaves, coleoptiles and roots must also be stored separately.

Preparation: Collected plant parts should be cleaned, chopped and stripped.

Drying: The moisture content of the fresh leaves, sprouts and flowers of the collected plants may reach up to 90%, while that of crops and grains may exceed 14%.

6.2 Drying

Drying is a technical procedure in which moisture content is decreased – by employing a controlled technical method – to a level that allows safe storage. During the process of drying, air of high temperature and low relative humidity is blown through the plant parts. The relative humidity of the air increases and its temperature falls. Heat transmission is directed from the drying-air towards the plant parts to be dried. At high temperatures, it causes emission of steam, at lower temperatures it results in evaporation of moisture. The hotter the airflow and the higher its speed, the faster the drying procedure becomes. The temperature of the drying-air is limited by the heat sensitivity of the active agents in the herbs and the speed of moisture transfer.

The factors that influence the success of drying:

The temperature of the drying-air: To obtain the best quality, it is advisable to employ air of the lowest temperature where drying is still effective. It is common practice to start the drying procedure at a high temperature, which is then gradually decreased and finally maintained at a lower level for a longer time.

The moisture content of the drying-air: The moisture content of the air that flows into the drying apparatus should be as low as possible, while that of the air flowing out should be high. The best quality of the end-product can only be reached if the moisture content decreases evenly in all parts of the plant.

The speed of the drying-air: The speed must be set in a way that the water on the surface of the plant evaporates, and afterwards the vapour is driven away. The optimal speed varies between 100 and 200 metres a minute. Optimal drying-air has the lowest possible moisture content and the lowest possible temperature.

The length of the drying procedure: The higher the temperature and the faster the airflows, the shorter the drying procedure becomes. The maximum length of the drying procedure is determined by economic efficiency and the danger of the decomposition of the materials to be dried, including likelihood of damaging the active ingredient.

6.2.1 Methods of drying

For most herbs, the optimal drying temperature is usually 40-60^{o}C, but for some species it may be as high as 80-85^{o}C. The final moisture content of the dried plant materials must be around 10-12%. Drying may be natural or artificial.

6.2.1.1 Natural drying

This method employs solar energy with the help of the displacement of air to evaporate water and to remove vapour. A major advantage of the method is that it does not require heat energy. Disadvantages include strong dependence on weather conditions, a high risk of contamination, and the need for considerable space. Natural drying is mainly carried out in underfloored lofts and well-aired sheds. Drying frames may provide an easier flow of air through the plant materials, and thus shorten the drying process (Figure 14).

6.2.1.2 Artificial drying

In this method, heat energy is used to remove the moisture content, and machinery for the moving of plant materials. According to the amount of heat transmission, there are **cold** - (15-25^{o}C), **warm** - (30-80^{o}C) and **hot** air (200-1000^{o}C) artificial drying methods.

In **cold-air drying,** a fan ensures the flow of air. The humidity originating from natural evaporation is driven away and the drying process is maintained. The length of the drying procedure is usually 8-12 days and depends on the moisture content of the air and the plant parts. With herbs, this method is uneconomical; thus it is only to be used with highly sensitive raw materials.

Warm-air drying is the most common method in producing herbal drugs. All the different drying devices regulate the temperature, humidity and the speed of the airflow in order to maintain the quality of drugs. In warm-air dryers, both the materials being dried and the drying-air move: this movement may be in the same or opposite directions. The drying procedure is considerably shortened to 6 to 8 hours.

Figure 14. Natural drying on frames[15]

Hot-air drying is widely employed in agriculture. In the case of wild plants, it is mainly used in producing pharmaceutical drugs. The raw material to be dried is exposed to temperatures of 200-1000^{o}C for only 2-5 minutes. Hot driers are heavy-duty devices; their drying capacity is 1.5-2.5 tons per hour. Their main disadvantage is that the regulation of the amount of the drying-air and the extreme heat is only possible in long intervals of 50-100^{o}C. Plant parts that dry easier may thus be burnt, while those that dry slower may remain humid.

6.2.2 Drying devices

CDF (Crop Drying Floor): This device is a transition between cold- and warm-air drying. It is an active-ventilation method that is carried out on crop drying floors (CDF). It provides for the effective drying of crops and grains, and eliminates the loss of active agents in plant parts. The fan of the device blows low-relative-humidity air at high pressure through a channel system into the pile of herbs. The system, combined with a hot air insufflator, is operational even if the relative humidity of the outer air is high. The factory specification of the device provides a loading platform of 300m^2, it is modified for the considerate drying of herbs, and its form is what is called a compact-channel crop-drying floor. The amount of surface that can be established is 50-160m^2. In order to provide an even surface of the floor, drying frames must be applied onto the side-channel system, on which the evenly spread raw material is to be placed. The device is suitable for drying grains, flowers, leaves, herbs and roots.

[15] Photo: J.Bernath, Corvinus University, Budapest (Hungary)

Spreading thickness: For roots 40-50 cm, for grains 20-30 cm, for flowers 30-40 cm, for leaves 40-60 cm, and for flowering shoots 50-100 cm.

In order to obtain the best possible result, the spreading thickness must be reached in a way that first the whole surface is covered with a 10-15 cm layer of material, then gradually, with the further supply of material. Further layers of 10-15 cm are applied in one or two days until the spreading thickness is reached. When the spreading of one layer has been done, aeration may be started. The drying raw material should be stirred when necessary. Raw materials placed on the device dry in 4 to 8 days.

Dehydro dryer: This device comprises two or three closed cabinets, in which drying frames are to be placed with a total surface of 32-36m^2 in each tower. The frames move vertically either in the same or in the opposite direction. They are moved by an elevating system that has four clutches in a way that each time one frame is elevated, a new frame with fresh raw materials can be placed in, while the one with the already dried materials may be retrieved through an aperture of the tower. A vacuum fan provides the airflow.

Schilde dryer: Similarly to the method of the Dehydro dryer, drying frames are placed into the machine, 10 frames into each. During the process of drying, these are replaced in a given order. Air heaters are placed at the bottom and in the middle of the drying cabinet, thus almost dividing it into two parts: pre- and post-dryers. Frames are 2 metres by 3 metres in size, are elevated and replaced by an automatic elevating system. One major advantage of this device is that it provides great efficiency and yet takes up little space. It is suitable for drying flowers, leaves and roots. The disadvantages of the device are that it is unsuitable for drying leafy shoots and that human labour is needed for filling-up, emptying and moving the frames.

