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Cultivation of medicinal plants in rural residential areas: advantages and problems

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The purpose. To determine factors influencing quality of cultivated medicinal plant raw material at small-scale production. **Methods.** Field, laboratory, questioning, statistical, analytical. Sampling of plants was carried out according to the approved state standards (DFU, EF), procedures and recommendations of monitoring rural residential areas. **Results.** Cultivation of medicinal plant raw material in private households of rural residential areas of region of probes is founded on historical basis. Series of factors promoting cultivation of medicinal crops is specified, as well as the basic risks and problems originating at cultivation of medicinal plant raw material are determined. It is fixed that in private households preference is given to growing 12 kinds of plants. Dynamics of changes of assortment and areas borrowed by medicinal crops is specified. The urgency of rational disposition of medicinal crops in small equipments on the area is illuminated. **Conclusions.** Series of positive and negative factors influencing cultivation of medicinal plant in conditions of small-scale production in private households is determined. The advantages are: self-busy condition and self-security of population for deriving profit, high purchase price of raw material, opportunity of prolonged storage of the finished product, adjusted infrastructure of its marketing. Risks influencing quality of medicinal plant raw material: instability of demand, absence of specialized means of protection, conforming means of mechanization and inventory, price policy on quality seeds. At cultivation of medicinal crops in private households more attention is given to raw material got from above-ground part of a plant (grass).

Key words: *residential territories, cultivated medicinal plants, quality raw material, factors, private plots.*

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The residential areas are exactly the area with which every inhabitant of a village or settlement contacts directly. Therefore, in order to detect any negative changes related with the small-scale production and the implementation of necessary measures to stabilize environmental safety, the monitoring of agricultural land of the residential areas in particular must be monitored [1]. The aspects of formation the market regulation, organizational and economic conditions of management in the agrarian sector are studied by scientists [2-4].

The private peasant farms represent the secondary, that is, additional to the main work of employment of citizens, based on their property. Recently, when the rural areas are characterized by the unemployment, for many rural residents, the peasant household is perhaps the only significant source of self-employment, self-sufficiency and profit.

One of the ways of the efficient and rational use of the agricultural land in residential areas is to grow not only vegetable and grain products, but also the transition to their integrated use, involving the perennial plants, in particular the medicinal crops, in crop rotation. This issue is also associated with the search of solutions of the issues relating with the balanced use of the agricultural land and the optimal balance of the land in the region, which is the subject of many studies [5-7].

Every year, the need of the pharmaceutical companies in the plant raw materials increases by 20-25% as a result of sales growth and the creation of the new drugs [8]. By turns the problem of many pharmaceutical enterprises operating in the field of the production of herbal medicinal products. There is

the guarantee of the quality of raw materials produced in the conditions of the farmers` and private farms. Therefore, each stage of production must be analyzed in order to identify potential risks [9].

New methods of cultivation, technologies of the processing of agricultural (medicinal) raw materials should not violate their medicinal properties, and the final product - the medicinal plant material must comply to the general and environmental parameters, observance of which is obligatory [10].

Environmental factors affecting the production of medicinal plant raw materials include the productive and territorial properties of the land and natural conditions [11]. The natural and climatic conditions of the Poltava region: plain territory, temperate continental climate with the sufficient amount of heat and moisture, bleak soils are quite favourable for the plant growing.

Historical background and traditions have also contributed to the fact that nowadays a considerable part of the structure of the private farms of the Poltava region and Lubny region, in particular, is occupied by medicinal plants. The cultivation of the medicinal plant material, is the source of stable families' income, in the current conditions of self-employment of the rural population and the traditions of medicinal plant production provide the transfer of skills from generation to generation.

The purpose of the research is to establish the factors that influence the quality of the cultivated medicinal plant raw material in the small-scale production.

Materials and methods of research. The research was conducted in 2016-2018 on the territories of private or leased land plots of the Berezotitska, Litvyakivska and Vovchytska village councils of Lubny district of Poltava region. The work was carried out through the field and laboratory research. The selection of plant the samples was carried out in accordance with the approved state standards (DFU, EF, TU) and methods and recommendations of the monitoring laboratory of the rural areas of the Institute of Agroecology and Nature Management of NAAS [1, 12-15].

Samples of plant (medicinal) products were taken directly from the private (or leased) land plots from typical plants evenly from the entire plot in two diagonal directions. In the selection of plant samples were excluded diseased plants, with signs of severe damage in the early periods of growth and development, or placed next to those that fell out. All plant specimens were labeled, the place and date of sampling were indicated.

