

EXPERIMENTAL PAPER

Determinants of growing herbs in Polish agriculture

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Summary

The paper describes basic determinants of the medical plant cultivation in Polish agriculture. The author discussed economic background of the introduction of these plants indicating the role of pharmaceutical industry in herb usage. Then, there is a presentation of results of the survey study carried out among farmers from the Wielkopolska region. Approximately 10% of the farms cultivate medicinal plants but more than 50% declare some interest in this kind of production, what indicates a big potential. Farmers think that herbs are economically attractive crops if the sale is guaranteed and the price is satisfactory. The demand for medicinal plants is developing and expanding for e.g. dietary supplements and other health-promoting products. Therefore, it can be concluded that cultivation of medicinal plants is the prospective direction of agricultural production and an important element of additional income of Polish farmers.

Key words: *determinants, herbs, Polish agriculture*

INTRODUCTION

Agriculture is a specific type of economic activity closely associated with the natural environment. It depends on the biological characteristics of plants and animals. The land is a particular factor of production, as it serves as a supplier of raw materials, animal feed, textiles, energy, medicines and dietary supplements.

The last group consists of plants used for the production of herbal medicines, but also food (nutraceuticals) and cosmetics (cosmoceuticals). The world production of herbs is now estimated at more than 0.5 million tons per year and consists mainly of dried herbal raw materials produced for pharmaceutical purposes. The turnover of medicinal and aromatic plants includes approximately 2000 species. The European market is one of the most important consumers of this production [1].

In Europe, due to the climate and soil conditions Mediterranean as well as Central and East European countries are the best localizations for growing herbs. Total area occupied by the species of plants is approximately 70,000 hectares. The largest suppliers of herbal material are France, Poland, Spain, Germany and Austria. European herbal industry processes approximately 200 species, mainly from field crops. Gathering from natural habitats is marginal today, as obtaining a uniform mass product from this source is difficult.

Polish agriculture has the largest area of the cultivation of herbal plants in Europe: 30,000 hectares. The number of producers fluctuates at about 20,000 farms a year. They operate specialized, controlled plantations, according to the requirements set by the contracts with food processing companies. Growing herbs is an important part of the production structure, a source of complementary income. It also supports the diversification of agricultural activities of individual farms.

The study presents the most important determinants of herbal production in Polish agriculture. In addition to statistical analysis, surveys conducted among farmers in Greater Poland region were used to assess their inclination to include herbal plants in crop rotation. The relational analysis has shown socio-professional characteristics of farmers and their effects on growing herbs. The working hypothesis assumes that the cultivation of medicinal plants has potential as prospective direction of farming in a changing economic environment and production.

MARKET CONDITIONS

In general, Polish farms deal with general production, mainly traditional crop production: cereals and oilseed rape. In recent years, the process of concentration of production has been observed, mainly in animal production, where unit productivity growth is connected to the increase of stocks. Growing non-food crops is still uncommon, primarily because of local traditions or requests of herb processing companies [1].

Herb cultivation is run by about 20,000 farms a year, on average. The plantation area is 0.5–2.5 ha, depending on the species produced, and in case of specialized farms it reaches 6–10 ha [1]. Approximately 70 species of medicinal plants are planted. The dominant species in Polish farms are: chamomile

(*Chamomilla recutita*), peppermint (*Mentha piperita*), valerian (*Valeriana officinalis*), St. John's wort (*Hypericum perforatum*), and milk thistle (*Sylibium marianum*). Twenty-nine original varieties of herbs are cultivated in Poland. The owner and breeder of 22 of them is the Institute of Natural Fibres and Medicinal Plants in Poznan.

The vast majority of produced material is purchased by the plant processing companies and the average purchase amounts to 20,000 tons per year. The highest purchase was recorded in 1986 and amounted to 28,400 tons, the lowest in 1980: 11,700 tons [2]. Two thirds of the organized production is sold on the domestic market, and the remaining third is exported, mainly to the European Union countries.