Imperial dryer: This is a device that comprises five conveyor belts. The raw material is carried onto the top belt by a carrier belt. The 9,600mm-long conveyor belts are placed one under the other in a way that they can drop the material onto the lower belt. Heating is provided by gas operated air heaters that are placed crosswise among the belts. Advantages of the device include continuous operation, good regulation of drying and that the system can be automatized. A disadvantage of the device is that when the belts are stopped, the material right above the air heaters may be burnt. This burnt and discoloured material may then be dropped into the material on the lower belt.

Binder dryer: This is the most up-to-date dryer device, which can be used for the production of the widest variety of drugs. Like the Imperial dryer, this device employs five conveyor belts, but since the hot drying air is produced with an inserted heat exchanger, it is free of combustion products. The process of drying may be regulated by the modification of the spreading thickness of the material, by increasing the speed of the belts, by the modification of the speed of the airflow and the amount of air flown in, and by adjusting the temperature. Disadvantages of the device include high costs of investment and high energy intensity.

6.2.3 Drying with solar energy

An efficient way of drying herbs is using solar energy (Figure 15). Solar drying is becoming more and more important worldwide because solar energy is a renewable, environmentally friendly and

abundantly available source of energy. Solar drying is most effective with crops that need low-temperature, slow and drying, including the most sensitive drugs.

Figure 15. An example of a solar dryer[16]

Solar dryers are of three main types:

Natural solar dryer: This is a dryer that does not include any active parts and only makes use of environmental energy. The drying area is covered with translucent foil or glass, so the material to be dried may be exposed to direct insolation. The drying-air first warms up in a gearing collector and then flows through the layers of material placed on perforated frames of the drying cabinet as a result of natural convection. The device is most effectively used for the drying of small quantities (10 to 100kg).

Solar dryers with active parts: These are dryers equipped with collectors, but the airflow in the drying cabinet is provided by a fan. They are usually covered with foil, and the first segment of the tunnel functions as a collector. Airflow is maintained by a fan in a way that the air which has warmed up in the first segment of the tunnel is blown over the material layer, which at the same time, is exposed to direct insolation. Such devices are capable of drying herbs of up to 1000kg.

Dryers with supplemental solar energy: These dryers, equipped with solar collectors, are suitable for drying several hundreds of tons of material, mainly sowing seeds and rough fodder. The air that warms up in the collector functions as drying medium. Air is warmed up in an uncovered collector that is integrated in the roofing. It is drawn in by a fan through a channel applied under the collector, and is then fed under the latticed floor of the dryer. The material to be dried is spread on the latticed floor in an even layer.

[16]Photo: http://www.uni-kassel.de/agrar/agt/?c=147&language=en

6.3 Extraction of volatile oils

Volatile oils or essential oils are not homogeneous compounds. They are mixtures containing alcohols, esters, aldehydes and ketones. At room temperature, they are usually in a liquid state and intensively evaporate; most of them have a characteristic and pleasant scent. Volatile oils accumulate in the outer volatile-oil-containers of parts of leaves and flowers, or in the inner volatile-oil-ducts of grains and roots.

6.3.1 Extraction with solvents

This method is used when extracting volatile oils is impossible by using steam distillation. Extraction may be carried out with the use of volatile or non-volatile solvents at low or high temperatures. The extracted material contains resin, fat, wax and colouring agents. The quality of the extract may vary depending on the solvent used, and the extracting technology employed.

Volatile-solvent extraction is usually done at a high temperature that is defined by the boiling temperature of the solvent. Solvents used include petrol-ether, chlorate hydrocarbons, acetone and alcohols. Extraction may be periodical or continuous. The plant is first extracted with a fat solvent that is immiscible with water, and the obtained 'concrete' oil is dissolved in alcohol. After the precipitation of materials that are not soluble in alcohol, 'absolute' oil remains, which is soluble both in volatile oils and alcohol.

6.3.2 Pressing

Volatile oils are extracted by the cold pressing of the pericarp, or by centrifuging after pulping. This method is best used with species of at least 10% volatile-oil content.

6.3.3 Enfleurage

This method is used with plants from which volatile oils are not extracted in any other way. These include, for example, lilies, tuberoses, jasmines, etc. An important condition is that the plant parts should still produce volatile oils for a while after they have been harvested. The main feature of the method is that the plant part containing the volatile oil is covered in a layer of 1-2mm fat, and then the volatile oil absorbed by the fat is extracted or precipitated with alcohol. The 'concrete' oil is produced by evaporating the alcohol, and contains wax-like materials. The 'absolute' flower oil is gained after de-waxing.

6.3.4 Distillation

Distillation is a process in which liquids are transformed into steam at their boiling temperature, and the steam is then transformed into liquids by cooling. Steam distillation or hydro-distillation is the most commonly used method of extracting volatile oils. Depending on the way of execution, there is *water-distillation* (the plant parts are placed in water and heated together), *water-and-steam-distillation* (the plant parts and the water is placed in one container but separated), and *steam-distillation* (the plant parts are only exposed to steam). In large-scale volatile oil production, it is steam-distillation that is most commonly used, and this is the technology that is widely known as volatile oil distillation.

6.4 Volatile oil distillation and its devices

6.4.1 Preparation

The aim of the preparatory treatment of harvested plant parts is to make the volatile-oil containers accessible to steam. It is important that the prepared plants should not block the flow of steam too much; otherwise there may be overpressure in the distilling caldron. Long leafy sprouts and dry inflorescences must be chopped before distillation in order to make a better economy of use of the distilling caldron. It is a common principle that plant parts that have been cut and prepared must be distilled in the shortest possible time. Only ripe crops and grains can be stored without a considerable loss of quality and volatile-oil content, since even after a long time of storage an appropriate amount of well-composed volatile oil may be extracted from them.

6.4.2 Distillation

Extraction of volatile oils is carried out by a distillation apparatus (Figure 16). Volatile-oil distillation is done in periodical- and container-distillators.

