**CULTIVATION OF MEDICINAL PLANTS**

Human cultivation of medicinal plants has been practiced for a long time in order to facilitate their collection and use. The main important aspect of the cultivation of medicinal plants is to obtain high-quality raw materials containing a large number of pharmacologically active substances. The productivity of a medicinal product is not only the mass of its raw materials, but also the preservation of the maximum amount of the active substance used to obtain a separate biologically active substance present in its composition, or drugs.

It is important to have a large number of pharmacologically active substances in the composition of the herbal medicine used in the manufacture of medicines in the aggregate form. For example, when obtaining tinctures or extracts from roots using valerian rhizomes, an important condition is the presence of valethotriates, free valeric acid and essential oil in the composition of the primary raw material.

It is also possible to control the biosynthesis of biologically active substances in medicinal plants in natural conditions. However, in the cultivation of medicinal plants, it is possible to manage these processes more easily, intervene in the process of biosynthesis and direct them in a certain direction.

During cultivation to increase the productivity of medicinal plants, they can be influenced by 2 methods: 1. Agrotechnical and agrochemical method; 2. The method of genetic selector effects on the plant.

The amount of pharmacologically active substances in medicinal plants depends on their form of development. Some plants bloom in both the first and second year. It is established that on such plants the number of active substances of the first year is less compared to the second year. For example, this condition was observed on digitalis. This process applies to other plants.

A wide range of active substances on various plants opens up great opportunities for obtaining valuable populations. In recent years, many different types of hybridization (interspecific, intergeneric) as well as polychloidemia through colchicine are preferred.

The “introduction” of medicinal plants is the cultivation of wild medicinal plants in areas in which they are common, or in areas where they do not grow at all. This term (“introduction”) is closely related to the terms “acclimatization” and “naturalization”. “Acclimatization” is the adaptation of a plant to new climatic conditions, in contrast to the area of ​​plant distribution. “Naturalization” is a high degree of “acclimatization”, not only the adaptation of a plant to a new habitat, but also its free development, reproduction and resistance to other types of phytocenosis in the struggle for life.

“Introduction” is a complex biological process. In the process of implementing this process, tolerance, adaptation to climatic conditions (plant temperature, air and soil humidity, light), genetic characteristics and geographical origin of the introduced species should be known. It is important to study the biological characteristics of a plant as a result of its interaction with the environment. Since this process is applied to medicinal plants, one of the most important factors is to ensure that their chemical composition does not change noticeably in the new conditions. Only after studying all the factors, including thermal, bioecological, geographical and chemical complex factors, after finding the integral and functional relationship between them, it is possible to plan the introduction of the plant.

As a result of research conducted over the years, the Institute of Botany of the National Academy of Sciences of Azerbaijan and other relevant research institutions in the conditions of Azerbaijan introduced many plants, such as tea, feijoa, lemon, mandarin, orange, kiwi, oleander, agave, passionflower, aloe, laurel, Magnolia grandiflora, eucalyptus, Japanese medlar, etc.

 **FORMATION OF THE BASE OF RAW MEDICINAL PLANTS**

Production and sale of countless herbal remedies, biologically active additives and homeopathic medicines in recent years has led to an increase in demand for raw materials of medicinal plants. Currently, the base of medicinal plant materials is formed as follows: 1) harvesting of wild medicinal plants; 2) harvesting of cultivated medicinal plants; 3) fund of imported plant raw materials; 4) on the basis of medicinal plants and a cell biomass culture.

The main source of medicinal plant materials is an industrial stock of wild and cultivated medicinal plants. There are more than 4,000 plant species in the territory of the Republic of Azerbaijan, of which 135 are wild herbs. At the same time, in the flora of the country there are many promising species that can be used in medical practice, and some species can be exported to other countries. Legal entities (company, pharmacy, etc.) and individuals with special consent (license) issued by the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan may engage in the preparation of medicinal plants.

Exported medicinal plant material is a small part.

Increasing tissue and cell culture of medicinal plants is considered a promising area.

Despite the increase in the number of herbal medicines grown each year, only 75% of the demand for plant raw materials in the CIS countries is met.

More than 250 plant species belong to the nomenclature of wild medicinal plants harvested in the CIS countries.

Cultivated medicinal plants are the main source of medicinal plants. Special farms and farm households are engaged in the cultivation of medicinal plants. The territory of the Republic of Azerbaijan is located in the south-eastern part of the Caucasus, which has a complex and colorful geomorphological structure and is characterized by a rich vegetation cover.

If we divide the territory of the Republic of Azerbaijan into ten natural-economic zones, it will become clear that a large number of medicinal plants can be grown in these areas.

In the natural economic zone of Ganja-Gazakh it is possible to cultivate aloe, mint, foxglove, saffron, calendula, chamomile, securinega, restharrow, fennel and others.

In the steppe part of the Shirvan zone, it is possible to cultivate aloe, castor-bean, geranium, licorice, ammi, henbane, mustard, milk thistle, coriander, calendula, raspberry, rue and other plants.

In the dry subtropical part of the Mugan-Salyan zone there are favorable conditions for growing licorice, ammi, cassia, dogbane, coriander, thistle, smoketree, rosemary, sophora, oleander, mint and so on.

The cultivation of glaucium, chamomile, valerian, elder, mint, belladonna, celandine, sage, violet, marshmallow, bastard hemp, henbane and other plants is promising in the highlands of Karabakh.

On the territory of the Karabakh-Mil-Mugan zone, it is possible to cultivate calendula, smoketree, amorph, stephania, ungernia, mustard, lemon balm, dogbane, fennel, comfrey, madder, cassia, psoralea, yucca, castor, etc.

The natural environment of the Guba-Khachmaz region makes it possible to cultivate chamomile, horse chestnut, securinega, cumin, dill, rue, yucca, eucommia, goat's-head, garlic, three-lobe beggarticks, silkvine, oleander, madder, marshmallow, valerian, mint, celery, lemon balm, saffron, foxglove and other plants.

In the Shaki-Zagatala zone, it is possible to grow chamomile, mint, valerian, fennel, cumin, belladonna, marshmallow, melissa, sea buckthorn, phytolacca, lavender, rose and so on.

The Aran and foothill parts of the Lankaran zone belong to a humid subtropical climate. In this area, there are favorable conditions for the cultivation of Java tea, aloe, tea, sesame, solanum, periploca, papaya, mint, eucalyptus, catharanthus, securinega, foxglove, pepper, passionflower, mountain knotgrass, various citrus and other plants.

In the Absheron zone, it is possible to grow agave, fennel, coriander, cumin, castor bean, laurel, calendula, saffron, henna tree, oleander, sophora, carum, datura and other plants.

The natural conditions of the Nakhchivan zone make it possible to cultivate mint, ephedra, pepper, apricot, hogweed, ammi, castor bean, cumin, licorice, rheum, calendula, sesame, periwinkle, etc.

Currently, more than 60 medicinal plants are grown on an industrial scale in the CIS countries. Various research institutes are engaged in the introduction of medicinal plants. Adaptation of a new medicinal plant to growing is considered a long-term task that requires hard work. This process consists of various stages, including collecting materials for planting, studying the biological properties of a medicinal plant, choosing geographic and optimal areas for planting new crops, developing effective reproductive methods and a variety of valuable, economically important populations. The average annual adaptation of annual plants is 3-4 years, and perennial plants - 6-10 years. Despite the growing trend towards introduction in recent years, it is impossible to adapt each medicinal plant to new conditions. Many plants (calamus, adonis, firmosses, wild rosemary, etc.) are very difficult to adapt to the new environment for their biological and ecological features.

Growing plants is carried out in the following cases: 1. Local medicinal plants for which raw materials are in great demand (pharmacy chamomile, medicinal valerian, sea buckthorn, etc.); 2. Medicinal plants with a limited area and stock of raw materials (Georgian madder, ginseng, belladonna, etc.); 3. Plants that cover a large area, but do not form dense spreading spaces (Hypericum, immortelle, etc.); 4. Plants that are the source of new drugs and medicines and do not have a sufficient raw material base (datisсa, sweetvetch, thistle, etc.); 5. Medicinal herbs of other countries that have no analogues in the flora of the country (aloe, mountain knotgrass, Java tea, cassia, etc.); 6. Plants that do not grow in the wild and are only cultivated (pepper, mint, etc.).

Preparation of cultivated medicinal plants, as compared with wild medicinal plants, has certain advantages. Agrotechnical maintenance and reproduction of plants as a result of selection, as well as the use of mechanical methods in reproduction, an effective process of harvesting and drying can improve the quality of raw materials.

Special farms for growing medicinal plants were created in different plant zones of the CIS countries. Such farms operate in Ukraine, Moldova, Belarus, Latvia, Georgia, Kazakhstan, Kyrgyzstan and Russia.

Imported raw materials of medicinal plants include raw materials of plants that do not grow on the territory of the country and mainly grow in tropical countries. These include the rauwolfia serpentina root, stephania roots, strophanthus seeds, Caucasian fir, poppy, etc.

After the country's demand is satisfied, the remaining raw materials can be exported in accordance with the needs of other countries. The number of exported medicinal plants is compiled in accordance with the demand for them. In the global market for raw materials of medicinal plants, there is a great demand for coltsfoot, licorice, mistletoe, buckthorn, horse chestnut, horsetail, calamus, black elderberry, large-leaved linden tree, common blueberries, common raspberries, black raspberries, henbane, medicinal marshmallow, chamomile, etc.