Collection and generalization of the information about the soil preparation, definition of a range of crops, care of crops, application of mineral and organic fertilizers, application of pest and disease protection measures were carried out by questioning and questioning the owners of the representative farms.

Research results. Among the 26 village councils of the Lubny District, 3 village councils - Lytviakivska, Vovchytska and Berezotitska have been allocated on the territory of which farms and peasant farms constantly grow medicinal crops for the purpose of further obtaining the pharmaceutical raw materials. For the collection and generalization of the information about the private farms, 20 representative enterprises were selected, where medicinal plants are grown for 5 years or more.

A number of infrastructure factors contribute to the cultivation of the medicinal plant raw materials in the region, one of them is the proper transport connection, which provides with the smooth movement of grown products to the procurement centers and pharmaceutical enterprises.

Another important factor influencing the expansion of the area occupied by medicinal crops within the rural residential areas is the employment of the able-bodied population. Various self-employment of the population is observed on the territory of the village councils - livestock breeding: pig breeding and dairy cattle breeding; Crop production: growing of the vegetable products, cereals and medicinal crops.

A questionnaire has been developed to collect information about the cultivation of medicinal plants in the rural areas, the main issues of which are: the presence of workers in the economy, technical facilities, land plots, the list of the grown medicinal plants, application of mineral and organic fertilizers on the land plots, watering, remedies, etc.

The questionnaire found that the average age of the owners is 25-35 and 55-65 years old. The average number of families is 2-4 people. The owners are mainly unemployed or pensioners. In the

overwhelming majority the cultivation of the medicinal raw materials are carried out on private plots (about 60%), and leased land.

According to the survey of the owners, among the motives that led to the cultivation of the medicinal plant material the most often is indicated: a high price compared with vegetable and berry products, the possibility of the prolonged storage of the finished products and the established infrastructure of its sales. Among the risks the most often is mentioned the instability of demand, high requirements for the quality of raw materials, the lack of specialized means of protection, available at the price of means of mechanization, inventory, quality seed material.

Medicinal plants are the plants of various systematic units, which, by biological and economic features, are grouped into groups - annual and perennial, medicinal and essential oils, spice flavors and ornamental plants, and so on. Individual groups of the medicinal plants respond differently to the environment, in particular, the conditions of cultivation. Among them there are cold-resistant, which are well wintering in the open ground, beginning with growth and development already at the temperature of 2-6^{0}C, as well as heat-resisting, which require high temperature, for which optimal conditions come in the temperature regime of 25-28^{0}C. With the general non-compliance to the growing conditions, all herbs are sensitive to soil fertility and moisture. To select crops, their normal growth and development, it is necessary to create a complex of soil and agrotechnical conditions, to maintain species or varietal agrotechnics in accordance with the soil-climatic conditions proposed to landowners in the general recommendations and specific requirements of each medicinal crop [16].

The obtained results of the surveys of the owners show that under the crops of medicinal crops there were relatively clean from the weed areas with even relief, structured soils of light and medium mechanical composition. It is established that in the private farms with no more than one land plot or a sufficiently large area of land, crop rotation is used. The best precursors are selected that have a positive effect on the further cultivation of the medicinal plants, among which are: clean and busy fallow, winter crops, maize, perennial, leguminous cultures. The owners directly themselves decide the issue of the rational placement of the medicinal crops in their farms. With experience in processing land, crop rotation is used by masters to support a satisfactory structural state of the soil, regulate the water balance and regulate the phytosanitary state of the soil. The medicinal plants are also grown and at intervals of 4-5 cultures.

When cultivating medicinal plants, where the vast majority are small-fruited, the soil cultivation was carried out by carefully leveling the surface. Under the perennial crops, the soil is plowed on the bark as deep as possible - 25-27 cm. For the creation of the most favorable conditions for germination of seeds and the appearance of friendly germination in the spring after the cultivation some of the landowners used pre-sowing dying, which ensured the friendliness of the emergence of the shoots. Thus, the main tilling of the soil in spring is plowing, which is practiced in almost all farms by hired equipment.

In the cultivation of medicinal plants, in most cases, organic fertilizers were obtained, which were obtained mainly in their own farms (compost, manure, humus, in the amount of 30-35 c/ha), and mineral fertilizers (ammonium nitrate, nitroamofosca, nitroamofos, etc.).

Caring for crops (inter-row cultivation of soil), the owners carry out with their own inventory. Also, for some medicinal crops, the destruction of soil crust, thinning, hanging, cooking, etc., is carried out.