Figure 16. A simple distillation apparatus for extraction of volatile oils[17]

In **periodical distillators,** the steam for the distillation is produced in an oil, gas or mixed fuel boiler that is placed independent of the distillator. The steam that has been driven into the caldron loses its overpressure, its volume increases, its temperature drops, and when getting in contact with cold plants, it loses its superheated quality, while it heats the plants to 100°C. For heating up the cold plants, approximately 15% of the steam is used up. Volatile-oil distillation is

[17] Photo: J.Bernath, Corvinus University, Budapest (Hungary)

always carried out with saturated steam of atmospheric pressure and at a temperature of around 100°C.

The caldron is filled up by hand-feeding or with a conveyor belt, probably with a bagger or by cutting chaff, always in one go. Care must be taken to evenly distribute the plants; otherwise, as the steam will flow in the line of least resistance, it will leave some of the material intact. The mass weight of the plants is defined by the moisture content, the degree to which they are chopped, and the extent to which they are compressed. After filling, the steam flowing through the plants in the closed caldron evaporates the volatile oils.

Container distillators combine the task of the device that transports the crops with that of the distilling caldron. The wheeled container, which can be towed and has a capacity of 25-35m^3, can be applied to the harvesting machine, and the chopped plants can be directly fed into it. To the container, once filled and closed, a steam pipe and a vapour drain pipe can be attached. Volatile oils are distilled in a similar way as in a periodical distillator. When the process is completed, the container can be towed away and its content depleted in a designated place. The container can hold up to 150-250kg of plants per cubic meter. Its height-diameter ratio is smaller than that of devices with a standing cylinder, so its specific steam demand is greater. This negative feature is counterbalanced by the fact that lossless distillation is possible, processing is fully automatized, and the need for human labour is minimal.

6.4.3 The length of distillation

The length of distillation is defined by two factors: the volatile oil must be of the best possible quality, while the process of distillation must be as economical as possible. The length of distillation depends on the qualities of the plants, the type of the caldron, and the amount and flowing speed of the steam. Volatile oils can be extracted relatively easily from external (exogenic) volatile-oil capsules. Volatile oils in leaves and flowers, raw or withered, can be extracted in a short time and with the use of a relatively small amount of steam.

With inner (endogenic) volatile-oil capsules, distillation may take longer, as much as 6 to 12 hours.

Distillation can only be finished when the distillate pouring out of the condenser no longer contains drops of volatile oil. Steam in-flow is usually stopped earlier, when there is no adjacent oil layer on top of the distillate. The oil that adheres to the wall of the cooler washes down quite slowly – the distillation of the volatile oil that appears in the distillate actually occurs 10 to 15 minutes earlier.

6.4.4 Cooling and precipitating

Water- and volatile-oil vapours, once cooled in the condenser, become liquid again. Condensers usually contain spiral pipes or pipe clusters, which are usually made of copper, aluminium or stainless steel. Cooling is done by water, the quantity of which has a quantity usually 30-35 times higher than the amount of the steam. The temperature of the distillate leaving the condenser does not usually exceed 25-30°C.

Precipitation of the volatile oil from the mixture of oil and water is carried out in what is called 'Florentini' vessel, based on differences in density. Small vessels are made of glass, while bigger

ones are of metal. Their operation and structure can be of two types depending on whether they are used to precipitate volatile oils heavier or lighter than water.

For an effective precipitation, vessels of the appropriate size and shape must be used. Effective precipitation may be expected in a vessel that holds the distillate and the water for at least 40-50 minutes. Volatile oils with a specific weight only slightly different from that of water need a lower speed of steam and a bigger 'Florentini' vessel in order to improve precipitation. Several vessels may be connected in series in a way that the size of the one following is bigger.

The frequency of volatile-oil extraction must be chosen in a way that the amount of volatile oil in the precipitation vessel does not exceed 15-20% of the volume of the vessel, so the efficiency of precipitation does not deteriorate.

6.5 Post-distillation operations

The precipitated raw volatile oil must be purified and filtered by removing floating contaminants and water content. It is advisable to use the method of sedimentation, because contaminants are difficult to filter and might easily clog the pores of the filtering apparatus. To remove floating water droplets and to decrease the dissolved-water content, an amount of approximately 0.5% of water-free sodium is mixed into the oil. Filtering and cleaning may also be done with a sedimentation centrifuge, a Seitz filter, or through a filter paper placed in a funnel.

The distilled plant parts contain valuable materials such as starch, protein and fats, which can be further utilized as animal feed.

6.6 Factors affecting the quality of volatile oils

During distillation, at a temperature of around 100^{o}C, several components of the volatile oils may go through chemical changes. As a result of hydrolysis, oxidation or polymerization numerous 'artificial products' may be produced. Several volatile-oil components are formed by heat during preparation or during distillation from the primary compounds that are to be found in the plants.

Overheated steam may cause the dissolution of other substances apart from volatile oils. Chemical changes generated by heat can be influenced by regulating distillation time, steam speed, steam pressure, and temperature.

In a watery medium, esters may disintegrate into basic components, alcohol and acid. Such disintegration is faster at higher temperatures. The speed of disintegration may be lowered by using higher steam speed. At the highest applicable steam speed the condensed water-oil mixture remains at above a temperature of 60-70^{o}C for a considerable amount of time, which means the disintegration of some esters may accelerate. So it is important that – at the beginning of distillation – the steam should break through the plants and condense in the cooler in the shortest time possible.

When storing the oils, dissolved water may cause undesirable chemical disintegrations, so it is of utmost importance to remove water as much as possible. Water solubility of volatile oils also depends on the temperature. Volatile oils produced in summer might get cloudy with the water departing from them as temperatures fall.

6.7 Producing fatty oils

Extraction of fatty oils is the most important phase of processing plant parts rich in fatty oils. For extraction, the plant parts must be thoroughly prepared. Preparation may vary depending on the species, the plant part and the method of extraction.

There are two basic ways of recovering fatty oils: extracting with a solvent and pressing. When extracting with a solvent, oils, waxes and other substances can be dissolved from solid crops by using the appropriate solvent. The most commonly used solvents are ethyl-alcohol, ethyl-acetate, water, hexane and acetone.