The main determinant of herbal production market is globalization and integration of many Asian manufacturers into the international market. On the world market, China supplies more than 200,000 tons of raw material, dominating the world trade. India produces 35,000 tons of herbs, Germany produces 15,000 tons, while the United States produces just 13,000 tons [3]. On the other hand, Europe and the U.S. import substantial quantities of raw materials and through participation in the production process of herbal medicines they control a significant part of the whole value chain. The value of global herbal medicine market is estimated at 20 billion Euro. The European markets share equals to 7 billion, followed by Asian and North American markets at 5,1 billion and 3,8 billion, respectively [3]. The three most commonly sold types of herbal preparations are laxatives, agents used to treat gastric acid secretion, preparations and products for nutrition, although herbs are commonly used for several other ailments and health disorders [4].

Some raw herbal material is collected from its natural habitat. Today collecting is limited, but it is still the primary method of gathering of approximately 100 species of plants with biomedical properties. In Europe, the annual supply from the natural habitats reaches 20–30 thousand tons. The most important locations of this activity are Bulgaria, Albania and Turkey. Apart from medicinal raw materials, the natural habitats are sources of spice herbs. Due to globalization and concentration of the herbal market, companies are forced to identify areas producing a uniform, high-quality pharmaceutical product or foodstuff. In this context, due to the climate, soil conditions, as well as crop traditions, Poland may remain one of the largest producers of herb material in Europe. For this to happen, there has to be a group of farms steadily choosing this direction of agricultural production.

MANUFACTURERS OF HERBAL RAW MATERIAL

The empirical study was carried out among farm owners of Wielkopolska region of Poland. The selection of the respondent group was purposeful as the

questions were directed to members of the Chamber of Agriculture i.e. an organization of farmers' self-government in Poland that represents the interests of all payers of the agricultural income tax. The group was divided according to the administrative division into counties and the number of 300 respondents was estimated as fully representative for the analyzed population. For gathering initial data questionnaire method was used where a set of questions was ailed to the respondents. The questionnaire included 14 questions concerning technical matters and demographics information. After logical and formal verification of the received responses, 268 questionnaires were qualified for further statistical analysis.

Determination of associations between quality attributes expressed in nominal scale (e.g. sex or education) or between a quantitative and qualitative attribute e.g. source of income and volume of the income was done with the use of contingency measurements, which indicate the degree of association between attributes. These attributes are considered as associated if they occur in higher number than it would happen if they were not associated.

The evaluation of the association is based on the X^2 statistics, which shows the deviation of the observed quantity for specific classes of both attributes from the quantity expected if the attributes were independent.

X^2 statistics is calculated on the basis of a table that is formed after grouping of the studied population according to two attributes and comprises k verses representing the variants of one attribute and l columns that represent the variants of the other attribute.

The X^2 is calculated according to the following equation:

$$\left\langle 0; n \cdot \sqrt{(k-1)(l-1)} \right\rangle$$

This equation serves for calculating the Cramer's coefficient, which varies between 0 and 1. If its value is closer to 0 it means the X and Y are not associated; the closer it is to 1 the more dependent are the attributes.

The study involved 220 farm owners from the Wielkopolska Province. The vast majority are middle-aged men (82%) who, on average, own about 35 hectare farms populated by 3–6 people. One-tenth of surveyed farm owners have grown herbal plants in recent years, and consider it to be an interesting addition to their crop rotation. A large group of farmers that do not grow herbs believe they lack the knowledge about the technology and ways of obtaining interesting varieties. They also think that herb cultivation is not traditionally done in their region. Farm owners see the economic uncertainty and the need to sign a contract before obtaining the yields as further barriers to introduce the herbs production.

Among the traditional industrial crops, used in non-food production in Poland are fibrous plants and herbs. When asked about these resources, more

than half of the respondents expressed their interest in the production of herbs (fig. 1).