**CULTURE OF PLANT CELLS AND TISSUES IS A PERSPECTIVE SOURCE FOR RAW MATERIALS**

Cell culture and tissue is the production of tissues that are secreted by proliferation from different parts of the plant or cell division in tissue cultures transplanted artificially in vitro.

The founders of the plant tissue culture, which is a new field of biological sciences, are F. White and R. Gotre (early 20th century). In the 30s of the twentieth century, the cultivation of a plant cell in suspension culture and the acquisition of the required amount of biomass from a single cell were developed, which made it possible to obtain homogeneous material from a genetic and physiological point of view.

Previously, only theoretically developed plant tissue cultures were included in biotechnology, which have been a specific area of scientific and economic activity since the 1960s. Currently, industrial plants produce new forms and varieties of many plants used for various purposes on the basis of the technology of growing plant tissues and plant production.

All objects used in this process are sterile in vitro. Part of the plant tissue used as a source (explant) and the nutrient medium are sterilized. Then, in special boxes, manipulations are carried out over an object grown with aseptically sterile instruments. Containers in which cells and tissues are grown are closed in such a way that during the whole process their infection with microbes is prevented.

There are three main directions in the production of tissue cultures of medicinal plants: obtaining a mass of callus that has not undergone differentiation; obtaining primary various genetic forms of a plant; ensuring cell selection and microclonal propagation of the plant.

In nature, callus is a natural response of plants to damage from various influences. Tissue culture cells isolated by the explant begin to separate in the nutrient medium without differentiation, which leads to the formation of callus, an undifferentiated homogeneous mass.

Callus is divided under aseptic conditions, and it is placed in a nutrient medium covered with surface agar to support its development. As a result, a culture of callus tissue is formed, which is stored for a long time, periodically divided into transplants and placed in a freshly prepared medium.

Calluses are very easily formed on explants of various organs and parts of plants - in the trunk, leaves, fragments of roots, seedlings, parenchymal cells, root tissues, in parts of the flower, fruits, fetus, and so on. Cultures of callus cells are mainly carried out in two ways; in a nutrient medium coated with surface agar, or in artificial (silica gel, biogel, polyacrylamide gels, polyurethane foam, etc.) and a liquid-food medium forming various gels.

Growth mediums play a very important role in cellular technology. They must provide tissue culture with all the chemicals needed to synthesize the desired product. The composition of medium includes mineral salts (macro- and microelements), phytohormones, carbohydrate source in sucrose, etc. At the same time, temperature, light, the presence of gas in the environment and other factors are also important.

One of the key features of tissue culture is the storage of the ability to synthesize secondary metabolites (alkaloids, glycosides, essential oils, steroids, etc.) inherent in the plant.

In the modern era there is a transition from research related to cell culture to industrial production. Due to this method, substances and goods of high value are obtained in different countries. In Japan, shikonin, an antiseptic and having a wide range of effects, was obtained from the tobacco cells of ubiquinone-10, a stoneseed tissue (Lithospermum). Rosemary acid was obtained from Coleus in Germany.

Cell selection is also considered a promising area for cellular technology, at the same time for obtaining new types of medicinal herbs. As a result of the work of A. G. Vollosovich, highly productive varieties of rauwolfia serpentina were created and strains with high content of Aymalin were obtained.

**Polyploidy**

Polyploidy - (Greek polyp - multitude, ploid - try, eidos - species) - this is an increase in the number of chromosomes in the cell nucleus. Such a situation in nature can occur naturally.

In recent years, people have attempted to increase the number of artificial chromosomes, and new advances have been made in this area.

There are two types of polyploidy: autopolipoidy and allopolyploidy.

 Allopolyploidy is the hereditary increase in the number of chromosomes in the cells of an organism belonging to the same biological species.

Allopolyploidy- an increase in the number of chromosomes in hybrid organisms. This mainly occurs during several interspecific and intergeneric hybrids.

In recent years, special attention has been paid to the acquisition of polyploid forms of various medicinal plants by artificial means. For example, the tetraploid form of the opium poppy contains morphine twice as much as the initial diploid form.

The tetraploid forms of chamomile have a denser stem and leaves. The content of pyrethrin in the composition is very high.

The composition of the tetraploid form of the common yarrow, contains azulene much more.

The composition of tetraploid forms of narrow-leaved lavender and clary sage contains more essential oils than diploid forms.

**PREPARATION AND PRIMARY TREATMENT OF RAW MEDICINAL PLANTS**

The purity of medicinal plant materials depends on meeting the procurement terms, the correct collection technology and the drying mode. When harvesting, the biological characteristics of the medicinal plant, the dynamics of accumulation of active substances, the effect of collection features on the condition of thickets must be taken into account. Collectors should be guided by instructions on the collection and drying of medicinal plant materials, measures for the protection and rational use of thickets; be able to distinguish medicinal plants from other plants, etc.

Preparation of raw materials for medicinal plants is a multistage process. A part of medicinal plants used as a raw material should be supplied during the period when most pharmacologically active substances accumulate, which depend on the type of plant, its development pattern and climatic conditions. The primary processing of raw materials of medicinal plants includes the cleaning of harvested vegetable raw materials from untreated parts of the plant, other plant mixtures and objects before drying. The procurement process should be carried out after the special training of suppliers. At the same time, contracts are concluded with suppliers, and inform them about the effective use of herbal raw materials and the protection of rare species.

Various parts of raw herbs are used, such as leaves, grass, flower, root, rhizome, seeds, fruits, shoots, bulbs, root-crop, and so on.

The soil parts of the plant (leaves, flowers, grass, fruits, etc.) are begun to collect in dry weather after the morning dew dries (after 8-10 o'clock) and continue until the evening (until 17 o'clock) until the evening dew subsides. Underground parts (root, rhizome, root crop, etc.) can be harvested during the day. If it rains, the raw material is collected after the plant is completely dry. After collection, the parts to be washed can also be harvested in the dew and in the rain. Plant materials should be harvested mainly from healthy plants, as well as plants that are not damaged by insects or microorganisms. The collection cycle is one of the basic requirements of the procurement process.

If the biologically active substances in the raw materials belong to the reserve nutrients (for example, mucus, sugar, etc.), such raw materials are collected in the autumn. If biologically active substances belong to the second metabolite (alkaloids, flavonoids, saponins, etc.), raw materials should sometimes be collected in different seasons, and not in the fall. For example, in the roots of belladonna, alkaloids accumulate more at the end of the growing season, that is, not in the fall, but a little earlier. Therefore, it is not recommended to collect its raw materials in the autumn.

Sometimes the amount of a substance in plants changes during the day. For example, the number of cardiac glycosides decreases in plants at night, because their splitting occurs, and increases during the day, especially in the afternoon. Therefore, the raw material of cardiac glycoside must be collected in the afternoon.

The vital processes in the freshly prepared raw materials are still ongoing, but the nature of the metabolism is changing and arises in new conditions. Since the raw material loses its moisture, enzymes (ferments) that control the biochemical processes of living tissue are forced to change the direction of their actions and carry out the splitting of substances in the cells.

In some cases, the activity of enzymes has a positive effect on raw materials; for example, the amount of coumarins from coumarin raw materials is increasing, and in raw materials derived from anthranol, these substances are converted to anthraquinones, which leads to an increase in the healing effect of raw materials.

In most cases, enzymatic processes have a negative effect on raw materials, destroy biologically active substances and lead to a decrease and complete loss of the healing effect. For example, enzymatic processes destroy the digitalis glycosides and alkaloids of the tropane group.

Freshly prepared raw materials are exposed to hot flasks of alcohol or chloroform, and then dried in closed media to suspend (inactivate) enzymes. However, the stabilization of raw materials in this way is expensive. In cases where there is no impact on the chemical composition of the raw materials, stabilization can also be carried out using hot water vapor.

It is not recommended to collect raw materials of medicinal plants near large residential areas, along roads with heavy traffic. As in plants growing under similar conditions, various toxicants accumulate (heavy metals, benzopyrene, etc.).

It must be remembered that certain types of medicinal plants can cause allergic reactions in certain people, cause dermatitis, inflammation of the mucous membranes of the eyes, nasopharynx. When collecting poisonous, potent and prickly plants, you need to observe precautions, do not involve children in the collection of this raw material. During the collection process, safety precautions should be followed.

Each type of plant raw materials has its own calendar terms and features of collection. In addition, there are general rules and methods for individual morphological groups, established on the basis of long-term experience.

Buds are harvested at the end of winter or in early spring, when they are swollen, but they do not budge. Birch buds are collected together with the branches, tied them in a bundle in the form of a broom and dried in cold conditions. Then shaking the branches, they are cleaned from the buds. Before drying, remove impurities and buds that have begun to grow. Pine buds are cut in the form of a "crown" with a shoot no more than 3 mm long.

The bark is harvested during sap flow before leafing (April - early May). At this time, it is easily separated from the wood. Usually, bark harvesting is combined with forest cuttings. On young smooth trunks and branches make circular cuts at a distance of 20-30 cm, connect with one or two longitudinal cuts. The tip of the knife separates the bark from the wood. Before drying, remove impurities, discard pieces of bark thicker than the allowable size, and clean from lichens.