For pressing, there are two methods: periodical pressing, in which the mode of operation is similar to that of traditional wine-presses; and screw pressing, a widely used method in today's farms, which provides continuous pressing.

Raw materials go through several technological phases before oil is produced. Firstly, raw materials must be cleaned from foreign matter, and then they must be peeled. The remaining 'clean grains' are usually crushed, without which extraction operations would not be efficient. Exposed to heat, the physical parameters of grains change, and when exposed to heat, oil also flows more easily. After pressing, the raw oil is caught, and after sedimentation, rendering and filtering, it is further utilized. An important by-product of oil pressing is the pressing residue or the press cake with an oil content of 4-6%, which can be extracted with solvents. Due to its significant content of protein, the press cake is an important animal feed.

Screw Presses

Screw presses are continuously running devices. Their main parts include the driving motor, the loading funnel, the pressing machine, the pressing axle or screw, and the filters. Raw materials that go through the pressing machine endure a volume-loss. This can be avoided if the pressing space is decreased in the direction of the transport of the materials, or if the amount of the transported materials is increased. On the surface of the pressing space there are filters, through which, with the increasing pressure, oil can leave the press and pour into the collecting vessel underneath. The pressed residue material leaves at the end of the pressing machine.

6.8 Cleaning and chopping

6.8.1 Devices for cleaning grains and seeds

Herb grains produced on a large scale are cleaned by the well-known and commonly used seed-cleaner machines and may only be marketed after being officially licensed. Lower quantities of grains of high value in drug production are cleaned in laboratory grain cleaner machines, which resemble the design of the large-scale machines of a reduced size. The aims of cleaning are:

- to ensure the physical cleanliness of the seeds, and the elimination of seeds of alien species and of any physical contamination.
- to improve the reproductive ability of the seeds – by separating the damaged congener seeds.

Grain Cleaning Devices and Machines

Riddles: With the help of riddles, differences in the grain size of species are made use of during cleaning. For riddling, metal-plate or bolting cloth riddles are used. The holes on the surface of the riddle may be circular, slot-holed or square. Circular and square holes define the widest waistline of the grains, while slot-holes define the narrowest waistline of the grains.

Air-blasters: These make use of the differences of several physical properties of grains of different species, and thus make grain cleaning possible. Technically, air-blasters may be aspiratory, pressing or laterally-blowing.

Triers: Differences in the shapes of the grains of different species make cleaning possible. There are cylinder-triers, disk-triers, screw-triers and stem-triers.

Special machines:

- Abrading and shelling machines are used to hull grains from fruits, and to separate leaves and flowers from stems, etc.
- Separators are used for classification after specific weight.
- Horizontal and vertical belt-machines help cleaning by the different roundness quality of grains.
- Magnetic machines make use of the different surfaces of grains by separating those that bind iron dust on their surfaces from those with a smooth surface.
- Colour separators separate the different colour grains from each other.

6.8.2 Devices for cleaning and chopping herbs

Devices and methods used for cleaning grains are mostly suitable for cleaning herbs, or for producing drug products of homogenous size.

Sorter belts are used for the manual sorting of herbs, should they be transported in bulk or otherwise. They are 5-7 meters long and 70-80cm wide. The speed of the belt is adjustable between 1 and 10 meters a minute.

Cutters cut the already sorted raw materials into the desired size either by linear or square cutting (Figure 17).

Shellers shell the valuable leaf and flower parts from herbs. The machine consists of a shelling thresher, an unstemming and dust-extracting riddle, and a sieve. Inappropriate moisture content deteriorates the effectiveness of the procedure. Raw materials that are too dry may dust or break up into small pieces.

Crushers and riddles for herbs

Crushers. Herbs may be marketed finely crushed. The standards – either common state ones or those of private firms – define herb quality depending on the fineness of grinding and on granulation. There are hammer crushers, cutting-grinding crushers, turbo crushers and pegged crushers.

Bauermeister hammer crushers, equipped with appropriate supplements, can function as cutting-crusher, turbo crusher or pegged crusher.

Alpin machines are cutting-grinding crushers capable of grinding all types of drugs. The Hungarian-made **UG 40** machine is similarly suitable for fine crushing.

Riddle machines are designed to sort out any substances from the cut or grinded material that are bigger or smaller than the required size, and also to separate sand and dust. Occasionally, they may fulfill different tasks, such as unstemming camomile. Riddle machines are of two types depending on the direction of their motion: there are those with a rectilinear motion and those with a rotary motion.

Figure 17. Cutter of sorted herbal raw material[18]

Motor-driven camomile riddles are composed of two riddle frames sloped in an angle of 4-10°, onto which riddles and sieves may be applied. They are primarily used in processing raw and dried camomile.

MMT-2 Industrial Grain Cleaner Riddles are the most commonly and most universally used riddle machines in processing herbs. They comprise a double bolting-hutch, onto which four supplements can be placed. There is a moving line of brushes under the riddle in order to clean the clogged riddle holes. When camomile is being unstemmed, knives are applied in place of the brushes.

GIGANT K-531 A is a **Petkus** riddle machine (Figure 18). It has a double riddle level, is equipped with a pre-fanner and a post-fanner, and two trier rolls. The superficies of the rolls are exchangeable. K-523 B and 523 B.02 are heavy-duty preparatory riddles with two riddle levels: the upper and lower riddles are equipped with a scraping and cleaning supplement. **K-545 A** is an up-to-date heavy-duty grain cleaner, which is suitable for multi-purpose fine cleaning, and is

[18] Photo: J.Bernath, Corvinus University, Budapest (Hungary)

equipped with three riddle levels, and with pre- and post-edging. To this the **K-231 A** double-roll trier with exchangeable superficies can be attached.

Figure 18. GIGANT K-531 riddle machine[19]

Heinen winnowing machines make a circular-swinging movement, so they are especially suitable for the production of high quality cut and riddled goods. They are mainly used for producing quality square-cut goods, but they are capable of any other riddling tasks. They divide the goods into three parts: end product, processable materials and dust/sand.