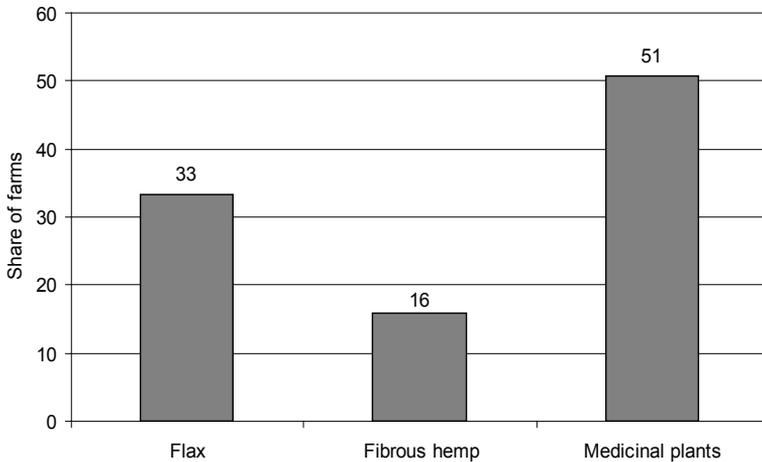


Figure 1.

Inclination to production of special crops

Source: Own research

An important factor in the introduction of new production lines is their cost-effectiveness. As much as 56% of farmers are of the opinion that herbal plants can increase farm income and 23% further acknowledge that these crops improve soil quality on the farm. The impact on the farm economy is therefore positive, provided certainty of the commodity sales. Counseling and seed availability are less important for respondents as these services can easily be accessed at specialized institutions.

When asked about the processing of herbs in Poland, farmers answered positively, selecting a phrase: “it is growing and producing more” and “there are a few small production companies”. That means it is not a problem to find customers interested in herbal material.

In the study of the determinants of growing herbs in Polish agriculture it is assumed that, in addition to economic factors, social and professional circumstances can influence a tendency to use special plants in the crop structure.

Therefore, the impact of selected features on the conduction of this type of production was analyzed. The first factor was the age of the respondents, which correlated with entrepreneurship and openness to new solutions. The majority of farmers are aged 39–55, which can be considered as a period of peak activity (fig. 2).

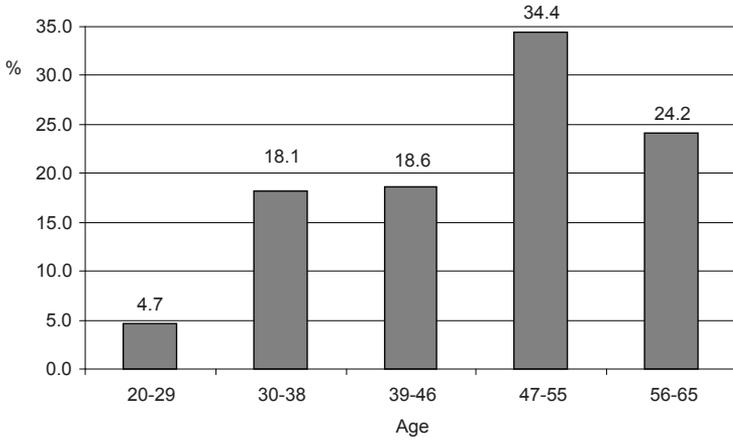


Figure 2.
The age structure of farmers surveyed
Source: Own research

Assessment of the impact of age structure shows that farmers over 40 years of age choose herbs as part of their farm production structure more often than younger people (fig. 3).