The leaves are harvested when they are fully formed, usually in the budding and flowering phases. The leaves are cut with knives, scissors, sickles or carefully cut off manually with the stem, without a stem or with a part of the stem, depending on the requirements of the regulatory documentation. In the “clean” thickets and on the plantations, the plants mow or cut off the entire above-ground part, and then the leaves are cut off. When harvesting from wild perennial plants it is impossible to collect all the leaves, some of them need to be left so that the plants will not die.

Flowers (or whole inflorescences) are usually harvested at the beginning or at the time of full bloom. Cut flowers with hands (chamomile, fragrant, calendula, etc.), cut with scissors, branch cutter, sickles, pruners (hawthorn, linden, etc.) or comb it with a special scoop (chamomile); on the plantations, however, use special cleaning machines. After harvesting, extraneous parts of the plant, diseased or fading flowers, and buds are removed.

Buds (santonica, Sophora Japanese) are harvested before the flowers bloom.

Grass (aerial parts of the plant) is harvested during flowering, some species - at the beginning of flowering (a series of tripartite, wormwood, lily of the valley, etc.), others - in the flowering phase and before shedding fruits (spring bloom), in the flowering and fruiting phase ( wild rosemary marsh). Cut off shoots with knives, scissors, sickles, on “clean” thickets mow them with scythes or mowers, after removing extraneous plants from thickets. In some plants, the entire above-ground part is cut at a level of 5-10 cm from the soil surface (lily of the valley, adonis, Hypericum), protecting the renewal buds, or without coarse lower parts of the stem (ordinary wormwood, common yarrow, etc.), or (three-part beggarticks); sometimes (in annuals) the whole plant is pulled out along with the root (marsh cudweed). For the resumption of thickets leave on 1 m2 several well-developed plants. Before drying, all impurities, lignified and thick stem parts, etc. are removed from the collected aboveground part. Sometimes the grass is threshed after drying (thyme, thymus, chamomile).

Fruits and seeds are usually harvested technically mature, and sometimes during ripening of 60-70% of fruits (umbellifers, castor bean, flax, mustard). When harvesting dry fruits and seeds, the aerial part of the plant is usually mown, dried and threshed (cumin, fennel, etc.). Juicy fruits are harvested by hand, without peduncles, if possible without disturbing the integrity of the fruit shell, as the crushed fruits easily mold. Cutting or breaking off branches with the fruits of sea buckthorn, hawthorn, dog rose, etc. is unacceptable. In such cases, a significant damage is caused to the place of mass distribution.

Underground organs (roots, rhizomes, tubers, bulbs) are usually harvested in the fall, less often in spring before the beginning of the growing season. At the same time, first of all, the above-ground part of the plants is cut, and the underground organs of the plants are dug out with shovels, pitchforks, diggers, on plantations - with plows, potato tenders. After harvesting, the remains of stems, basal leaves, dead rotten parts of roots and rhizomes are separated, shaking off the ground. In this case, the roots are usually washed by immersing them in a flowing cold stream of water. Raw materials containing mucus, saponins, washed quickly due to the high solubility of the active substances. Some types of raw materials remove the cork (licorice, calamus, marshmallow).

After collecting the underground organs to restore the thickets in the formed hole, it is recommended to shake the seeds from the excavated plants or put pieces of rhizomes. The collection of more than 1/5 of the plant in the area where the underground organs are collected is not allowed.

The best container for transferring raw materials to the place of drying are wicker baskets, wooden boxes, fabric bags, and dense packing of raw materials at this time is not recommended. Leaves, grass, flowers should not be placed in plastic bags, backpacks. Since in them the raw materials quickly self-heat, which leads to the destruction of the active substances.

Juicy fruits are collected in small and wide baskets, sometimes in buckets. When filling containers such fruits are folded in layers, separated by herbal or leafy pads.

The collected raw materials need to be quickly (in 2-3 hours) delivered to the place of drying or spread out in the shade on a cloth, tarpaulin.

**DRYING OF PLANT RAW MATERIALS**

Most types of medicinal plants used in medicine in dried form. Only certain species directly after collection are processed in a fresh state.

From the point of view of thermodynamics, drying is the process of interaction between a moist material (medicinal raw material) and a heat carrier (heated air), from a technological point of view it is a process of removing liquid from plant material (dehydration).

Collected medicinal raw materials contain, as a rule, 70–90%, and dried –10–15 (20)% of moisture.

Biochemical processes in the collected raw materials at first proceed as in a living plant, i.e., the synthesis of biologically active substances prevails. Then, as natural dehydration occurs, due to the cessation of the supply of moisture and nutrients, the metabolic processes shift towards decay, which leads to a decrease in the content of biologically active substances in the raw materials. If drying is carried out at a temperature that does not denature the enzymes, then the lysis reactions continue during the drying process until a sufficient dehydration of the raw material is achieved. However, in some cases, the processes occurring in the drying raw materials, on the contrary, lead to an increase in the content of active substances. The optimal mode of drying should be based on experimental data on the effect of drying and its specific methods on the content of certain groups of biologically active substances.

In some cases, drying is preceded by drying of the collected raw material, i.e., keeping the raw material at ordinary temperature under a canopy. Sometimes the drying process helps to increase the content of active substances or speeds up the process of subsequent dehydration.

Moisture is in the plant in a free and bound state. Free water retains all the properties of pure water: mobility, activity, the ability to evaporate and freeze, dissolve various substances. Bound water (chemically, adsorption, capillary, osmotically) loses these properties to one degree or another, evaporates and freezes more difficultly, has less activity and reactivity.

The duration of the drying process and the productivity of drying plants are influenced by the morphological characteristics of the raw material, its initial humidity, the total surface of the material being dried, as well as the humidity, temperature and velocity of the coolant.

Currently used methods of drying medicinal plant materials are divided into two groups: 1. Without artificial heating. 2. With artificial heating or heat. The method without artificial heating also comes in two forms: a) air-shadow, carried out in the open air, but in the shade, under sheds, in attics, in special drying sheds and air dryers, b) solar, under the open sky or in solar dryers .

Air shadow drying is used to dry leaves, herbs, and flowers. In the simplest cases, the raw materials for drying are laid out under sheds or in special drying sheds. It is preferable to carry out drying in specially equipped air dryers or in attics. Air dryers equip racks. Drying in air dryers, drying sheds and attic rooms proceeds more slowly than in the open air under canopies, but provides better quality raw materials.

Solar drying is used in areas with a hot dry climate, mainly for bark, roots, rhizomes and other underground organs, which, as a rule, are almost not damaged by the influence of solar radiation. Solar drying is especially "shown" for raw materials containing tannins. However, it should be noted that the content of some alkaloids during the drying of raw materials in the sun decreases (scopoly, groundflower). It is recommended to dry in the shade from the damaging effect of the sun rays on pigments of leaves, flowers and herbs. The advantages of the solar method of drying include faster dehydration than the air-dried ones.

Both in the air-shade and in the case of solar drying, in order to avoid moistening the raw material at night, it should be removed in a room or covered with a thick cloth.

Heat drying is used to dry various morphological groups of raw materials. It provides rapid dehydration and can be used in all weather conditions and in any areas of the workpiece. Depending on the heat supply, there are convective and thermoradiation drying.

Convective drying is carried out in batch or continuous dryers. Numerous dryer designs can be divided into stationary and portable type dryers. Stationary dryers are usually installed in farms where medicinal plants are cultivated, or at large procurement centers. They consist of a drying chamber equipped with shelves and a heating installation. Dryers are heated with water, steam or flue gases. Portable dryers are designed for drying mainly "wild" medicinal raw materials. Folding portable dryers are convenient for transportation and allow you to organize the drying of raw materials directly in the areas of procurement.

Radiation drying is carried out using infrared rays with high penetrating power and allowing to significantly reduce the process of dehydration. This method is used in the laboratory.

The optimal mode of drying is given in the instructions for the procurement and drying of specific types of medicinal plant materials.

General rules of drying are as follows:

1. Raw materials containing essential oils should be dried at a temperature of 30–35 (40) °C with a rather thick layer of 10–15 cm to prevent evaporation of the essential oil;

2. Raw materials containing glycosides - at a temperature of 50-60 °C. This mode allows you to quickly inactivate the enzymes that destroy glycosides;

3. Raw materials containing alkaloids should be dried at a temperature of up to 50 °С;

4. Raw materials containing ascorbic acid should be dried at a temperature of 80-90 °C.

In all methods of drying, medicinal raw materials, with the exception of ether-oilseeds, are laid out in a thin layer and regularly turned over. At the same time, however, it is impossible to allow crushing and grinding of raw materials.

As a result of experimental studies, it became known that the weight of raw materials belonging to different morphological groups decreases during the drying process. These indicators are as follows: flowers, buds –70–80; kidneys - 65–70%; leaves –55–90; herbs –65–90; roots and rhizomes –60–80; bark –50–70; tubers - 50–70; fruits –30–60; seeds –20–40%.

Drying is considered complete when the roots, rhizomes, bark, stalks do not bend when bent, but break, leaves and flowers are ground into powder; juicy fruits do not stick together into lumps, and when pressed, they crumble.