It has been established that different means of protection are used at farms, in particular, measures that ensure the preservation and increase of the crop yields, and the protection from pest and disease is important. In the predominant farms, biopreparations of diverse action are widely used: insecticides, fungicides and pesticides for the protection of plants against pests and diseases. About 80% of the farms where altea drugs are grown, the new «Enzio» systemic contact insecticide, which contains two active substances, has a wide range of effects against pests at different stages of their development and side effects in the adult stages of ticks.

The collection of raw materials and their refinement is carried out mainly by the own inventory, and to the process of drying the raw materials the relatives are involved. For the drying of the raw materials attics, awnings, racks, are used, but often the collected raw materials are dried in the unsuitable

conditions: in sheds, hinges and also under the sky. After drying, the raw materials are packaged and sold to the purchasers - the majority by pre-order.

Due to the high price policy of the original seed material, the vast majority of farms in the cultivation of medicinal plant material use seeds and planting material of their own reproduction, which in turn does not always positively reflect both the quality of the raw materials and its assortment.

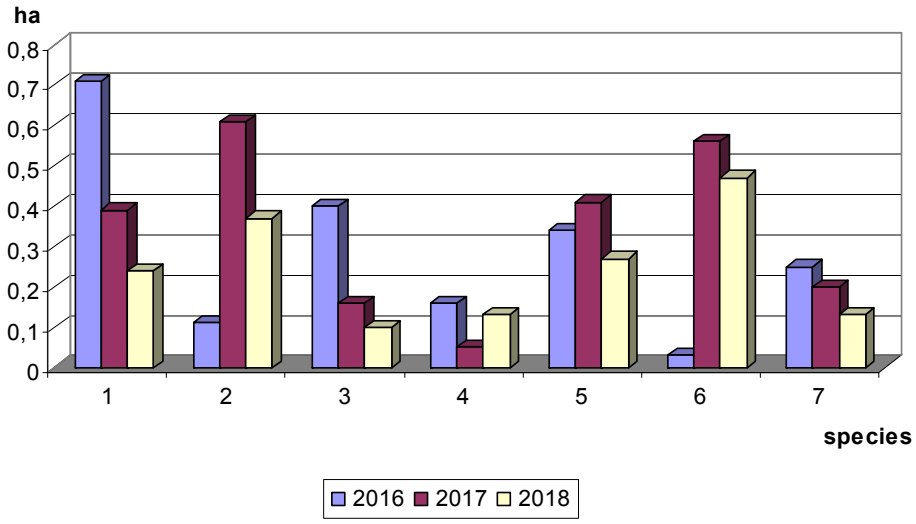
As the conditions of the rural residential areas differ in the certain heterogeneity, 4 categories of the representative farms were allocated to ensure the reliability of the results of the research. In the farms of the 1st and 3rd categories for the cultivation of the annual medicinal plants plots of land and leased land were involved. In farms of the 2nd and 4th categories on farms and rented lands, perennial medicinal crops were grown. Agreements on cooperation with landowners were concluded for monitoring of medicinal plant seed crops on land plots.

It has been determined that 12 crop species have the advantage of cultivating in the private farms, most of them (75%) have aboveground part (grass).

The priority medicinal crops grown as the monocultures in the farms I, II and IV categories are the *Bidens tripartita* L., *Althea officinalis* L., *Hyssopus officinalis* L., *Galega officinalis* L., *Nepeta cataria* L. In the farms of the 2nd and 4th categories - *Salvia officinalis* L., *Valeriana officinalis* L. and *Onions arvensis* L., and in the farms of the 1st and 3rd categories - medicinal herbs - *Calendula officinalis* L. and *Matricaria recutita* L.. Farmings of all categories also prefer the complex using of the plants - *Echinaceae purpurea* L. Moench. and *Althaea officinalis* L., which are grown both for the grass and for the production of roots with roots.

Within the designed of the representative farms during 2016-2018 there were changes in the sown area and in the priority of crops. The calculations showed that the positive dynamics in the increase of the sowing area was noted for the alteya, the medical plant, for which in 2018 the sowing area was increased by 16 times in comparison with 2016, due to the increase in demand for the raw materials - both for the grass and for the root and the emergence of a new market.

In 2018, in all farms, there was a decrease in the sowing area for medicinal crops (a threefold herd, a medicinal lemon balm, a true cow's milk and others), compared with 2017, by almost 20%. This trend was due to the problem of marketing of some types of the medicinal raw materials - the previous saturation of the market, increased requirements for the quality of the raw materials from pharmaceutical companies and procurement organizations (Fig.).