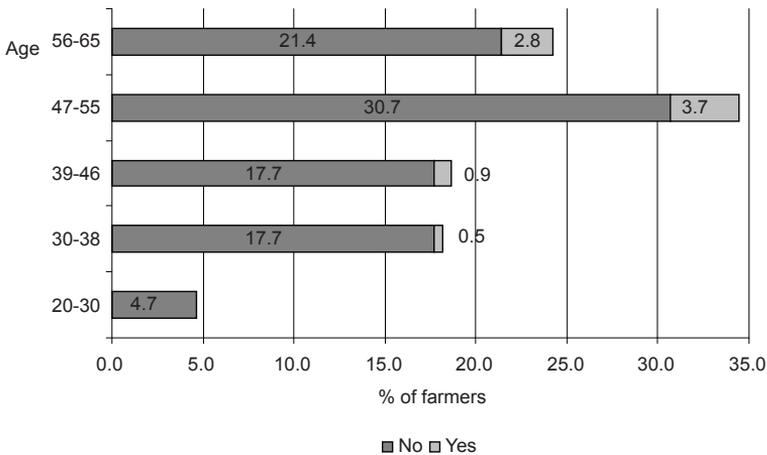


Figure 3.
Correlation between farmers' age and herb production
Source: Own research

Growing herbs, as a specific direction of the agricultural industry is related to the producer's experience and his knowledge of crop rotation. This means that older, experienced producers are more willing to reach for these plants.

Another important feature of the social structure is the level of professional skills and education. The surveyed farmers hold a formal level of education higher than an average Polish farm owner. 70% of surveyed farmers hold at least a high school certificate (fig. 4).

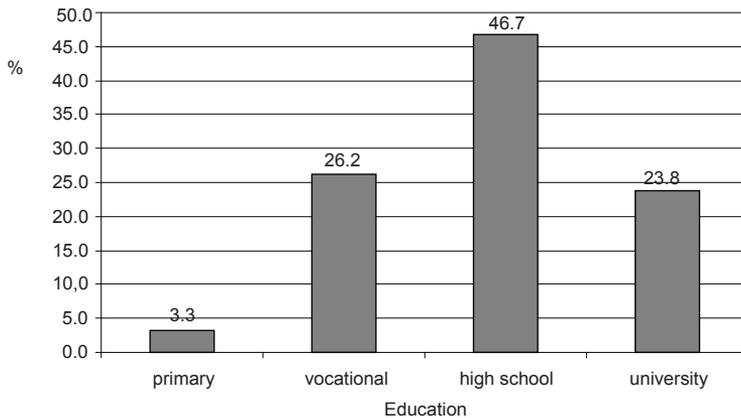


Figure 4.

Education of surveyed farmers

Source: Own research

There is a little correlation between the education level and a tendency to grow herbal plants. Although statistical analysis indicates a larger share of less-educated farmers in the group of producers of raw herbs, it cannot be considered as a trend, since only 3.3% of farmers have primary education (fig. 5).

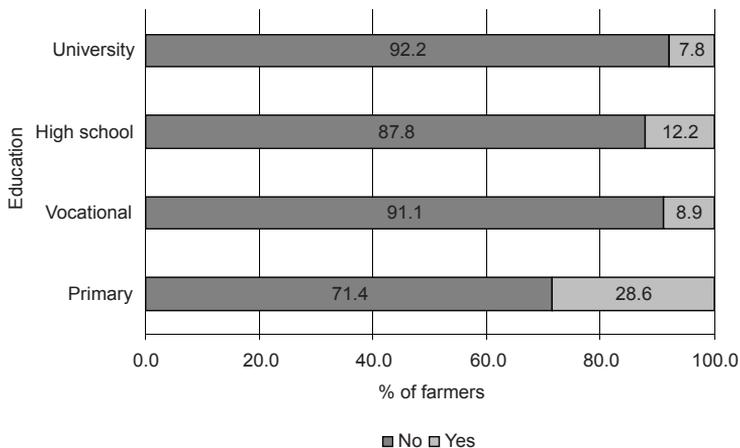


Figure 5.