**BRİNGİNG PLANT MATERİALS TO A STANDARD STATE**

After drying, the defective objects are removed from the raw materials and brought to a state of full compliance with the requirements of the regulatory and technical documentation. Simultaneously with bringing to the standard state they constitute a homogeneous batch of this type of raw material.

Elimination of raw material defects and removal of impurities is achieved by cleaning the raw materials from mistakenly collected non-marketable parts of the producing plant, removing the defective parts of this raw material, changing the natural color, moldy, coarse stems, lignified parts of the roots, screening out overly crushed parts of the raw material, cleaning it from foreign organic and mineral impurities . Usually, all operations are carried out simultaneously with the use of various means of mechanization. These are manual and mechanized screens with interchangeable sieves (shakers), winders, separators, conveyor belts and special sorting machines: “slide” - tape stripper, winders-sorting with fans, sifters. Then for manual processing of raw materials used sorting tables.

When sorting herbs from raw materials, non-leafy rough parts of the stems are removed, parts that have lost their natural color are threshed out of crushed herbs from threshed herbs (thyme, thymus, sweet clover) and the stem parts of plants are removed. Used for sorting grasses sieve or stand.

The sorting of flowers consists in sifting out the excess of the crushed raw materials, when it is required by normative technical document, and removing the raw materials, which change the color during drying.

Sorting berries is carried out on the fan-sorts of various designs with a set of sieves having openings of different sizes. At the same time, light impurities (“puny” fruits, leaves, twigs) are separated by a stream of air created by a fan, and the remaining impurities are separated by sieves according to particle size.

Seeds are cleaned on special separators with an appropriate set of sieves. The separation of impurities from raw materials occurs in them due to centrifugal force and air flow.

Sorting of roots, rhizomes, and bark is carried out using mechanized screens or sorting tapes (conveyors).

Raw materials entering procurement centers or warehouses, either overdried or overdried, also need to be improved. Undried raw materials are brought to air-dry condition, spread out in a well-ventilated room in a thin layer; dried over is kept in a room with slightly elevated humidity for 1–2 days.

All sorting operations are carried out in rooms with exhaust ventilation. Thus, the dust generated during the processing of dried raw materials can irritate the upper respiratory tract. Particular care should be taken when working with toxic and potent raw materials - protect the eyes, protecting them with glasses, nose and mouth from dust using a respirator or gauze bandage.

**PACKING, MARKING, TRANSPORTATION AND STORAGE OF PLANT RAW MATERIALS**

The requirements for packaging, labeling, transportation and storage of medicinal plant materials and charges from it are regulated by the GOST, as well as State Pharmacopoeia.

Packaging. Dried vegetable raw materials occupy a large volume, which complicates its transportation and storage. In addition, in the unpacked form, it is easily moistened or dries, changes color. To ensure the safety of raw materials in terms of quality and quantity in the process of transportation and storage, it must be packaged in a container specified in the reference document for raw materials. Packaging should be clean, without any odor. For each batch you need to use the same container.

For packing of raw materials, single or double cloth bags are usually used, paper bags from Kraft paper, multi-layered or double, single or double paper bags, plastic bags, cloth bales, bales, sheathed or not sheathed with cloth, boxes made of sheet wood materials and corrugated cardboard. Bags are used for packaging fruits, seeds, crushed bark, roots and rhizomes. Double bags are packed with ponderous, hygroscopic and free-flowing raw materials (flowers of santonica, Althea root, licorice root, alder seedlings, raw material in the form of powder, fees).

The mass of raw materials packed in bags for fabric bags should not exceed 50 kg, for paper and plastic - 15 kg, for paper bags - 5 kg net.

Fabric bales, oblong and shaped like a box, are packed with medicinal raw materials that cannot be compressed due to insufficient adhesion (bearberry leaves, thyme grass, elder flowers, alder seedlings, calamus rhizomes, etc.). The mass of raw materials packed in bales should be no more than 50 kg net.

Piles are used for packing bark, roots, rhizomes, leaves, herbs (except for small types of raw materials). They are produced by pressing the raw material with a mechanical or manual press and wrapping the bale with a cloth. The mass of raw materials in bales should be no more than 200 kg net.

Fragile and dry types of medicinal raw materials are packed in boxes made of sheet wood materials. Before packing, the boxes inside are lined with wrapping and sack paper or subparchment. The mass of raw materials should not exceed 30 kg.

For packaging of packaged medicinal plant materials and fees, the following types of consumer packaging are used: cardboard packs for packaging products on automatic machines, paper or plastic bags, paper wrappers for briquette packaging, filter bags, etc. In recent years, a large amount of packaging materials have been proposed used in the application of packaging of medicinal plant materials produced by various companies, and noted in the articles of the relevant Pharmacopoeia.

Marking. The markings on the packaging of goods in the form of inscriptions on tags or labels facilitate the handling of raw materials at the warehouse and during storage. Marking is applied to the container with indelible paint in large print. When marking should be the following indicators:

◊ name of the sending enterprise;

◊ name of medicinal plant materials;

◊ amount of raw material (net weight and gross);

◊ stocking time; of raw materials;

◊ batch number;

◊ normative technical document on a specific type of raw materials.

A packing list is put in each package and the following are indicated in it:

◊ name of the sending enterprise;

◊ name of raw materials;

◊ batch number;

◊ packer's name or number.

The barcode is placed on the packaging material for sale in the pharmacy chain.

Transportation. Medicinal raw materials should be transported in dry, clean, free of odor and not contaminated by granary pests vehicles. Transportation of poisonous, potent and ether-oil raw materials should be carried out separately from other types of raw materials.

During transportation and release of raw materials, each batch is accompanied by a document on the quality of raw materials issued by the sender.

Storage. Medicinal plant raw materials should be stored in dry, clean, well-ventilated warehouses, not contaminated by granary pests, protected from direct sunlight, at a temperature of 10–12 °С. Storage facilities may be temporary (sheds, barns, attics) and permanent (specially equipped storage rooms).

The warehouse should have a number of premises: a receiving office, where the paperwork is made, the quality of packaging, labeling, and sampling for analysis is checked; an insulator for the temporary storage of raw materials contaminated by pests; room for temporary storage and processing of non-standard raw materials; rooms for separate storage of various groups of raw materials.

Storage conditions in warehouses should ensure the safety of raw materials for external signs and the content of biologically active substances during the shelf life for it.

The main factors affecting medicinal plant materials during storage can be divided into two groups: 1) External - hygienic (humidity, temperature, light); natural and climatic (time of year, zoning); 2) Internal - physico-chemical and biological processes occurring in medicinal plant materials.

A significant impact on the quality of raw materials during storage has its moisture. It usually ranges from 12 to 15%. It is unacceptable to store raw materials with high humidity, as this contributes to its self-heating, mold, caking and rotting. The increased air humidity of the warehouse also leads to a decrease in the quality of raw materials and a decrease in the content of active ingredients in it. Especially for hygroscopic species (flowers of hawthorn, lily of the valley, leaves of henbane, belladonna, etc.) this is unacceptable. Raspberry, blueberry, currant berries are best kept with frequent airing.

The bulk of medicinal raw materials are stored in common areas. Poisonous, potent and ether-oil-raw materials, as well as fruits and seeds are contained separately in groups in isolated rooms. Poisonous and potent medicinal raw materials are stored in a separate storage room, in safes or metal cabinets under lock and key. The windows should have metal bars, the doors should also be made of iron. The premises are equipped with light and sound alarms. After completion of the premises should be sealed.

In warehouses, raw materials should be stored on racks installed at a distance of at least 15 cm from the floor. The height of the stack should be no more than 2.5 m for berries, seeds, buds and 4 m for other types of raw materials and no less than 25 cm from the walls, no less than 50 cm between the piles. information about raw materials. The label should indicate the name of the raw materials, the name of the sending enterprise, the time of procurement, the batch number, the date of receipt.

Raw materials during storage must be shifted annually, checking for the presence of granary pests and the compliance of the storage period with a shelf life. The warehouse and racks are disinfected during the inspection of the raw materials.

**IMPACT OF ANTHROPOGENIC FACTORS ON THE QUALITY OF MEDICINAL PLANT RAW MATERIALS**

Medicinal herbs are not referred to basic xenobiotics that are accepted to the human body. Nevertheless, the medicinal plant raw material should be considered as a specific risk factor for human health.

It should be noted that in recent years, medicinal plants and their manufactured products that have been processed compared to the traditionally containing xenobiotics food, air and water attracted the attention of researchers. In regulatory documents there is almost no permissible amount of xenobiotics in plant raw materials.

The chain of entry of extraneous bodies in the human body can be illustrated by the following scheme.

Anthropogenic impact - Medicinal plants ---- Raw material ----- Medicinal form --- Human(pollution of gaseous

emissions from absorption

through dust and soil)

At this time, the anthropogenic load decreases when moving from one stage to another. This is due to the fact that plants choose toxic substances and have a limited accumulation. The use of various parts of medicinal plants as a raw material, subject to varying degrees of human impact; conducting limited amounts of toxicants on dosage forms as a result of the extract; The uncontrollability of the processes of taking dosage forms in the human body (external, internal, intravenous, intramuscular, etc.) based on a general pattern prevents the preparation of relevant documentation for the control of xenobiotics.