Triers are used to sort out substances that are not sortable by a riddle machine because of their shape that is different from that of the rest of the materials. Triers with a horizontal cylinder have a rotating roll with cell cavities and with an axle to which a double outlet is applied. Materials that settle in the cell cavities are carried at the appropriate height by the rotating roll, from where they go into the outlet drain. 'Foreign matter' within the roll always slides back, and due to the angular offset of the machine, moves forward. Cell cavities are usually of 4-12mm.

6.9 Storage and packaging

6.9.1 Storage

Herbs produced by drying can only be stored in well-aired storage rooms. It is important that storage or stocking rooms should always be clean, in certain cases sterile. Poisonous herbs must be stored separately from other herbs, in a separate storage room. The goods should be stored in a closed case or an appropriate dark space. Herbs should never be kept in moist and unventilated spaces because they are in danger of moulding. Every mouldy, faded or otherwise changed herb should be immediately discarded and replaced with a fresh one. Herbs with strong smell must also be stored separately in order to prevent other herbs from taking on the smell. The basic rule of storage is that the desired part of the plant is cut and then handled as gently as possible. Every unnecessary cut, squeeze or piling up of the cut plants may reduce their eventual quality and effectiveness. Even if in case of obtaining the leaves, it is usually better to cut the entire stems and then remove the leaves when they are dry. Every herb container must be labelled with the name of the herb stored in it and the date of preparation.

[19] Photo: http://emarket.ua/objavlenie/-petkus-k-531-gigant-gigant--IDmDC1.html

Even well dried and stored herbs slowly lose their effectiveness. A rule should be followed about replacing dry herbs every season. Pharmacy, which is better acquainted with the characteristics of various herbal drugs, generally prescribes the shelf life of herbs from 6 to 18 months, or slightly longer for root-based drugs.

6.9.2 Packaging

The method of packaging depends on the characteristics of the herb, its quantity, the method and distance of shipment, or the special needs of the customer. Most common methods of packaging include bales, large or small sacks, paper- or plastic bags, wooden packaging cases or boxes (Figure 19). Generally, properly dried herb parts should be stored either in appropriate covered containers or in paper bags. We have to consider that light continues to affect herbs; therefore they have to be kept in dark glass containers and wooden, cardboard or tin boxes.

Bales are mostly used for herbs that may be pressed. Bales are made with heavy-duty hydraulic baling machines; they weigh 60-100kg, and are covered in sackcloth. Herbs that cannot be pressed are packaged in large-size bale sacks.

Herbs of great bulk density must be packaged in small sacks. Highly absorbent drugs must be packaged in paper or polyethylene bags. Valuable herbs and those sensitive to pressure are packaged in wooden cases or paper boxes.

6.9.3 Volatile oils

During storage certain chemical reactions may occur that may deteriorate the quality of the oil. Heavy metal compounds accelerate the chemical reactions even at low temperatures even if they are only present in small quantities. During storage all the chemical processes may take place that usually trigger decay during distillation. At lower temperatures the speed of these processes is low, but with long storage decay may be considerable. An amount of a few tenths of water dissolved in the volatile oil may cause the decay of a ten times greater quantity of ester, as a result of which the acid content of the oil increases, bringing about further decay.

Figure 19. Storage of processed herbal raw material[20]

[20] Photo: J.Bernath, Corvinus University, Budapest (Hungary)

Destructive processes must be prevented during storage. The lower the temperature, the lower the speed of chemical reactions; so it is advisable to store at the lowest temperature possible. Oxidation can be eliminated by excluding air, so the storage containers must be fully filled and hermetically sealed. Volatile oils, especially if stored in glass containers, are ideally stored in a dark storage room, for light may trigger polymerization.

Volatile oils are often stored in metal containers, cans or tanks. Containers are made of iron galvanized with zinc or aluminium. Small quantities of oil are best stored in brown glass containers. It is not advisable to use plastic containers or rubber stoppers for they will normally be damaged by most volatile oils.

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7 MARKETING, ADVERTISING, SALES, AND ENTREPRENEURIAL SKILLS

Regional Agrarian Chamber of the South Moravian Region Brno (Czech Republic)

The collection activity is successful in the long run if the marketing and product chain is ensured. In order to become not only a herb picker and a herb processor, but a businessperson who is able to find their customers, approach them and sell a product to them, several measures should be taken.

Businesspeople undertaking production (not services) need their own products to sell. They should own or rent so-called *production resources* (a factory, a workshop, a plant, a field, etc.) in order to produce their own merchandise.

Requirements for producing saleable goods are the following:

A. Thorough knowledge of the plants and herbs suitable for collection and selling.

B. Familiarity with the natural sites where these plants grow wild (and do not belong to anyone).

C. Collection of the required parts at the optimal time and with optimal methods.

7.1 Who will my customers be and how do I find them?

In order to become successful, potential customers and their reasons to buy certain products should be identified. Type of customers should be primarily determined. There are different types of buyer, including the corporate customer and the end consumers.

7.1.1 Corporate customers

Corporate customers will buy certain products (raw materials) in order to use them for their own business – products (potentially developed within the project) are therefore one of their sources of profit. They can either pack them directly into professionally prepared packages and sell them to their buyers, or they may use them as raw material required for their own production. Among others, they may use them:

- For their own consumption;
- For herbs purchase facilities (e.g. run by tea producers);
- For food or drink producing companies and production plants;
- For cosmetic companies;
- For whole food stores or distributors of herbs and healthy food.

7.1.2 End customers

End customers buy a product to use it for themselves. They can typically be found:

- At farmers' markets;
- Through the internet;
- Among neighbours, acquaintances and their acquaintances;

- At fairs, feasts, Christmas markets and other events that attract a large number of people with the intention to purchase what is not commonly found in shops;
- In their own shop (if opened at a convenient place).

Correct assessment of possibilities and the suitability of a product for a specific type of a customer will help to identify the type of customer to focus on.

7.2 Which form of business to choose?

Herbs and parts of plants picked for commercial use become useful raw materials after we have picked and processed them.

The raw materials themselves or a product made of them (e.g. tea, jam or juice) become products – in other words something somebody is willing to buy and have for their own use. Depending on the purpose thus identified, the next step is to decide how to prepare the product for the given customer.