Impact of education on growing herbs

The total area of land designated for agricultural use is important in the structure of production of each farm. Among the surveyed producers, average farm size is 35.7 ha, and most of the farms are in the range of up to 50 ha (fig. 6).

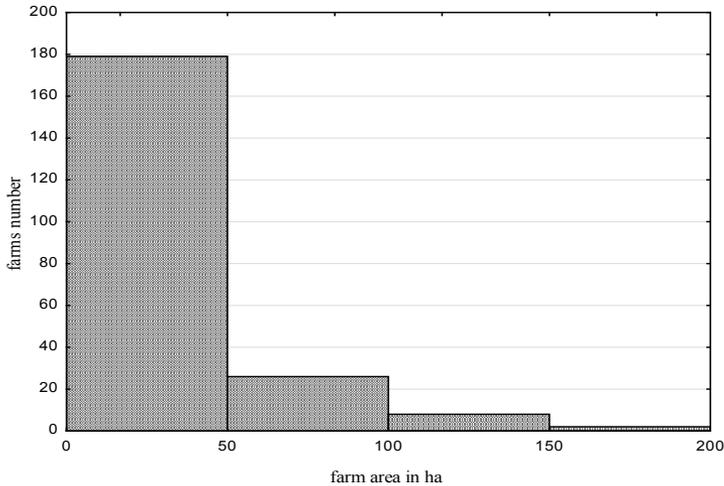


Figure 6.
Farm structure in terms of area (ha), excluding the largest farm (470 ha)
Source: Own research

Investigation of the relationship between the area of the farm and the cultivation of herbal plants clearly indicates that in the largest farms (larger than 100 ha) interest in herb cultivation is much higher than in other area groups (fig. 7).

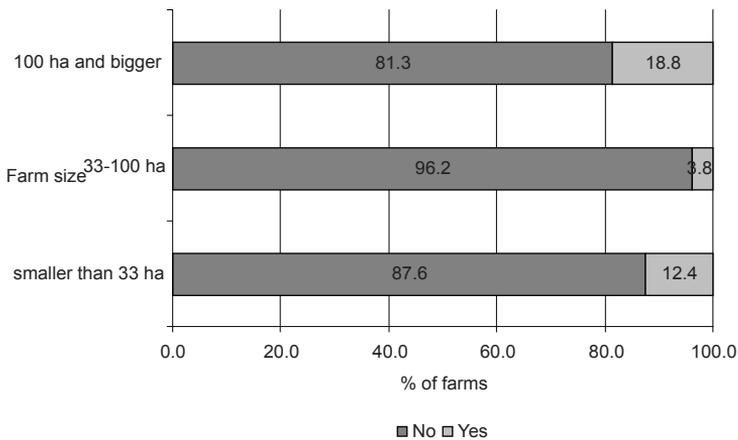


Figure 7.
Relationship between area and herbs grown on the farm
Source: Own research

The economic situation of the farm and the chance of improving it by changing the structure of crops affects making the decision on introducing the industrial plants in the crop rotation. In the course of study, the income level of the respondents in 2010 and 2011 was assessed, and then cross-referenced with herb cultivation in both periods (fig. 8 and 9).

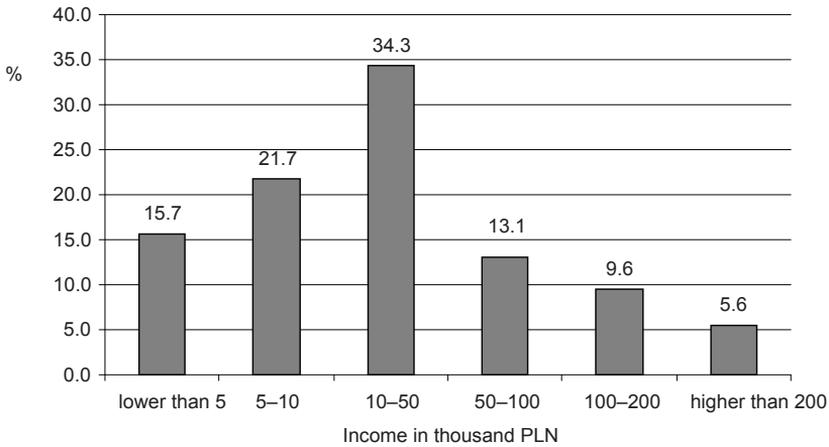


Figure 8.