There are several aspects of this problem. The first aspect is methodological and the choice of objects must demonstrate the state of the object in each ring. This is a direct pharmacological problem. Another aspect is ecological; to study how to transfer toxic substances to the plant. The most important are gas-generating emissions, pollution of dust and soil with toxicants created by enterprises. These factors, which are the main sources of pollution, should be specifically investigated. In this aspect, the intensity of the reaction of various species to various anthropogenic pollution and the collection of toxicants in various organs and tissues are closely related.

The third aspect of the problem is analytical. This is a further improvement of the analytical methods of toxicants and the mass adaptation of these methods in industrial areas and laboratory conditions.

The last aspect is legislative. Taking into account anthropogenic impacts, the relevant regulatory documents and recommendations on the regulation of areas of medicinal plant raw materials are considered.

There are several groups of xenobiotics that are more dangerous for the human body. These include heavy metals, pesticides, nitrites and nitrates, nitrocinamines, a group of carcinogenic compounds (mainly polycyclic aromatic hydrocarbons), radionuclides, arsenic, and others. Due to the intensity of anthropogenic factors, the first 2 groups - toxicants and radionuclides are more dangerous.

**DEFINITION OF ECOTOXINS IN MEDICINAL PLANT RAW MATERIALS**

Ecological conditions have changed in areas where medicinal plant raw materials have been supplied to industry as a result of the influence of anthropogenic factors on all factors of the natural environment. As a result, a sufficient amount of ecotoxins was found in plant raw materials collected in such regions.

Ecotoxins are compounds that circulate in the biosphere as a result of human activities, are highly toxic and are considered to be foreign bodies for humans and animals.

The problem of contamination of medicinal plant raw materials ecotoxin and complex and covers areas that are closely interrelated with each other (technological, analytical, legislative, etc.). From the point of view of pharmacognists, taking into account the effects of internal and external factors, medicinal raw materials also depend on the degree of heavy metals and other toxins in its composition and are considered as one of the key indicators.

The question of the accumulation of xenobiotics in medicinal plant raw materials began to be discussed in the second half of the 20th century. Xenobiotics are extraneous bodies for human organisms (industrial pollution, pesticides, radionuclides, household chemicals, medicines, etc.). Xenobiotics cause significant damage to the environment when it comes to the environment, adversely affects the genetic apparatus of the human body and even causes death, and also upsets the balance of natural processes in the biosphere.

Objective information about Pb, Cd and pesticides contained in medicinal plant raw materials was first given by German scientists *S.L.Ali* and *H.Schicher* in the 70s of the XX century.

More dangerous ecotoxins for the human body include heavy metals and pesticides. Their medicinal herbs and phytopreparations are a source of real danger to human health.

The presence of heavy metals in medicinal plant materials is considered as the main influence of anthropogenic factors. Heavy metals are metallic elements with atomic numbers of 20 and an atomic mass of more than 40. Medicinal plant materials contain a large number of metallic elements that are indispensable for a biological system, which are not environmentally dangerous. They are part of medicinal plants through natural and anthropogenic sources. Natural sources of heavy metals include wind erosion of soil and mountain slopes, volcanic activity, forest fires and some other processes. All these sources pollute plants with heavy metals. Most heavy metals are small amounts of rock. Heavy metals, including a large number of plants, weaken metabolic processes, hinder the development and decrease in plant productivity.

Anthropogenic sources of heavy metals include fuel combustion (including fuel burning by cars), removal of useful natural resources and their processing (especially non-ferrous metals), ferrous metallurgy, chemical industry, metalworking, energy and building materials, household waste, etc.

The effect of motor vehicles and individual industrial enterprises on medicinal plants was purposefully investigated. As a result of the study, it was established that medicinal plant raw materials should be supplied from the main line 200-300 m from the distance. Although the amount of heavy metals in medicinal plant materials collected in a radius of 3.5 km of large industrial facilities is relatively large, they do not pose a real threat to the human body. Most likely, these indicators also depend on the type of medicinal plants and on the amount of raw materials used by them. In recent years, as a result of man technological activities, global emissions of heavy metals into the atmosphere and soil occur. Heavy metals enter the structure of plants in two ways: through the root (root feeding) and leaves (foliar feeding). At the bottom of the soil, most metals are in maximum concentration. At the same time, due to excessive pollution of the atmosphere, plants are obtained not only from Pb, Cd and Zn air, but also from polluted soil.

Plants can accumulate heavy metals on the surface of leaves, flowers and the stem as a result of their combination with cuticles and the cell wall. The heavy metals accumulated in this form can be cleaned by washing the plants. For example, Pb is a large amount of sediment on the surface of a plant and is easily cleaned with water. In contrast, Cu, Zn and Cd are washed with a small amount of water, and also soaked into the parenchymal tissue of the leaves.

The ability of a plant to take chemical elements through its roots is diverse and variable. Cd, Cs, Pb are very easily absorbed, and Fe is poorly absorbed. Some metals are adsorbed from soil to the surface of the root. But most metals become part of the plant. More toxic metals for plants are Hg, Cu, Ni, Pb, Co and Cd.

The accumulation of heavy metals in a plant depends on the plant organs and the type of metal accumulated. Zn is evenly distributed throughout the body of the plant. Pb, Sn, Cr accumulate the most in the roots. Mn, Mo, Sr, Cu, Ni are collected in leaves and tissues. Fe and Co are relatively less collected on leaves and stems. The properties of the absorption of elements for the momlod of plant organs are very different.

The maximum concentration of metals accumulates in the leaves and brittle branches, a relatively small amount in the roots and the shell and the minimum amount in the wood. The degree of saturation of the main tissues of the plant with heavy metals decreases in this sequence: roots - leaves - seeds (fruits). The amount of metals collected in the roots and seeds of a plant can vary up to 500-600 times, indicating that the underground organs are more protected.

In the composition of plants, heavy metals are divided into four groups according to the absolute volume of accumulation: 1) Elements with a high amount — Sr, Mn, Zn; 2) Elements with an average amount of - Cu, Ni, Pb, Cr; 3) Low-concentrated elements - Mo, Cd, Se, Co, Sn; 4) Elements with a very low concentration - Hg.

The average degree of probability of the maximum concentration of certain elements on the leaves of plants is (mkg/ g): Fe 20-30 (750); Mn 15-150 (300); Zn 15-150 (300); Cu 3-40 (150); Co 0.01-0.30 (5); Ni 0.1-1.0 (930); Cr 0.1-0.5 (20); Pb 0.1-5.0 (10); Cd 0.05-2.0, (0); Hg 0.001-0.01 (0.04).

Plant families such as *Caryophyllaceae, Cruciferae, Cyperaceae, Poaceae, Fabaceae* and *Chenopodiaceae* are tolerant of accumulation of excessive microorganisms.

With the age of plants, its chemical composition also changes: the amount of ash increases and its composition changes. Each systematic group of plants in the landscape has its own chemical composition and is very demanding on the environment in which it grows. In a plant ash, Ni and Zn can be 10%; Co, Cr, Sr 1-3%; Cu and Hg 0.1-1.0%.

Microorganisms can have different concentrations in different types of plants, and this amount can be a distinctive feature for a particular plant species and species.

Trace elements contained in medicinal plants can further improve the pharmacological effect of certain biologically active ingredients. However, it should be borne in mind that toxic metals such as Pb, Cd, Hg and others. can go into a variety of herbal preparations and can eventually end up in the human body.

In general, the presence of heavy metals in plants is due to genetic and environmental factors. If the genetic factor tries to keep the number of stable elements in the plant, environmental factors, on the contrary, cause this unstable quantity. Since the soil contains a large number of elements, the amount of instability in plants can be quite large. According to data sources, the amount of heavy metals in plants and raw materials collected from different regions varies. This difference, on the one hand, depends on the biological characteristics of plant species, and on the other hand, on the ecological state of the environment.

The study of the chemical composition of plants collected from a highly anthropogenically polluted territory indicates that medicinal plants take metals selectively. For example, in areas polluted by oil, cadmium, which receives horsetail, increases 1.5 times, manganese - 2 times, lead - 1.2 times, and cobalt - 1.3 times. Taking zinc and nickel is virtually unchanged. However, in yarrow, the amount of cadmium increases by 2.7 times, cobalt - by 4.1 times, nickel - by 1.6 times, the amount of lead and manganese practically does not change, the amount of manganese - even decreases.

From the point of view of ecological purity, first of all, the number of elements of cadmium, lead and mercury should be determined in medicinal plant raw materials. These elements are the main causes of pollution of the biosphere and are the main targets for the control of food products and necessary food raw materials in many countries around the world.

Pesticides are also included in hazardous ecotoxins other than heavy metals. Pesticides are chemical or biological substances (or ingredients) that are intended to kill insects, rodents, infections that spread diseases of plants and animals, and are also used as regulators of plant growth and defoliant. Scientists of the 60s of the 20th century began to pay attention to the amount of pesticides in medicinal plants. As a result of scientific research conducted in Germany, Bulgaria, Poland, the former Yugoslavia, Hungary and some other countries, the amount of pesticides in medicinal plant raw materials turned out to be high enough for approved food products (table 1).

