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Cultivation of Medicinal Plants in Ukraine. Problems and Perspectives

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Current state of medicinal plants cultivation is estimated and main factors affecting medicinal plants cultivation development in the world and Ukraine are identified. Countries and regions specialization for harvesting and cultivation of medicinal plants, production of therapeutic and prophylactic medications of plant origin, including medicinal plants are shown. Basic restraining and stimulating factors and prospects in Ukraine are clarified.

Key Words: medicinal plants, herbal raw medicinal plant, cultivation profitability

Introduction

Flora is a great natural source and treasury of valuable biologically active compounds, which are used for medicinal and prophylactic purposes. Since ancient times people used natural resources and especially plants for nutrition and disease treatment. Folk wisdom and observation served as a basis of plants application in medicine. In its turn, technological progress has created favorable conditions for knowledge exchange and contributed to amplification of plant-based drugs arsenal due to involving of flora treasures.

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Nowadays, like also in furthering recent years, the world marked trend of increasing demand for natural products, cosmetics, perfumes and medical products made of natural raw materials, including medicinal and aromatic plants. Such products are closer to human nature, safer and healthy.

According to experts of World Food Organization of the UN, half a century ago medicinal plants found their use mostly in countries where they were almost the only available remedy of various diseases treatment. At modern stage of social development, using of natural means, especially use of medicinal plants and products based on them is typical for all developed countries. Sales of medicinal plants was more than 1 bln. $ at the end of the last century. Current global market of medicinal plants is estimated at 600 thousand tons per year. More than 40% of worls pharmaceuticals are made of either medicinal plants or their components.

According to the World Health Organization (WHO), about 80% of the world population uses medicinal plants and plants-based medications for treatment and prevention of diseases. According to WHO experts the share of phytoceuticals will increase to 60% during next 10 years due to the fact that about 15% of the world population suffers from allergies, including allergy to synthetic drugs.

Analysis of Studies and Publications

The study of the current state of medicinal plant cultivation, harvesting and collecting of medicinal plants raw materials, prospects of the industry in Ukraine and related issues are shown in the results of scientific research studies of such scientists as Minarchenko V.M., Gorban A.T., Kryvunenko V.P., Bakhmat M.I., Kvasha O.V., Homina V.J., Komarnitskyy O.B., Hubaniov A.G., Hlushchenko L.A., Semak B.B., Barna M.Y., Yakubenko B.Y. and others. At the current market and economic conditions, study of the main influential factors and global economic market processes that are relevant to the target area is a prerequisite for successful develop-

ment of any industry. The same trend is observed for medicinal plant cultivation.

The purpose of research – identification of modern trends of medicinal plant cultivation in Ukraine, identification of major constraints and stimulating factors and prospects of industry development.

Main Part

Numerous studies both in the world and in Ukraine indicate a significant diversity of plants used in scientific and traditional medicine. The total number of medicinal species used by national medicines constantly changes. Only about 21 thousand species are used for drugs producing when there are more than 400,000 species of plants containing biologically active substances in quantities effective for using in medical purpose. The majority of phytodiversity is used by Chinese, Tibetan, Indian and Arabic medicine. According to the opinion of international experts, the effective use of biodiversity can reach 50 or even 70 thousand species and this increase will significantly improve the living conditions of humanity. The number of sources of biologically active compounds may increase by 2-3 times, including about 15 thousand plant species that include species that are endangered and in need of urgent protection measures (IUCN-IUCN).

Natural raw materials as “environmentally friendly” cleaner and safer means have high demand oh the global market. Although global environmental problems and reduce of the natural resources of medicinal plants restrain providing of demand for medicinal plants increase.

Raw materials procurement of wild medicinal plants is currently carried out mainly in three world regions: Eastern Europe (mainly Russia), Asia and South America. More than 100 manufacturers of medicinal raw materials represent the Russian market. They mostly have only regional status, because they carry out realization of products within nearest customers, 20% of them work at the national

level, and very few work on the international level. Russia is a major exporter of medicinal raw wild species; Poland and Bulgaria have slightly lower exports to the markets of the European Union. Poland is a recognized leader in the cultivation of medicinal plants. Wild plants are dominants in the Bulgarian assortment of products; they are exported to 30 countries.

In Asia, the leading countries are China (6,000 species), India (5,000 species) and Vietnam (4,000 species). Raw herbs and phytopreparations are delivered to 80 countries, where they have the same demand.

In South America, particularly in Argentina, Peru and Brazil export of medicinal raw materials of natural origin makes an essential contribution to exports of these countries due extremely rich natural flora.

In Ukraine, more than 50% of drugs are made of plant materials. About 70% of drugs for the treatment of cardiovascular diseases and metabolic disorders are made of raw plant materials. Natural medicinal herbs for their production make about 60% of total plant raw material used for the production of therapeutic and prophylactic drugs. About 200 species of medicinal plants are collected and harvested in natural communities on the territory of Ukraine, approximately 50 of these species – in large amount.