The structure of income of respondents in 2010 (1 USD = 3 PLN)

Source: Own research

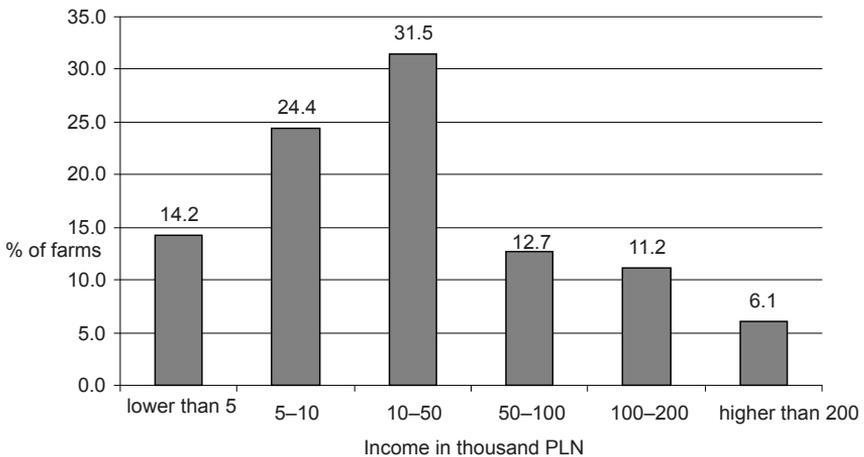


Figure 9.

The structure of income of respondents in 2011 (1 USD = 3 PLN)

Source: Own research

Interesting conclusions come from the analyze of the relationship between income and inclination to growing herbal plants. In 2010, with the increase of agricultural income, growing herbs decreases in the crop structure (fig. 10).

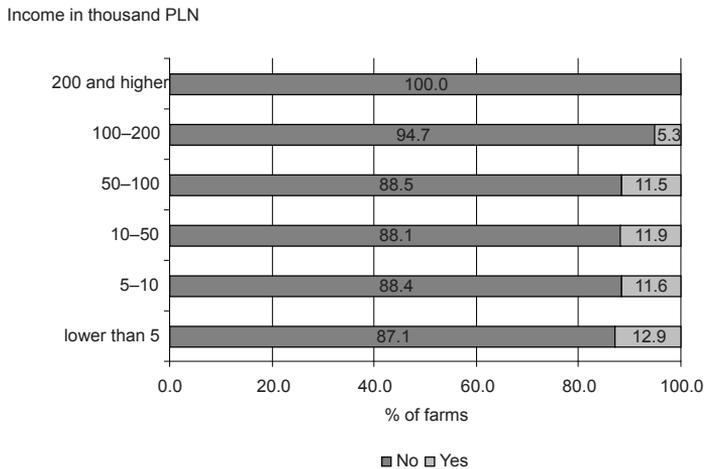


Figure 10.
Income and cultivation of herbal plants in 2010
Source: Own research

However, in 2011, no statistical difference in the percentage of farms with herb production, depending on agricultural income was found. Moreover, in groups earning more than 50 thousand PLN, the ratio remains the same (fig. 11).