Table. The number of pesticides contained in medicinal plant raw materials, which grow in different regions of the world

|  |  |  |
| --- | --- | --- |
| Regions | Years | Quantity, 00 |
| γ-HXTH  | DDT | DDE | HXB |
| Germany | 1979 | 20-40 | 20-40 | 20-30 | 10-100 |
| Former Yugoslavia | 1975-1980 | 10-90 | 20-40 | 20 | 10 |
| Poland | 1976-1978 | 30-200 | 20-1100 | 20-60 | 10 |
| Egypt | 1980 | 40-100 | 20-170 | 20 | 10 |
| China | 1979 | 110 | 50 | 20 | 10 |
| Tunisia | 1980 | 600 | 30-40 | 20 | 40 |
| Altai region of the Russian Federation | 1999-2000 | 0-4,9 | 0-2,1 | 0,1-4,3 | 0,2-7,4 |

γ-HXTH- γ-hexachlorocyclohexane

DDT – dichlorodiphenyltrichloroethane

DDE -

HXB – hexachlorobenzene

Currently, almost 500 of more than 1,200 pesticides are actively used in the CIS. They are divided into 3 classes: chlorine-organic, phosphorus-organic and sim-tyrosine derivatives. Chlorine-organic pesticides are less toxic than phosphorus-organic pesticides, but they have the ability for a long time to remain in the soil, plants and living organisms to circulate. Sometimes their metabolites are more toxic than the original. Laws that completely or partially prohibit the use of chlorine-organic pesticides and laws enacted in 1973 have now no effect. Because such pesticides can remain in the environment for a long time. These substances persist in the soil for a long time and are characterized by high solubility in oils and organic solvents and accumulate in richer tissues.

It was found that pumpkin seeds are the most concentrated source of chlorine-organic pesticides (69% of the sample was incompatible with food standards). This is due to the fact that, since the pumpkin has large and multi-layered surface roots, the root system of the plant is different in that it permeates more pesticides from the soil than other plants. Oil-soluble chlorine-organic pesticides are soaked in pumpkin seeds.

Cassia leaves have the ability to absorb more isomers of hexachlorocyclohexane. In the leaves of the plant, it was determined 0.24-0.90 mcg/g α-HXTH; 0.10-0.44 mcg/g β-HXTH and 0.10-0.64 mcg/g γ-HXTH.

Polychlorinated biphenyls and hexachlorobenzenes are especially toxic. Polychlorinated biphenyls are widely used in various industries. Recalls the solution of dixordiphenyl chloride for its physicochemical properties, as well as for its distribution in the environment. However, since polychlorinated biphenyls are less studied and the environment is included in different sources, it is currently impossible to determine their path to the biosphere.

It was found that the concentration of polychlorinated biphenyls and chlorine-organic pesticides in medicinal herbs is 69 times higher than their content in the soil. These data once again prove that the above toxic substances can be collected in plants used as medicinal plant materials. It should be noted that the amount of polychlorobiphenyls and chlorine-organic pesticides in medicinal plant materials depends on the supply of raw materials from the region.

The collection of pesticides in plant materials from different morphological groups is different. A collection of polychlorinated biphenyls from chlorine-organic pesticides is characteristic of underground organs (root, rhizome, etc.). The smallest amount of polychlorinated biphenyl is found in fruits, and organic chlorine pesticides are collected on the surface of plants. When vegetable raw materials are collected more than once in the same area, the amount of toxicants in the raw materials is small than in the previous crop. The concentration of chlorine-organic pesticides in medicinal plant raw materials is 5-10 times less than polychlorinated biphenyls.

Thus, it was found that the presence of heavy metals and pesticides in medicinal plant materials depends on a large number of internal and external factors. Internal factors are fairly stable and to some extent studied. However, external factors vary in each region and differ in their diversity, therefore an integrated approach is needed. This approach allows to determine the level of ecotoxicants in the composition of herbal medicines.

It is necessary to determine the norms of heavy metals and pesticides, which may be part of the raw materials to meet the pharmaceutical companies and pharmacy requirements for environmentally friendly medicinal herbs.

**RESOURCE MANAGEMENT OF MEDICINE PLANTS**

Medicinal plants occupy an important place in the world of plants, where people use it for various purposes. The sharp increase in the interest of medicinal plants in recent years has led to the fact that the use of wild herbal raw materials has become an urgent problem. Resource management of medicinal plants is one of the most important areas of scientific and practical activities of various specialists in all countries of the world, but in each country its implementation and direction are different. This diversity depends on the size of countries, the characteristics of the economy, the demographic situation, the abundance of herbal raw materials, supply possibilities, etc. factors. As a rule, biological, exploitative and annual quantities of wild grass, mapping of spatial zones, identification of new types of biologically active substances and the development of more effective herbal remedies based on them are one of the pressing problems facing pharmaceutical science.

Various research institutes and relevant departments of the AMU participated in the study of the raw materials of wild herbs in the Republic of Azerbaijan and the determination of their distribution areas. As a result of years of research, the raw materials of many plant species have been studied.

Plant resources usually refer to natural resources. Plant stocks include any plant materials needed by humans. There are 5 areas for direct or indirect use of plants: 1. Food for people and animal feed; 2. Source of raw materials for industrial and economic activities of people; 3. For decorative gardening; 4. To protect and improve the environment; 5. Raw materials as medicine and for the manufacture of medicines. Rationalization of medicinal plants refers only to the raw materials used for the purposes indicated in clause 5. The resource management of medicinal plants is surrounded by almost all herbal herbal remedies that can be used in medical practice.

The resource management of medicinal plants is a separate section of botany and formacnosia that serves to study the raw material resources of wild medicinal plants, identify their spreads, organize, effectively use and protect medicinal plants. As we can see, the resource management of medicinal plants is a complex science, and is closely associated with botany (especially geobotany), pharmacognosy, phytochemistry, and so on. closely related to science. At the same time, it forms the free part of plant wealth, which explores plants and their products used by people for various purposes.

The main essence of resource management of medicinal plants is the study and rational use of wild herbs. The importance of wealth is measured directly by the fact that more than 50% of the phytopharmaceuticals used in recent years were derived from wild herbs. Wild herbs play a very important role in the supply of raw materials directly to the pharmaceutical industry. On the other hand, the pharmacy chain and the pharmaceutical industry suffer from a lack of herbal medicinal herbs. This is due to the fact that most of the territories of the Republic of Azerbaijan are not involved in the study of wealth, the lack of adequate supply of wild plant materials is very painful and at the same time expensive work.

The main responsibilities of resource management of medicinal plants include:

1. Determining the amount of raw stock of wild herbs for each region, as well as determining areas of mass importance of common species, as well as the identification of reduced species, as well as less common species as a result of purchases;

2. Definition of plans of plant raw materials and factory items that can be purchased annually in certain regions;

3. To organize the operation of supply zones on a rotational basis in order to ensure the efficient distribution of harvested areas with the expectation of a natural self-procurement process in areas of mass distribution;

4. Chemical taxation of biologically active substances contained in medicinal plants, ultimately identifying higher populations;

5. Determination of the degree of mass spatial distribution after the delivery of raw materials, the influence of anthropogenic and geographical factors on the quality of plant raw materials, as well as the area of environmentally friendly distribution of wild medicinal plants;

6. Development of recommendations for the rational use and protection of rare species of wild herbs.

In the resource management of medicinal plants, not only wild herbs are explored, but also other effective crops - food, feed, technology, and so on. In the CIS countries, more than 160 medicinal herbs are used, some of which are already cultivated. The definition of raw materials for cultivated plant species is not considered a very important issue. These herbs include medicinal valerian, great plantain, motherwort herb, common hops, and so on. There are several types of plants, their reserves of natural raw materials are hundreds of times higher than the required amount. For example, dandelion, stinging nettle and so on. The study of the raw materials of these plants also does not matter for wealth. Issues such as identification of areas for massive plant types, the definition of environmentally friendly areas of mass distribution are considered more relevant. Other cultures can be divided into 3 groups:

1. Wild medicinal herbs with extremely scarce raw materials (herbal alcea, common barberry, dwarf everlast, tormentil, sweet flags, etc.);

2. Types of plants with a small amount of raw materials and the lack of sufficient information about the stock (various hawthorn, elder black, etc.). This group also includes plant species that require a lot of supply and processing of raw materials (for example, birch shoots, raspberry fruits, etc.);

3. Species of plants that are in the "Red Book" or species that are endangered in different regions or fall into the list of rare plants..

Also included are plant species that are exported in resource management as well as plant species that are clinically researched and considered promising.

During the research, resource management as a basis for taking not only stocks of plant materials, but also the ability to supply, cost-effective distribution of mass spatial zones (population density, proximity to the transport network, etc.). The territory of the Republic of Azerbaijan is geographically different. Therefore, resource studies in individual regions should be implemented with consideration of certain features. For example, in the Guba and Lankaran mountain range, different types of transport should be used, given that the local conditions are mountainous. The annual stock of textile products in industrialized regions (Baku, Ganja, Sumgayit, Mingachevir, etc.) should be taken into account, and an excessive supply of raw materials should not be allowed.

The study of the raw material state of wild medicinal plants and their effective use are associated with three stages: preparation, escalation and cameral.