However, stocks of wild medicinal plants and their distribution in vivo isn't unlimited. Urgent measures must be taken to their study, protection and sustainable use. The current situation in the world collecting of medicinal species natural raw materials shows rapid reduction of their stocks and distribution. Some species are endangered due to increase in procurement, collection and harvesting and due to barbaric methods of collecting. Industry of collecting in some regions has reached gigantic scopes and led to the loss of non-renewable and environmental violations. Nowadays, most of medicinal plants in the world are rare or endangered species. Resources of wild species are decreasing rapidly in Ukraine due to reduce of suit-

able for collecting of material areas because of the environmental problems associated with pollution. Therefore, according to some researchers, cultivation in areas of natural growth and introduction is a promising mean of providing ever-increasing demand for plant material.

Quality requirements of the pharmaceutical industry are another important stimulating factor for the development of medicinal plant cultivation both in the world and in Ukraine. The pharmaceutical industry in the EU works in accordance with the standards with high requirements for quality assurance of medicines in their design, manufacturing and control. The system of trade license issuing requires passing all examinations in pharmaceuticals competent authority to ensure their compliance with the current requirements of safety, quality and efficiency. GMP principles and detailed rules are applicable to all processes that require licensing.

Production of phytopreparations and medicines from plant materials is extremely resource-process. Material index of such drugs is hundreds and even thousands units, while the index of the material of synthetic drugs ranges from 20 to 150.

Material consumption of phytochemical production is high due to the necessity to process a large amount of plant material for extraction of relatively small amounts of biologically active compounds. The content of such substances in the majority of plant material ranges from 0.1 to 1.0-2.0%. Research of phytopreparations showed that material costs account for 60% of all costs in production of pharmaceuticals. In most productions these cost are the following: herbs – 54.5%, solvents and extractants – 41.0%, other raw material – 45%.

Consumption of plant material in phytochemical production depends mainly on two factors: technological production process and quality of plant material.

Quality of plant material, primarily means the levels of biologically active substances compared to standard. In most industries during planning of consumption

norms of raw materials, this factor is ignored. Lower limit of content of active substances in plant material in accordance with the standard requirements for these materials can be regulated of the in the best case.

Analysis of raw material provided to pharmaceutical enterprises of Ukraine in order to processing shows that even within the same sources of raw materials there are significant deviations of biologically active compound content. In particular, the content of essential oil in raw materials of wild thyme – *Thymus serpyllum* L. meets the requirements for the standard amount of essential oil (more than 0.3 %) of the State Pharmacopoeia of Ukraine (SPU) only for 3-5% of the raw materials. The rest is pretty impressive scope of standard deviations, oil content ranges from 0.1 to 0.6%. Raw materials with over or under-performance content of biologically active substances can reach 50-100%. The content amount of thymol and carvacrol in the essential oil, determining the quality of raw materials, has even more essential scale. The similar situation is with other plant-based productions.

Common problems associated with raw materials quality characteristics consists of phytochemical production problems and expanses for solvents due to their use in extraction of active ingredients. in the extraction process the weight ratio of solvent and plant material remains constant and does not depend on the percentage of the extracted substances. However, higher content of active substances in plant material requires less consuming of material in physical weight per unit of the final product, and therefore costs and solvents are reduced. Therefore, for any phyto production both high content of active ingredients and its content stability is an important indicator.

Under ideal conditions raw materials supply have to be realized from a source that is traceable and reproducible. In practice it can be mostly guaranteed by carring out for growing raw materials under the terms of environmentally sound cultivation technology.

The world market of medicinal plants grows rapidly and demonstrates high pace and significant economic increase. The European market is the largest among commercial markets of medicinal plants and medicines made from herbal ingredients. European countries import and produce a huge range of medicines. In France, Germany, Italy, Sweden, Switzerland, England and Ukraine herbs are traditionally used as a supplement to medical treatment. In the European Union（EU）programs regulating the production and use of raw materials of plant origin are formed and duly supported by national policy. State support to producers of medicinal raw materials in the EU is extremely important, considering that in Western Europe with a significant indicator of development of the territory and the rapid decline of natural reserves of raw materials, it is not the only way to meet the needs of their own raw material production.

Despite the fact that in the global market high demand on natural raw materials as “environmentally friendly”, increase of demand for raw materials and reduce of the natural resources of medicinal plants stimulate the development of medicinal plant cultivation as an independent branch of agricultural production.