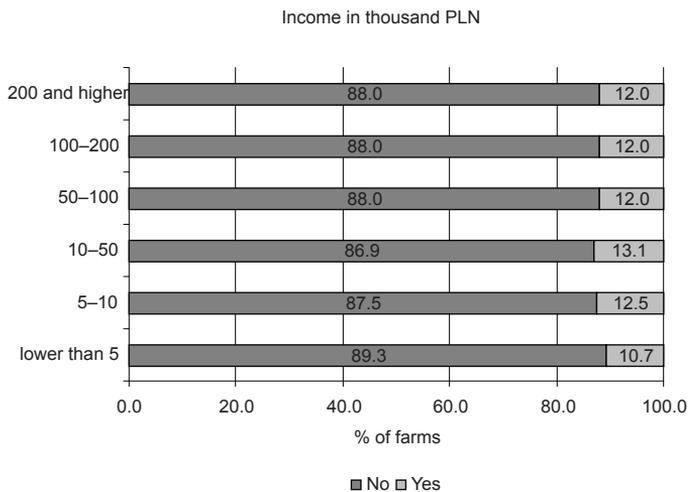


Figure 11.
Income and herbs cultivation in 2011
Source: Own research

Manufacturers of herbal material in Poland seek for advice from academic institutions, mainly agricultural universities and research institutes. The respondents expressed the following opinions about the organizations dealing with herbs:

- are modern and active – 16%
- insufficiently promote knowledge of the technology – 30%
- produce modern varieties of plants – 9%
- examine and implement innovations – 8%
- write academic papers of little use – 10%
- deal with the theory – 12%
- do not understand the market – 19%
- are underfunded – 19%.

As it is clear from these statements, many farmers expect more research and advice from the institutions concerning the dissemination of technological and economic knowledge. If they knew the rules of cultivation of herbal plants and their impact on the economy of the farm, perhaps these plants would be implemented to the structure of its production.

PROSPECTS FOR HERBAL PRODUCTION

Plants producing organic substances from inorganic compounds by biosynthesis are the primary link in the food chain. They are a source of protein, carbohydrates and fats for all animals and contribute to the advancement of biological evolution. In addition to basic plant nutrients, this group also produces a number of natural compounds of specific curative properties. This group is called herbs. Their characteristics are well known and used since the beginning of human civilization. They have been used in traditional as well as modern methods of treatment to form the basis of herbal medicine.

The first records of the use of plants in medicine are found in the documents of the Chinese emperors 2700 years BC. The father of medicine, Hippocrates, in his book “Corpus Hippocraticum”, described 455 plants affecting human health. Ancient Romans and Greeks, as well as Christian religious orders benefited from this legacy, developing knowledge of medicinal plants. The monasteries established medical schools largely based on herbal medicine. The scientific approach to raw materials arose in the 19th century with the development of chemistry and knowledge about the composition of individual plants. At the same time, doctors withdrew from the use of herbal medicine resources due to the introduction of synthetic drugs. However, modern science, especially biology and medicine, restored herbs to their rightful place. There are many research institutes involved in the study of medicinal plants, their breeding, cultivation, selection, acclimatization and pharmacological significance. In Poland,

the Institute of Medicinal Plants (now named the Institute of Natural Fibres and Medicinal Plants) has been playing this role since 1947.

While most suited areas for the cultivation of herbs and medicinal plants are hot and warm, a temperate climate is also good for the herb production. In Poland, approximately 200 species useful for processing can be found. Herbal industry uses about 170 species of medicinal plants and spices. 120 species are used in the pharmaceutical industry and official phytotherapy. Polish farmers grow about 60 species of herbs, which enables them to obtain large batches of raw material of high quality, meeting the requirements of good manufacturing practice (GMP) [5].

Herbs are a group of special plants that differ from traditional ones not only biologically and agrotechnically, but also economically and in terms of the organization of production. The primary determinant of the production rate is the market of herbal medicines of plant origin, directly related to the demand on the pharmaceutical market, which includes medicinal drugs, dietary supplements and healthy foods.

In Europe, the market is dominated by Germany and France. Poland with its 6% market share is one of the most important participants in the common economic space [6]. Each year approximately 25,000 tons of dried herbs for the pharmaceutical industry and other industries is being produced. Three-quarters of this mass comes from field crops and the remaining quarter from natural sites.