At the preparatory stage, the objectives of the study are determined. These duties are often estimated by the stocks of raw materials and the number of annual stocks. In addition, expeditionary studies are planned for the date of expiration and duration. Data on the ecological-senotic characteristics of the study area are collected until field work is completed. In particular, in what forests, meadows, wetlands, or groups of plants are the species or species studied, on which fertile soils are plants, etc. For this purpose is the source used. Herbarium materials are also used in the Herbarium Foundation of the Institute of Botany of the National Academy of Sciences of the Republic of Azerbaijan. Along with this, local departments of the Ministry of Natural Resources and Ecology should receive information on plant species protected in the area prior to the procurement process. Organizations engaged in the supply of raw materials should receive actual stocks of raw materials over the past 5 years.

At this stage, appropriate cartographic materials should be prepared (topographic maps of scale 1: 600,000, 1: 300,000 or 1: 100,000). For beginners, geobotanical maps or plans are also needed, which also contain information on the location of forest, marsh, grass, and other groups of plants. If the type of plant being studied is typical of a forest area, information about trees in the forest and places to be cut will be obtained from forest areas. This information is additionally collected for woody plants. For tame and herbaceous plants this is given shortly. Land use maps are used on flat land. Maps can be used as auxiliary tools, soil maintenance and inappropriate environmental media. All types of maps are used to determine the directions of research and the degree of distribution of masses of different types.

Thus, common problems are solved at the preparation stage. Information is collected on the distribution of the studied plant species, the ecological status, the state of harvesting, and a detailed plan for field research has been drawn up. This stage is considered key to the study of wealth, that is, it depends on the successful completion of the expedition stage and the exact outcome of the final results.

The expedition stage is based on the organization and implementation of the expedition in accordance with a previously prepared plan. The main purpose of this stage is to determine the zones of mass distribution of the actual supply of medicinal plant raw materials in the area under study, to determine the stocks of raw materials and specific indicators necessary to determine the quantity of raw materials that can be supplied annually.

The cameral stage involves the calculation of stocks of raw materials and the determination of the number of annual stocks. A plan for the supply of raw materials for the region or region has been prepared, and feedback has been received on the rational use and protection of rare species. At this stage, the mapping of plant resources is also carried out.

**Basic concepts and terms used in the resource management of medicinal plants.**

Biological reserve - the value of raw phytomass, formed by all specimens of this type at any sites - both suitable and not suitable for harvesting.

Possible annual workpiece - the amount of raw materials that can be harvested annually in a given territory without damage to the raw material base. It is defined as the quotient of dividing the value of the operating stock of raw materials in all parts of the workpiece by its turnover.

Thicket is the aggregate of individuals of a single species growing in the plant community at a site suitable for carrying out commercial harvesting.

The key plot is the area that serves as a benchmark for this type of land in terms of raw materials of the medicinal plant.

Model exemplar is the average copy of the mass or escape, used as a counting unit to determine the density of the stock of raw materials specific thickets or key area.

Billet turnover is a period that includes the year of preparation and the number of years needed to restore stocks of raw materials.

A population is a collection of individuals of a species that freely interbreed with each other, grow in a given phytocenosis and occupy a certain territory.

Potentially productive land is a set of thickets or field arrays of the same species in a homogeneous territory, where the organization and conduct of preparations of medicinal plant materials are possible.

Projective cover is the percentage of the area occupied by the projection of the above-ground organs of the studied species.

Commercial array is several closely located thickets (populations) of the studied species, suitable for the organization of workpieces.

Commodity copies - adults, intact copies to be collected. They do not include individuals left for seed or vegetative renewal.

The transect is a rectangular pad 1-2 m wide, laid along the route, on which the number and density of the stock of plant raw materials are calculated.

The stock density of raw materials (yield) is the average value of the raw part of the plant, obtained per unit area of thickets. It is expressed in units of mass per unit area (g / m2, kg / ha, t / ha).

Accounting sites are areas of size from 0.25 to 100 m2, laid down within the thickets or commercial array to count the number, projective cover or stock density of the raw material of the studied plant.

Cenopopulation is a population or its part, limited to one phytocenosis.

The operational stock is the value of the raw phytomass originating from commodity specimens in the plots.

**METHODS FOR DETERMINING RAW MATERIAL RESOURCES OF MEDICINAL PLANTS**

The raw material resources of medicinal plants can be determined in two ways: 1. Determination of stocks of raw materials in certain areas where the plant is distributed; 2. Determine the stocks of raw materials in some specific areas and determine the stocks of raw materials in the region or region based on the results obtained.

The implement of these methods depends on the biological, geographical and ecological features of the plant, the purpose of the work, the availability of cartographic material in the forest and soil structure. If the supply of medicinal plant materials is carried out in a particular region or province, and the raw materials are collected by the brigade, the stock of raw materials should be determined according to method 1. It is also desirable to determine natural resources for many years (eg annual crops), as well as raw materials of rare plants. As a rule, use the 2nd method to determine the stocks of raw materials in many large administrative-geographical areas (for example, in provinces, autonomous republics). It is more beneficial to determine the raw stock of plants that have a certain type of vegetation that prevails on pastures, and changes the productivity and richness of plants with varying degrees of variability over many years.

In specific areas where the plant has spread, the method of determining the stocks of raw materials is as varied as determining the area where the plant is spreading, and determining the stocks of raw materials. Mass distribution areas are based on topographic maps, personal observations, forest workers and support of the local population, as well as materials from the Herbarium Foundation of the Botanical Institute of the National Academy of Sciences of Azerbaijan.

*Determination of raw materials stocks of medicinal plants in specific areas.*

Thus, the definition of raw materials gives very good results. However, the results often disappear. Since the areas exposed to plants are exposed to human factors (germination area, use for construction and inadequate supplies). Therefore, the determination of stocks of raw materials at the plant should be carried out periodically in the same area, that is, repeatedly within several years.

Mass spatial areas are determined by topographic maps taking into account the conditions in which the plant spreads. For example, ordinary thyme is likely to grow on the slopes of mountains, forests and meadows.

As is known, the size of the spatial area of the masses and its productivity (density of raw material resources) determine the raw materials of the plant.

*Determining the size of mass spatial distribution.*

Determining the size of the mass spatial distribution is largely dependent on the distribution of species of wild plants. If areas of distribution are too dense or dense, it is easy to establish boundaries, and its shape is similar to any geometric shape (triangle, square, square, circle, etc.). The parameters are then determined to determine the size of the field. If the studied plant species are distributed in the form of separate small areas (forest, meadow, etc.) that make up less than 50% of the total area, the entire area is calculated in the manner indicated above, then the area size of the plant species studied is calculated with% To determine the size of the fields are measured in transverse and longitudinal steps. Then, the step sizes are measured at separate small spatial areas, the size of one mass spatial area is concentrated and determined. In this case, it is assumed that in the general region only a few percent distribution of individual distribution areas in the general region.

*Determination of performance.*

There are 3 methods for determining the performance of medicinal plant raw materials.

1. Reporting platform method. Reporting sites represent the average area (from 0.25 m2 to 100 m2) defined in the mass distribution area to determine the weight, quantity, or projective cover of a plant. This method of determining the raw stock of shrub vegetation (lily of the valley, cowberry, strawflower, etc.), Used as surface herbs such as non-sharp herbs and raw materials. The method is very simple. However, this requires a lot of effort, and the results obtained in this area cannot be applied to other areas of the plant. When it comes to this method, firstly, several reporting areas stand out in the area of enterprise distribution. Reporting zones should be distributed in different parts of the area where the plant is distributed.

It is much easier to set the productivity of the raw material in the reporting platforms. First, depending on the number of adult plants, the series of playgrounds are identified. Typical teas, mayonnaise, bitter wormwood, ordinary sorghum, sandblast, and so on. The size of the registration area for plants is 1 m2. Availability of 10-100 m2 yards for 10 m2, large bushes and not too big trees (ordinary fever, swallowing, etc.) to determine productivity of shrubs (ordinary raspberries, different types of hips, common horses, etc.) advised. Reporting platforms are considered optimal, with at least 5 experimental adult plants being studied. Formats can be squares, square, and rectangles according to their shape. Moving within a mass spreading area, every 3 depending on the plant being studied; 5; 10; They allocate a pitch of 20 steps. If the species in question is dominant in the vegetation cover and its patterns are roughly equal to that of the area, it is sufficient to allocate 15 to 25 report areas. If the area surveyed is not abundant, but also unevenly distributed, the number of reporting platforms should not be less than 50.

The number of platforms should be so high that the results obtained in statistical work do not exceed ± 15% of the average mathematical calculation. The size of reporting sites for grasses can range from 1 to 10 m2 for small and medium sized shrubs, and from 10 to 100 m2 for small grasses and small trees. Then all the raw materials of the species studied at the designated pits are collected according to the instructions for the collection of the plant raw material and immediately dispensed with 5% accuracy. Only young or damaged specimens are collected. It should be collected in dry air. First of all, 15 reporting platforms are identified. The results obtained on each pitch are highlighted separately. The statistical report of the total results obtained is made and then there is a reserve that can be exploited. At this time, if the difference between the minimum and maximum weights is 5-7 times, there is no need for additional pitch. If there are more differences, additional pitch should be installed and reported. Then the statistical report of the general results is taken and the average numerical value is determined by which the possible amount of plant raw materials is determined. The mathematical error of average numerical value should not exceed 15%. The total amount of raw material found is the result of the results obtained by the size of the whole area.

