

Market and evidence-based income challenges of growing medicinal plants in Serbia

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Introduction

Collecting and cultivating medicinal plants has a long tradition in Serbia, but the quantities of wild-crafted plants are in constant decline thanks mostly to demographic changes, while to a lesser extent to market quality demands, as well as restrictive measures to protect biodiversity (Živković et al., 2020). The cultivation of medicinal plants provides standardized plant raw materials for the demands of the pharmaceutical industry (Chen et al., 2016). This raw material is obtained from botanically identified plants grown in an environment where they achieve the maximum content of specialized metabolites and are harvested at the optimal stage of development (Dajic Stevanovic and Pljevljakušić, 2015).

The profitability of medicinal plant cultivation is often seductive in media reports, but answers to the questions of real costs are often overlooked (Pljevljakušić and Brkić, 2020). Therefore, this manuscript aims to review the current state of collection and production of medicinal plants in Serbia and to present recent market data and most of the main costs that follow this type of plant production, using the example of growing artichoke and ribwort plantain.

Materials and methods

Data collection

For the purpose of collecting data on the quantities and number of medicinal plants on the market, as well as the area under cultivated medicinal plants, the data of the Chamber of Commerce of Serbia, the reports of the Statistical Office of the Republic of Serbia (SORS, 2021),

and the data of the Association of growers of medicinal plants from the village of Bavanište were used.

Cultivation calculation cost data collection

Basic data for calculating the profitability of the cultivation of medicinal plants were collected from the multi-year history database of plant production of the Institute for Medicinal Plants Research "Dr. Josif Pančić" (production fields located in Pančevo) as well as by interviewing producers from the village of Bavanište (South Banat). In the calculation, the fixed costs of production were neglected, where it was assumed that the producer owns the land, agricultural machinery, and facilities for post-harvest processing and drying. The costs of packaging, handling, and transportation are also neglected. Essentially, the costs of seeds, fertilizers, fuel, and labor were taken into account. Data on the most common costs associated with the cultivation of medicinal plants were presented descriptively, while for the purposes of this report, the cases of artichoke and ribwort plantain cultivation costs were separately processed. Commercial prices of plant raw materials are taken from the official price list of the Institute "Dr. Josif Pančić".

Results and discussion

Cultivation area and market

In 2020, the estimated area under medicinal plants in Serbia was about 2,207 hectares or 1% of arable land, while it is also estimated that it could be grown on three times the area without running into the risk of a surplus of raw materials on the market. In the same year, about 3,695 tons of medicinal plant species were wild-crafted, while the approved contingent quota was 5,275 tons.

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According to the data of the Republic Institute of Statistics (SORS, 2021), the value of the total foreign trade exchange of medicinal plants in 2021 was realized in the amount of 24.0 million euros (5,668 tons), of which the export value was 14.8 million euros (3,091 tons) and imports 9.2 million euros (2,576 tons). Total foreign trade exchange of medicinal plants was realized in the amount of 24.0 million euros (5,668 tons), of which the export value was 14.8 million euros (3,091 tons) and imports 9.2 million euros (2,576 tons). The average export price was 4.8 euro/kg, while the average import price was 3.6 euro/kg. Interviews with producers and wholesalers of medicinal plants showed that the most commonly cultivated plant species in Serbia are peppermint, chamomile, lemon balm, and marshmallow. The remaining plants for which there is a great demand, and which are less often cultivated, are mainly root-drug species of yellow gentian, comfrey, angelica, and valerian. Artichoke (*Cynara scolymus*) is a perennial cultivated medicinal plant species, of which leaf (*Cynarae folium*) is most often used in the pharmaceutical industry. It is grown from direct sowing and can be mechanically harvested. In the first year, multiple leaf harvests are possible, while in the second year only a few harvests are possible due to the early formation of the flower-bearing stem. At the current price of 3 euro/kg and a yield of 2 t, the expected gross income is 6000 euro, but 60 % of that is cost, so the estimated profit per hectare is somewhere around 2400 euro. The cost structure is such that energy consumption for drying is about 42 %, while the share of labor and material costs (seeds, fertilizer) ranges from 25-27 %. Despite the rising price of fuel, the working operations of agricultural machines in the total cost structure of artichoke cultivation take the smallest share, which is about 6 %. Ribwort plantain (*Plantago lanceolata*) is a perennial medicinal plant that is cultivated for its leaves (*Plantaginis folium*), which are used in phytopreparations for various indications. Plantation establishment of ribwort plantain is done by direct sowing in spring in well-prepared and pulverized soil. Although the seeds are very small, they have very good germination and the plant itself is very resistant to both the lack of moisture in the soil and its surplus. Similar to artichoke cultivation, in the first year, multiple harvests of leaves could be done, while in consecutive years plants will bring up the flowering stalk, which complicates the harvest process and reduces the yield. At the current price of 3 euro/kg and a yield of 2.5 t, the expected gross income is 6250 euro, but 54 % of that is cost, so the estimated profit per hectare is somewhere around 2900 euro. The cost structure is such that energy consumption for drying is about 37 %, while the share of labor and material costs (seeds, fertilizer) ranges from 27-29 %. The working operations of agricultural machines in

the total cost structure of artichoke cultivation take the smallest share, which is about 7 %.

Conclusion

Although Serbia is a large exporter of medicinal plants and it has been shown that the profit per unit area in its cultivation is higher than in conventional agricultural crops, the area under cultivated medicinal plants is still around 1%. This is a consequence of the specificity of medicinal plant production, which requires the hiring of specialized agricultural machinery, extensive labor, and drying facilities. It is estimated that the cultivation of the current assortment can be expanded to three times this area without the risk of a surplus of raw materials, but considering the cultivation of root-drug plant species (i.e. yellow gentian, comfrey, angelica, and valerian), for which there is a great demand from wholesalers, could even more significantly expand the area under cultivated medicinal plants. This research has shown that 50-60% of the total profit of cultivating medicinal plants (i.e. artichoke and ribwort plantain) belongs to the costs, which in their structure are about 37-42 % for drying energy, about 27-29 % for fertilizer and seeds, 25-27 % for labor, and only about 6-7% for agricultural machine operations. This information is useful for planning the future cultivation of medicinal plants where costs and availability of labor and energy for drying must be taken into account in order to produce quality medicinal plant raw material.

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