The easiest way of conducting business is by simply drying the collected herbs, or performing another basic processing, and to sell them in a herbs outlet. However, if more complex forms of processing are chosen (final product), successful sales yield higher revenues per kilogram of picked raw materials. In other words, if the value of a product is increased, for example, by processing plants into jam or syrup, the revenue gained for each kilogram of picked raw materials will be even higher.

Inevitably, more energy, efforts and financial means have to be invested into a product with higher added value, but it is worth the investment as the revenue received for each kilogram of the picked raw material will be considerably higher in the end. It is therefore also advisable to calculate the difference between the costs and benefits (receipts) for each form of business and to decide which form will suit better. It should also be considered whether raw material is to be further processed (e.g. production of jam) or final product is to be sold.

7.2.1 Alternatives of a commercial enterprise

A. Bulk sale (Figure 20);
B. Individual sale;
C. Marketing and professional sale.

Description of alternatives of a commercial enterprise is shown in the Table 3.

Table 3. Alternatives of a commercial enterprise

FORM OF BUSINESS	Bulk sale	Individual sale	Marketing and professional sale
TYPE OF CUSTOMER	Corporate customer	End customer	End customer or corporate customer
TYPE OF PRODUCT	Raw material for further processing	Raw materials are also end products for direct sale	End product with added value produced from the raw material

EXAMPLE OF A PRODUCT	Rose-hip fruits to be sold in a purchase facility or to a tea producer	Rose-hip fruits to be packed and sold at farmer's markets	Rose-hip fruits to be processed into jam and this product further to be sold through internet or into whole food stores
INTENSITY OF BUSINESS	Least demanding	Demanding	The most demanding
FINANCIAL OUTCOMES	The lowest *(typically supplementary source of money)*	Medium *(may be a person's main income)*	The highest (*the entrepreneur may even get rich*)
ADVANTAGES	All picked and dried raw materials can be sold in a purchase facility at one moment; Getting the money immediately; No further worries with production, packages and sales; Minimum cost of running this type of business;	Higher amount gained for one kilogram of raw material; Business can be partially developed and expanded; A more interesting form of business, bringing a lot of motivation, meeting with people; Relatively low cost required to run this type of business;	The highest revenue gained for one kilogram of raw material; Big chance to develop and expand business; The most interesting form of business, which may positively influence not only a businessman's life, but other people's lives too;
DISADVANTAGES	The lowest revenue gained for one kilogram of raw material; Almost no chance of developing and expanding the business; This business does not provide strong motivation and may become boring;	Packaging and labelling the product must be ensured; Convenient places and ways of sales must be found; Selling and distribution of products to customers is rather demanding; Money is received when individual customers pay;	More effort to be spent on planning and implementation of marketing; Both professional sale and distribution of products to end customers must be ensured; Demanding because of much planning and high management costs; Money is received when customers are found, persuaded and attracted;

7.2.2 Preconditions for business

Before deciding which form of business to conduct, not only the advantages and disadvantages of each alternative are to be assessed, but preconditions for business are also to be considered, namely the abilities and skills available. *Business resources* should be carefully evaluated.

7.3 Business resources required for different forms of business

For various forms of business, i.e. bulk, individual, or marketing sales, various business resources are required. Selection of plants for selling, its natural habitats, collection methods, basic marketing info and many other things should be carefully defined. The main business resources required for various forms of business are listed below.

7.3.1 Bulk sale

- to know plants and herbs suitable to be picked and commercialized;
- to know or find natural sites where these plants grow wild (do not belong to anyone);

- to have the right picking tools and space for drying and storage of herbs;

7.3.2 Individual sale (in addition to necessary resources mentioned under Bulk sale):

- to have a sales stand;
- to have information on where the stand can be located and where we can sell;
- to have at least basic packaging materials;
- to have transport means.

Figure 20. Bulk sale in Czech Republic[21]

7.3.3 Marketing and professional sales (in addition to the necessary resources given under Bulk sale):

- to know at least the basics of marketing and professional business;
- to know at least the basics of business finance management;
- to have information on potential customers;
- to have packaging materials;
- to have colleagues to help us in our business (in picking, production and sales);
- to have at least some basic financial capital to invest into production and promotion;

Before selecting one of the forms of business, certain additional factors should be considered, e.g. family support available, human qualities and motivation, as well as the extent of business risk.

[21] Photo: E.Chromečková, Eva Regional Agrarian Chamber of the South Moravian Region Brno (Czech Republic)

7.4 Preparation of a marketing plan

A marketing plan is vital for a successful profit-making business. It is of utmost importance especially for business forms B and C. A summary analysis and a plan should be created in order to obtain a better understanding of customers and market competition.

7.4.1 Content of a marketing plan

Situation analysis

Situation analysis provides for the information that shows the basic market situation.

This analysis should consist of internal and external sections. The internal analysis should evaluate the preconditions, i.e. business resources, the ability to create a marketable product; and assess strengths and weaknesses.

In an external analysis, legislative conditions and market circumstances should be described and should be based on market research, including the examination of the strengths and weaknesses of potential customers and the competition.

Finally, the limiting conditions for business and potential risks and opportunities are evaluated. All information can be summarized in a so-called SWOT table, identifying strengths, weaknesses, opportunities and threats to the enterprise (Table 4).

Table 4. SWOT table template

INTERNAL ANALYSIS	
Strengths	Weaknesses
EXTERNAL ANALYSIS	
Opportunities	Threats

Business resources and the competitive advantage represent *Strengths*, missing resources and internal risks identified are *Weaknesses*; external risks are *Threats*.

Marketing targets

Easily measurable targets to know what to focus on should be set. These measurable targets include a number of customers to gain in a given period, expected revenue and the quantities to be produced.

Marketing strategy

A marketing strategy will help clarify the ways to meet given marketing targets. One of the time-tested approaches is the so-called *Marketing mix*.

Plan of key marketing activities

Based on the marketing strategy specified in individual parts of the marketing mix, individual activities are planned in detail, e.g. determining and finding the ideal type of product packaging and the right distributors, designing effective promotion, etc. The plan of each activity should contain a time schedule and a plan of individual steps.