2. Model samples method. An example of a model is the average statistical raw material sample for the weight of the medicinal product determined for the specific mass distribution domain. This method is used to determine the raw material of trees, large shrubs, sparse grasses and all plants underground bodies. In the above-mentioned variants, determination of productivity in reporting platforms requires a lot of effort, and areas of the yards are excessively large. To find productivity in this method, three indicators - the size of the total distribution area, the number of plant specimens or the number of beans, and a plant sample or intensive middle weight should be determined. When determining the exact patterns of distribution of individual plant specimens, or the difficulty of supplying raw materials from a plant, the reserve of animals is determined. The number of model samples is carried out in a public broadcasting area or in reporting areas designated in a small area. The size of the reporting platforms can range from 0.25 to 10 m2, depending on the density of the mass spatial areas. Determination of plant specimens and their weights is up to 10% precision. If the number of plants in the area of 1 m2 is not less than 1, the pitch (transect) in the direction of the study is determined and reported. Reporting yards are defined in 20, 50 or 100 steps. Results from the 25 to 40 footsteps are more accurate. To determine the weight of the plant raw material, sample samples or pods are collected in the registration yards or transects. At this time, all plant specimens in the area should be collected. A more systematic approach is used to obtain a more objective outcome, in which case every 2, 3, 4 or 5 plant sample is collected. The number of sample samples depends on the plant variation. Thus, in the determination of the weight of underground bodies or flower baskets, 40-60 patterns are provided. Up to 100 and more patterns should be collected for other vegetative organs of the plant. If the plant patterns produce a strong variation, they need to be grouped together. Mas. 1-3 sprouts, leaves, vegetative and generative organs. The number of plants is separately listed for each group of raw materials. For each sample model, the weight of the plant raw material is determined and the average numerical value is found. At the same time, all patterns are drawn together and subsequently their average weight is inaccessible. The average number of plant specimens is found by tapping on the average weight of the samples to find productivity.

3. Projective cover method. The projection implies a certain area covered with the surface of the plant. The fertility of the plants with the inert or inadequate hull (thyme, lilac, crocodile, etc.) is determined by the method of covering. Meanwhile, 2 quantities are identified - the average projective cover of the plant species within the boundaries of the mass spreading area and 1% of the vegetable raw material, ie the "price" of the cover of 1% of the projecting cover. The projective implicit frame-frame or vision is designated. Square frame is a frame with 1 m2 area, divided by 100 wires with wire or rope, each with 1 dm2. Each square is 1% of the total area. The framework is put on the investigated plant within the report area and determines how many squares cover the surface area of ​​the whole or half of the plant. The simplest method is the designation of the projective cover. For this purpose, the report area is overlooked and the percentage of areas closest to each other will be determined. This method is relatively inaccurate, and only experienced researchers are allowed to use it.

To find the “cost” of 1% of the projective cover, vegetable raw materials are collected and drawn out by 1 dm2 per reporting area. Since the “price” of 1% of the projective cover differs in different groups of plants and in the environment, this indicator should be calculated separately for each zone of mass distribution.

Productivity is determined by the percentage of the projective coverage equal to the multiplication of 1% of the design coverage by the “price”. Other indicators (statistical error, operational capacity, etc.) are calculated as in the model example of the method.

As a result of determining the raw stock of a wild herbal plant in a specific area, it is possible to obtain accurate indicators for the mass distribution area. However, the results obtained are quickly overturned, and the area under study may change as a result of the human factor (planting, construction, etc.). Therefore, in 10-15 years in the study area, it is necessary to conduct resource studies.

*Implement of stock of medicinal plant materials in certain areas.*

Determining the stock of medicinal plants in specific areas and determining the stock in the entire area surveyed on the basis of the results obtained can only be applied to medicinal herbs belonging to any type of landscape and herbal plant group.

To apply this method, 3 conditions are necessary: ​​1. The type of plant to be studied must be adapted to any element of the relief, to a specific group of plants or to the soil. In this process, there is no need to refer to the plant for a specific species. Thus, the number of plants may be small in the study area (forest, meadow, etc.). At this time, additional data are needed (degree of illumination, tree density, humidity, etc.), and ultimately, the location of specific plant species can be determined; 2. Have large-scale diagrams or planes falling from relief elements and the type of plant being studied; 3. Know the vegetation cover of the study area.

It is possible to determine the stocks of plants such as sweet flag, bearberry, Chinese angelica-tree, thorny ginseng, cowberry, and so on using stocks in special areas. The number of spheres of particular importance should be sufficient to learn more about the location and performance of the mass spatial zones in them.

The dimensions of the areas of special importance may vary. The size of the fields is growing, as the uniformity of the plant cover becomes smaller. Typically, the region of particular importance can vary from 1 km2 to several km2. At this time, special areas should cover at least 10% of the total potential area.

The selection of specific areas depends on the specific plant species. For example, these areas for cmin are selected in young pine forests with sandy soil, for the usual bearberry pine forest and in the same type of other forests felled, for wild rosemary in the peaty-spruce forests. You can not attach special importance in areas of mass distribution. In this case, the numbers are exaggerated. Therefore, areas of particular importance should be defined as strictly systematic, as reporting platforms (maps of forest plans, or every third or fifth of the forest in accordance with local conditions).

If the area of special significance is relative to the vegetation cover, and plant samples are slightly or strongly distributed (for example, a hill in which there is an ordinary barberry), there is no need to determine the percentage of the area occupied by the mass distribution area. In certain areas there are several steps (transect), and the number of samples (projective cover) and performance are determined at a height. Subsequently, the average performance is determined by specifying the areas in which it operates.

If the plant is not evenly distributed in the study area, first determine the percentage of the area in which the plant is distributed in the area of special importance. For this purpose, the width of the spatial spaces is 1 m wide by 1 m along steps of special significance. The size of the area occupied by the mass distribution area is determined as a percentage. Then the performance is determined by the usual method.

In any case, the next step will be processing the results. In the first case, the average performance in each of the key areas is determined. Then special areas are grouped into high, medium and low performance. Medium and moderate productive groups have an average price. If the species is distributed unevenly, the average percentage of spatial spaces will be determined in all areas of particular importance, then the average performance will be determined for all spatial spaces in all specific areas.

To find the potential performance of the study area, calculate the palette (a tool for calculating the area in the plan and maps) or weight based on a map map. The pallet is a transparent plate and is divided into degrees 1 cm2. It must be placed on the contour map of the designated area. Then complete or partial contours are considered dams. The contour area is determined by removing the map mask. The weight method is considered more accurate. To this end, a copy of the contour is removed, the damaged part is cut and weighed on the analytical weight. In order to convert weight indicators into field indicators, a square is cut off and a weight is set (for example, an area of ​​1 dm2). Depending on the scale of the map, the area of ​​the square and its weight are compared with the weight of the contour and the size of the field is determined.

To determine the potential use of the facility in the study area, the area of ​​the supply area is increased to the average productivity in the area of ​​particular importance. It should be noted that the figures obtained are considered the only correct type of vegetation in this area. The definition of the reserve using special value gives less accurate, but complete and stable results. Thus, it is desirable to carry out more regional and provincial reserves. This method is less knowledgeable for procurement organizations.

*Determining the quantity that can be supplied.*

Determining the amount of exploitation of plant materials, provides an opportunity as well as how to use these plants for one time in a specific area of ​​mass distribution. Numerous studies show that every year only fruits and seeds of plants that grow vegetatively (for example, hawthorn, viburnum, etc.) can be supplied in the same distribution area. In all other cases, you need to calculate the number of annual deliveries. First of all, it is necessary to know that specific types of plants completely restore all parameters in their original form in the field of mass distribution. In general, for most plant types, an approximate feed time is determined. It is advisable to make delivery of flowers and flowerpots of plants, such as raw materials, as well as annual herbs every 2 years, perennial herbs, half-shrubs every 4-6 years, and the offer of all plants underground for 15-20 years.

The amount that can be used to search for annual quantities of plant materials should be divided by the total amount of time spent on the supply of the mass distribution zone.

*Compiling of the results.*

Upon completion of all work related to the determination of stock of plant materials, a final report is compiled. It refers to:

- the purpose of the work performed, the name of the studied areas and the name of the medicinal herbs studied;

- a brief description of the field of study (transport network, agriculture, forest, etc.);

 - method of work performed;

All results obtained should be separately indicated in the final table for each plant species.

It should be noted that in addition to these two methods for determining the stock of plant raw materials of the wild in recent years, other methods have been used. Thus, vegetation in mountainous areas is more mosaic, therefore, certain changes in the definition of raw materials are assumed. Methods have also been developed that require special skills based on aerial photography, photography and researchers.

*Comparison of resource specification raw wild plant.*

Due to the fact that the distribution of the resources of the raw plant is carried out through the map, it is possible to compare the plant resources on the map. At this time, each type of card has its own area of ​​use. Large-scale charts (1: 25,000, 1: 50,000, 1: 100,000) are used to reflect specific, widely used spaces in a region or region that is not very large. Average maps (1: 600 000) can be applied in individual provinces or throughout the country. Small-scale charts (1: 1,000,000, 1: 2,500,000,000) are applied to larger objects, for example, throughout the country.

It is important to have schemes that reflect the results of phytosanitary rehabilitation of wild animals and contours of spatial spaces for the collection of circuit maps. On the maps of the field of wild medicinal plants are marked with numbers or colors. Each of the wild herbaceous plants may also be shown by some common markers. It is advisable to use charts on small-sized charts.