In field conditions, it is important to respect the technological regime of agronomical practices, harvesting and preparation of raw materials for processing (eg. drying, cleaning) and proper storage. In case of harvesting from natural sites, measures must be taken to protect the natural environment. The plants under statutory protection must not be harvested. The areas contaminated by industry, vehicles, gas, waste water or chemicals should be excluded from harvesting. It is expected that in the future, field cultivation of herbal plants will become even more important with diminishing role of wild habitats.

Economic and technological prognosis show the future development of herbal production. This is expected due to the increasing demand of the pharmaceutical and food industries and also because of the appearance of the product innovations containing herbal plants in its composition. The examples of such innovations are: healthy foodstuff, dietary supplements or herb-impregnated textile products improving the effects on human organism. Increasingly, herbs are the subjects of biotechnological and nanotechnological processes contributing to the enrichment of composite materials or changing the properties of other synthetic or natural components.

In this context, the producers of the raw material will have a chance to become a resource base for innovative processing and pharmaceutical companies, thus, to diversify their sources of revenue.

CONCLUSION

Polish agriculture undergoes modernization and restructurization. The processes result from the implementation of the principles of common agricultural policy of the European Union and from the transformation of the global economy, food and agricultural markets. The most important determinants of farmers' activity are the factors of production resources, especially soil, the quality of which determines the possible selection of the structure of production and economic factors, such as price and sales. The farmer, as a businessman, bears the costs of use of the natural resources. In the typical farm, cultivation of cereals, industrial crops and livestock production is run. For centuries, herbal plants have been a special group differentiating the sources of income of the industrial plants producers. Nowadays, in Poland 25–30 thousand hectares of the raw materials are grown, mainly in specialized farms characterized with favorable soil and climatic conditions. Farmers recognize the herbal plants as economically attractive and are willing to increase their acreage provided guaranteed sales. An important influence on the cultivation of herbal material is the area of the farm: the larger the scale of farming, the herbs are more common in rotation.

The main directions of the use of herbal material is the pharmaceutical industry and the production of spices. However, herbs are becoming an increasing part of medical products and textiles. A part of the herb production is also exported to European Union countries and outside the European market. Herbal raw material market is stable and well organized, and most of the transactions are carried out as long-term contracts.

In addition to field crops, a supplementary source of herbal raw material are natural habitats, which, however, are restricted in order to protect the environment. The batches of harvested plants are small and their quality varies. In the future, up to 90% of the herbs will come from field crops, which will increase the demand for the supply of specialized farms.

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DETERMINANTY UPRAWY ZIOŁ W POLSKIM ROLNICTWIE

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Streszczenie

Artykuł przedstawia podstawowe uwarunkowania uprawy roślin zielarskich w polskim rolnictwie. Autor opisał tło ekonomiczne wprowadzania do struktury produkcji ziół, wskazując na rolę przemysłu farmaceutycznego w wykorzystaniu surowca zielarskiego. Następnie przedstawiono wyniki badań empirycznych przeprowadzonych wśród rolników województwa wielkopolskiego. Przeciętnie 10% gospodarstw uprawia zioła, ale połowa deklaruje zainteresowanie tymi roślinami, co świadczy o dużym potencjale produkcyjnym. Rolnicy uznają zioła za rośliny atrakcyjne ekonomicznie pod warunkiem gwarancji zbytu i dobrej ceny sprzedaży. Popyt na surowce zielarskie zależy od zapotrzebowania rynku leków roślinnych, który rozwija się i rozszerza o suplementy diety i inne artykuły prozdrowotne. Zatem uprawa roślin zielarskich jest perspektywicznym kierunkiem działalności rolniczej i stanowi ważne uzupełnienie w przychodach polskich gospodarstw.

Słowa kluczowe: *uwarunkowania, zioła, polskie rolnictwo*