Marketing budget

Each marketing activity entails different costs. In this respect, it is to be calculated how much money is available for these activities, and if the given financial resources are not sufficient and there is no chance to receive credit, the marketing plan is to be reconsidered.

Checking if targets are met

Either at points specified in advance (e.g. at the end of each season) or after completing a marketing activity, it should be examined to what extent meeting the targets set at the outset has been successful. In case reality deviates from the plans, it is advisable to reconsider targets or to modify the marketing strategy.

7.4.2 Target customer groups

First of all, there are different target customer groups who might be interested in purchasing certain products. Furthermore, it is necessary to evaluate which of these target groups are the most likely for the particular business and why. Finally, it needs to be decided which of the target groups identified should be approached. Basic division of target customer groups is into *Corporate customers* and *Consumers*.

7.4.2.1 Corporate customers

Examples of corporate customers include:

- Tea producers;
- Cosmetic companies;
- Food producing companies;
- Drink processing companies;
- Chains of whole food stores.

7.4.2.2 Consumers

Examples of consumers include:

- People with preference for high quality food;
- People living a healthy life;
- People with long-term health problems;
- Our neighbours and acquaintances.

At least a small research project is advisable to tap potential interest in the products in order to test under what conditions (mainly at the anticipated prices) customers would be willing to buy the specific products. At the same time, this research should also suggest how to set individual parts of the marketing mix for the offer to be attractive to customers. The research can be done through personal discussions, or an internet application like *Survio.com* can be used.

7.4.3 Marketing mix – 4Ps

The marketing mix is a key part of the marketing strategy. At the same time, it represents a complex of tactical tools helping us to adjust the parameters of the offer to potential customers. The marketing mix is also known as the "*4Ps*", referring to the first letters in the words for the main groups of tools: *Product*, *Price*, *Place* (of distribution), and *Promotion*.

1. *Product*

The qualities of the product to be offered and sold to the customers should be carefully considered. Should it just be a raw material for further processing or a raw material meant for direct consumption? Or should the product with higher added value be created? What should the packaging of the product be? Which of the customers' requirements will the product satisfy?

2. *Price*

Several factors should be taken into account when setting the price. It is influenced both by competitive prices a customer is used to paying and by the extent of the product processing, thus by the fact whether the customer has to process the product further or not. Price should always cover direct cost, as well as a part of the indirect cost and the margin. The right price is such that it attracts so many customers buying so many goods that profits are generated.

3. *Place (of distribution)*

Similar to promotion, when choosing distribution channels, it should be asked where potential customers are actually located and how they will obtain the goods. In case of bulk sale of raw materials, the product may be sold to tea producers in herbs purchase facilities. In case of individual sale to consumers, the product can be offered at farmers' markets. In both cases, the own transport resources will have to be used for distribution. Direct deliver to the consumer's home upon an order from an e-shop, using postal or mail order services is possible. In case the products have a higher added value and are sold further professionally, they may be distributed in store chains or wholesale stores.

4. *Promotion / marketing communication*

It is advisable to use so-called targeted promotion to make promotion effective without unnecessary cost. In other words, the aim is to promote the product mainly to the target groups who will buy the product. It is usually through the media that these people can be reached.

Although a highly effective promotion medium, references and recommendations of the acquaintances that are already the customers or at least know about the products are rather atypical.

Another significant consideration is the name of the product – should a no-name product be sold or should investments into brand development be made? A carefully chosen brand name may do wonders, but a name with negative connotations may lead to disaster.

7.5 Assessment of competition

Looking into competition, the following things should be discovered:

A. Whether there is any space for the business in addition to the competitors' activities;
B. What the advantages of the competitors compared to our business are – what additional benefits they offer to our potential customers;
C. What the weaknesses of our competitors are – where the opportunity for us is (our competitive advantage).

There are several ways to find and assess individual competitors or to evaluate the competitive environment. The main methods are:

- Research of goods on offer (in shops, at markets etc.);
- Internet research (competitors' websites, search engines, e-shops, articles about given topics);
- Discussions with customers;
- Discussions directly with competitors.

7.6 Promotion and advertisement of business

Financial resources and, more importantly, knowing the target customer groups to be attracted by advertisements are highly required for effective product promotion.

7.6.1 Advertising locally

In order to attract attention to a shop, it is advisable to choose local advertising, such as promotional display, bonded leaflets or an article in local newspapers, as well as advertisements on the websites of a town or village. When selling from a stand during a specific event, visitors' attention may be attracted also through promotional materials, such as catalogues, posters, trade fair radio, etc.

7.6.2 Advertising on the Internet

To attract prospective customers to the websites with an e-shop, internet advertising might be very useful – e.g. through *Google Adwords*. Quality websites are of utmost importance. For this purpose, one of the providers that may be used is *Webnode.com*, which enables to create your own website without any knowledge of programming free of charge or for little money.

7.7 Finding customers

It is vitally important to offer and sell goods, or get orders for goods in locations where potential customers are known to be.

7.7.1 Companies

A list of potential corporate customers can be obtained from paid as well as public databases and records, such as many CE countries' "Yellow book directories". Companies to approach should be selected from the branches relevant to our offer (e.g. tea production).

7.7.2 Internet

Active internet use means creating and running own websites which could directly advertise certain production. Orders can be accepted and processed either through e-mail or using an interactive form or a small e-shop. On the other hand, products could be offered through bigger e-shops. Investment into website optimization (SEO) and the so-called Pay per click (PPC) model of advertising may increase the chance of the products being found by potential customers.

7.7.3 Acquaintances

If case of small-scale production, offering and selling to acquaintances, neighbours, friends and their acquaintances may be sufficient. In this case, making a list of all the known people and of those who might be interested in the products can help. The next step is to approach them and offer the products to them.

7.7.4 Markets and trade fairs

The list of events abundantly visited by consumers (in case of trade fairs as well as companies) can be found on the internet, using search engines (Google and others) typing in appropriate keywords, such as “farmers’ markets”, “agricultural trade fair“, “consumer markets“, “Christmas markets“ etc. The organizers’ websites usually provide information about fees and other conditions for exhibitors and vendors.

7.7.5 Places with a high turnover of people

This category may include, among others, spaces in front of big department stores or train stations as well as underground and other passageways or ordinary market halls.