Drawing. Areas of the medicinal crops in the representative farms in 2016-2018 years, where cultures: 1. - *Bidens tripartita*; 2. - *Nepeta cataria*; 3. - *Melissa officinalis*; 4. - *Galega officinalis*; 5. - *Echinacea purpurea*; 6. - *Althaea officinalis*; 7. - *Matricaria recutita*

The results of the analysis of the plant samples regarding to the quality of the received raw materials, namely the availability of the required amount of active substances (polysaccharides, extractives, flavonoids, vitamins, glycosides, etc.) in cultured medicinal plants, indicate that the collected medicinal raw material meets the requirements of the State Pharmacological Center, EF and the requirements developed in the Experimental station of medicinal plants TU (table).

For example, the content of essential oils in the baskets of *Matricaria recutita* was 0.53 ± 0.02%, at a rate of 0.50%, *Melissa officinalis* 0.52 ± 0.02 ml/kg at a rate of 0.50 ml/kg, *Nepeta cataria* 1.2 ± 0.05% with a norm of 0.9%. The high indexes of polysaccharide content in the roots of *Althaea officinalis* products were noted at 14.7 ± 0.59% at a rate of not less than 14.6% and in the grass, 7.8 ± 0.31%, with a norm for SFU - 5%. For *Bidens tripartita* contents of polysaccharides in the grass exceeded the norm almost in twice 6,68 ± 0,27% at a rate of not less than 3,5%.

Table. The contents of the active substances in the medicinal plant material

No. n / a	Cultivated species	Type (name) of the raw materials, term of the collection	Requirements SFU and EF	Results of the investigation
1	Althaea officinalis	**root** in the autumn or early spring **grass** in the phase of mass flowering	**polysaccharides** in the roots not less than 14,6%; in the grass 5%	root-14.7 ± 0.59% grass - 6.68 ± 0.27%
2	Echinaceae purpurea	**flowers and grass** in the flowering phase (July-August) **root** in September-October, at 2-3rd year of vegetation	**polysaccharides** 9.0% **extractive substances** in the roots about 40%	9.0 ± 0.36%
3	Nepeta cataria	**grass** in the flowering phase	**essential oil** 0.9%	1.2 ± 0.05%
4	Melissa officinalis	**grass** in the flowering phase of the plant twice in summer: the first time - in June, the second time - in August-September	**essential oil** 0.5 ml / kg rosemary acid not less than 1.0%	0.52 ±0.02 ml/kg 1.5 ± 0.06%
5	Calendula officinalis	**flowers** in the phase of mass flowering by hand or mechanized when half of the tongue- flowers are opened	**flavonoids** 0.40%	0.74 ± 0.03%,
6	Matricaria recutita	**baskets** the first harvest is carried out when the plant reveals 5-10 inflorescences, for the period of flowering yield is carried out 2-5 times	**essential oil** 0,50%	0.53 ± 0.02%
7	Bidens tripartita	**grass** in the phase of budding-the beginning of flowering (July-early August)	**polysaccharides** not less than 3,5%	6,68 ± 0,27%

To help the farm owner and ensure the high quality of medicinal products in accordance with the standard requirements of pharmaceutical production at the Experimental Plant of Medicinal Plants "The recommendations for the formation of highly productive phytocoenoses of medicinal plants in the conditions of rural residential areas" were developed. The recommendations are based on the use of

scientifically-based methods of cultivation, modern techniques processing and storage of medicinal plant material, taking into account the opportunities of small-scale production [17].

Conclusions

A number of positive and negative factors influencing the cultivation of medicinal plant material in private farms of rural residential areas have been established. The benefits include: the favourable natural and climatic conditions of the region, self-employment and self-sufficiency of the local population for profit, high purchase price of the raw materials, the possibility of the long-term storage of finished products, the proper transport links, and the infrastructure of its sale is established.

Risks include: instability of demand, high requirements for the product quality, lack of specialized means of protection, specialized means of mechanization and inventory, price inaccessibility for the quality seeds and gardening material. When growing the medicinal crops in private farms the preference is given to 12 types of plants. Priority is given to the medicinal species, the raw material of which is an over ground part (grass).

To help the farm owner and ensure the high quality of medicinal raw materials "The recommendations for the formation of highly productive phytocoenoses of medicinal plants in the conditions of rural residential areas" were developed. These recommendations are used by a wide range of people directly from villages and by specialists who are studying the environmental problems of the rural development.

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