Field of medicinal plant cultivation worldwide is profitable. The prospects of the industry is obvious, including the significant and growing demand for the products. The profitability of medicinal plants cultivation of most species significantly exceeds the corresponding figures for growing traditional crops and income from the collection of raw materials in nature conditions. According to the Food Agricultural Organisation of the UN in the small Hungary area aside for medicinal plants cultivation there are about 42 thousand hectares, where about 40 tones of medicinal and essential oils raw materials are grown per year. Income from the sales of this products is 35 million $ USA. The Chinese experience of ginseng growing shows that its cultivation is 50 times more profitable than wheat and profitability of cultivation of some species of tropical medicinal plants ranges from 100 to 500%. However,

the specifics of medicinal plants cultivation should be considered, because achieving of high profitability is usually long termed.

Medical plants cultivation is traditional agriculture industry for Ukraine. Its products include raw materials for the production of pharmaceuticals, food and cosmetic and perfume industry. Due to the transition of the national pharmaceutical production to the good manufacturing practice (GMP) rules, requirements to the cultivation practices and quality of medicinal plants dramatically increased according to international standards (GACP). An important step in quality control of cultivated medicinal plants is the State Pharmacopoeia of Ukraine the entry into action, it is harmonized with the European Pharmacopoeia with appropriate quality control.

An important element of the technological process of growing herbs is cultivar. It is important to ensure resource efficiency and profitability. Ukrainian cultivars of medicinal plants show high performance, complex resistance to adverse environmental conditions and are the basis for the low-cost environmentally friendly technologies. Cultivars of plants, both native flora and introduced species, are adapted to local soil and climatic conditions, ensure uniformity of raw material quality, which is important in its processing, and also in use of manpower and equipment.

Wild species and forms of medicinal plants of Ukraine are rich in genetic and breeding material for new cultivars, cultivated populations and shapes. Natural materials are widely used for selection sources for the future pedigree plant cultivars, and in crossings for hybrids and polihibrydiv. The value of the source material is adaptability to living conditions: resistance to low and high temperatures, salinity and soil compaction, damage by pests and diseases, stresses.

Nowadays selectors are challenged to create different by ripeness productive varieties that have marked the long-term preservation of quality characteristics. These cultivars will create raw materials conveyors and uniformly use the infrastructure sector. Acute issue of range of cultivated plants expanding due to the

rapid decline in procurement of raw materials of natural origin, improving the quality of bioactive compounds content and environmental safety products of medicinal plants cultivation.

The use of modern high-quality resources of medicinal and aromatic plants of Ukrainian selection, which is represented with 34 high performance cultivars combined with environmentally sound and energy efficient technologies provide high profitability of more than 200 species of medicinal plants in all soil-climatic zones of Ukraine. The profitability of traditional raw materials production such as chamomile and valerian significantly exceeds the profitability of grain crops - wheat and barley.

In particular, the production yield of chamomile *Matricaria recutita* L.is 4-6 hundredweight per hectare, the cost of growing makes 1.02 thousand $ per hectare, due to market prices prevailing in 2016, the profitability of primary production was 78%. For valerian yield of roots – *Valeriana officinalis* L. was 30 hundredweight per hectare and the cost of production – 6.2 thousand $ per hectare, profitability – 83%. The profitability of crops such as marshmallow *Althaea officinalis* L. – 85%, *Ononis arvensis* L. – 91%, *Daucus carota* L. – 90%, *Scuteiiaria baicalensis* Georgi – 124% and for *Bidens tripartita* L. – 138%. This profitability essentially exceeds the profitability of growing crops

Refinement - washing, drying, milling and packaging are important parts of the technological process for medicinal plants cultivation, these factors significantly affect profitability. Therefore, despite the high yield, the formation of production infrastructure requires investments and time. As a result new economics masters medicinal plants cultivation slowly because of commercial impact of production should be expected longer than for growing grain or vegetable crops.

One of the important problems of the industry development is low use of agricultural technics in Ukraine. In terms of 1 hectare, an average use of technics is in 4,

and for some cultures in 6 times less than in EU countries. The problem is lack of the specialized machinery and equipment for handling raw materials. Portable instruments for determining the quality of products, special packaging materials and packaging are required for the development. The organization of wholesale markets and connections between producers and foreign customers are important for the realization of medicinal plants is.

Conclusions

Medical plants cultivation is one of the most promising crop industries, both in the world and in Ukraine. Demand for medicinal plants raw materials and production has a positive upward trend, diversification and standardization of its quality.

The increase of needs to medicinal plants and its uncontrolled use reduce and drain natural resources. There is a necessity to expand the cultivation of medicinal plants in different countries in order to meet the demand for raw materials. It is established that Ukraine has favorable conditions for growing about 200 species of medicinal plants.

Ukraine has a long tradition and the necessary conditions for the development of medicinal plant cultivation - favorable soil and climatic conditions, cultivar resources, advanced modern technology and experience.

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