7.8 Forms of sales organization

When producing such amounts of products that cannot be personally, increasing of human capacity should be considered. Engaging other interested stakeholders (salespersons and vendors) in selling might help to strengthen sales.

Vendors are people performing their own business and sales activities – they may sell goods in their own stands or shops (B&M or mobile shops). Vendors are usually oriented on consumers.

Salespersons working as our employees or co-workers are different from vendors. They need not be employed by the company; they may be self-employed and keep offering products of more companies to the customers. In order to motivate them to get as high a volume of new orders as possible, a motivation system of commissions is usually effective, even if they are employed on a fixed contractual salary. Salespeople are particularly useful when dealing with corporate customers.

7.9 Boosting the offer

Regardless of the type of potential customer, careful attention to the following points should be paid. The business should offer:

- High-quality product presentation – attractive packaging, physical demonstration etc.;
- Personal approach, ability to listen to customers and sensitivity to their needs;
- Good knowledge of product and examples of its use;
- Free product trials – a sample or tasting;
- An active approach and attention to customers;
- Flexibility even in handling of possible complaints.

7.10 Cost planning

To be successful in financial terms, it is necessary not only to calculate and plan cost and revenue, but also to continuously monitor them. There are two main categories of costs: investment and operating costs.

7.10.1 Investment costs

These are inevitably incurred when launching a profit-making business. They cover the necessary equipment as e.g. machines, tools and product transport means. During a profitable activity, investment costs do not usually repeat as long as renovation, refilling or improved equipment are not required.

Various investment costs may be unavoidable. For example:

- Registration of food products;
- Immovable property for our business;
- Ladders;
- Picking tools, scissors and similar tools for picking herbs and parts of plants;
- Baskets, bags or sacks;
- A stove;
- Pots, other utensils and further kitchen appliances;
- A dryer;
- A dismountable stand;
- Promotion displays;
- Designing websites;
- Mobile phones;
- A car, etc.

7.10.2 Operating costs

These are incurred regularly during the whole business cycle. For example:

- Ensuring quality and safety of food products (quality testing included);
- Phone bills;
- Fuel or fares in public transport;
- Promotion and advertising;
- Internet connection;
- Website operation;

- Fees for rented space for a stand;
- Electricity, gas bills;
- Sugar and other ingredients for production;
- Packaging material and labeling;
- Property insurance premiums;
- Health and social security payments for a self-employed person;
- Potential employees' salaries of and state tax and security payments for them;
- Taxes and some administrative charges represent special types of operating costs.

7.10.3 Revenue and profit

Revenue is money received from customers. Before using it for personal needs, part of the money should be put aside to cover operating costs. At least once every few months certain payments should be made or money could be invested to renovation of some equipment. It is also advisable to keep a reserve fund, in case unexpected costs occur (devices are to be repaired; penalties are to be paid; bargain opportunities open up, etc.).

7.10.4 Taxes and payments to the state

What is left after deducting costs from the revenue (except for taxes) is the profit. Annual state taxes are calculated from the profit at the end of each calendar year. However, as calculation is difficult, it is advisable to hire an accounting specialist to do this. An accountant will not only put books in order, but will also calculate taxes and help with tax statements. Tax regulations may be different in the CE countries.

7.11 Further development of business

In case of successful business development, expansion might take place. Through developing and expanding the business the threat posed by the competition or by changing market conditions possibly resulting in business failure is reduced. Business can be expanded in two possible directions or as a combination of the two:

7.11.1 In production

a) In order to gain larger quantities of raw material
   - Finding more sites with required raw materials;
   - Hiring or employing additional collectors;
   - Investing into larger premises and technical equipment, which enables processing and drying larger quantities of raw materials;

b) In order to produce merchandise of higher added value
   - Looking for new possibilities (in addition to basic processing) of increasing the added value of raw materials in order to have a more valuable product;
   - Finding out through research or in discussions with customers what the more valuable product should be like in order to attract their attention and how much they would be willing to pay for it;

- Calculating what new product would be worth producing and selling;
- Investing into necessary technical equipment to start producing a new merchandise from selected raw materials, which may yield better profits;

c) In order to produce a wider range of products

- Finding out which products with higher added value paid off and why;
- Finding out from customers buying these products what similar products they would be interested in and how much they would be willing to pay for them;
- Starting production of further (new) products which people seem to be interested in and which are likely to pay off.

7.11.2 In sales

a) In order to gain more customers of the same type

- Intensifying sales efforts – spending more time on selling;
- Hiring or employing new salespersons;
- Using business agencies or companies selling similar (however not truly competitive) products to the same type of customers;
- Using new promotion and distribution channels to the same type of customers;

b) In order to gain new types of customers

- Finding out which new types of customers could be interested in our products based on existing production resources;
- Verifying through research what exactly these prospective customers need;
- Accommodating the product and its content, packaging and promotion to the needs of the prospective new customers;
- Building channels to new customers, using e.g. store chains or distributors already selling to such customers;
- Using the internet to look for new sales opportunities at home and abroad.

Each fundamental expansion of business requires updating the existing marketing plan or a new marketing plan, which should be then followed.

The speed of business expansion should be considered very carefully. A deliberate approach and a rather slower pace of growth usually pay off. It is often more useful to raise our own money by saving earnings than to run deep into debt.

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CONCLUSION

Traditional and wild Project intends to preserve traditional knowledge about the valuable properties of wild plants and their collection traditions by organising trainings, seminars and promotion events for local communities, including unemployed people, the elderly, women and the Roma population, in Hungary, Poland, Slovenia and Czech Republic.

This background document helps trainees better understand the main aspects of sustainable plant collection and utilization activities, build-up the entrepreneurial and marketing skills, and enhance employment opportunities. The trainings provide the transferrable and easily-adaptable tool for further implementation and use in the Central European region.

The document is also available in participant countries' languages (Hungarian, Slovenian, Polish, Czech and Roma in some cases). The training materials package, including this document, developed by the project partnership is available on the project website. CD copies of the training materials package were disseminated to the partners, key stakeholders and general public.

Traditional and wild

Promoting traditional collection and use of wild plants to reduce social and economic disparities in Central Europe

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