

Sustainable production of medicinal plants in Serbia

Adel Moafa

* Phd,candidate

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Abstract- In recent years, the sector of medicinal, aromatic and spice plants (MASP) in Serbia is experiencing new growth, developing new technologies, standards and markets. Today, unfortunately, despite the extremely rich biofund of this group of plants, production, processing and export of medicinal plants is below the levels of the late eighties. The closure of several large public companies, together with the lack of a sufficiently favorable political situation, has led to the discovery of raw materials and products in some other markets.

Therefore, in order for this to return to the place it deserves, it must act vertically and horizontally: vertically towards the institutions that directly or indirectly determine the state of the sector (ministries, chambers, associations, etc.), and horizontally towards participants in production and processing.¹

Index Terms- Natural resources, crops of medicinal plants, ecological-genetic research and selection, organic production

I. INTRODUCTION

Medicinal herbs, production and marketing are often unknown to many people. By growing medicinal plants, a larger amount of plant raw materials is obtained, uniform quality is achieved, and the pressure on natural resources is significantly reduced. On the Serbian market, the supply of seeds of medicinal plant species as well as planting material is not adequate. On the other hand, our country is a large exporter of unprocessed medicinal herbs and aromatic herbs. We often state that Serbia, thanks to its geographical position, ie climate and soil, as well as its rich tradition, is extremely suitable for collecting and growing medicinal, aromatic and spicy plants. However, we must also state that these potential opportunities are not used adequately.

II. PRODUCTION OF MEDICINE PLANTS

The production of medicinal plants has so far been accompanied by many problems (insufficient organization, fragmentation of programs, insufficient equipment, both human and technical, incoherence of science and practice, limited number of cultivated species, unsuitable varieties, small and fluctuating yields, unsatisfactory quality, underdeveloped market). Today the

situation is gradually changing. Many problems have been overcome, the structure of medicinal plant production has been significantly improved. New species and new varieties are being introduced and the results of scientific research are being used more and more. The number of commodity producers is increasing, both in the social and individual sectors, and the cultivation of medicinal plants is becoming their only or main occupation.

Production specializes or concentrates in certain farms, where it takes on the character of a basic economic activity. The expansive development of this production begins, and thus the increased interest of breeders to learn new methods and ways to improve production. In our country, little work has been done on the issue of growing medicinal herbs. The lack of literature is also one of the reasons for the insufficient cultivation of medicinal plants in our country. Since in our country the cultivation of medicinal plants in culture, as agricultural production, has not been sufficiently researched, given the importance of medicinal plants, in organizing scientific work, attention should be paid to developing a methodology for introducing certain plant species into culture. It is necessary to take into account the climatic conditions and soil types of a certain area, which enable the appropriate type, and even a variety of medicinal and aromatic plants to be grown on a specific type of soil. It is necessary to analyze the possibilities of collecting medicinal plant species. We should not neglect what nature already provides.

In addition to several types of medicinal and aromatic plants that have been cultivated since ancient times, there is a great need for those medicinal plants that are primarily collected from the wild: linden, callus, nettle, etc. The task of science would be to choose from numerous plant species those behind which there is interest on the domestic and foreign markets and for which there are growing conditions. The problems of studying medicinal plants must be considered from the point of view of the general conditions of agricultural production, primarily the farming system which characterizes other agricultural crops. Therefore, it is often not possible to apply solutions from foreign literature, no matter how modern and based on new knowledge.

Growing medicinal herbs, as well as aromatic and spicy herbs in a protected area is becoming an increasingly lucrative hobby, and there are those for whom it is becoming one of the main types of income. The Resava region and the municipality of

¹ Filipović, V. and V. Popović (2014): State of the production and the collecting of medicinal plants in the Republic of Serbia. International Scientific Conference „Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the Danube region - rural development

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Svilajnac are especially known for growing these plant species. Interest in plantation cultivation of medicinal and aromatic plants was initiated by the demand of the processing industry whose end products are based on medicinal and aromatic plants, as well as the need for raw materials of uniform quality and quantity. More intensive plantation cultivation dates back to the 50s of the last century, and since the 70s some medicinal and aromatic species are fully introduced into the culture, which means that their origin on the market is exclusively from plantation production (mint, thyme, resist, chamomile, čubar, melisa, borač, marigold). The global trend of recent years is a great demand for medicinal and aromatic herbs. It is estimated that the same trend will continue in the coming years.

Thanks to the favorable climate, soil and unpolluted environment, Serbia is very suitable for intensive cultivation of medicinal plants. In terms of biodiversity, Serbia is ranked among the 158 best centers in the world; more than 700 plant species with medicinal properties have been identified in the rich flora, while 400 species of medicinal plants have been registered (of which 280 species are traded as industrial raw materials which are used for further production of medicines, cosmetics and hygiene preparations, spices, various extracts). ...).

In relation to the collection of plants from nature, plantation cultivation of medicinal plants has several advantages:

1. cultivation yields raw materials of standard quality, especially when larger quantities of uniform drugs are needed for the needs of the pharmaceutical and related industries (quality depends on genotype, chemotype, ecotype - habitat, climate, age, etc.);
2. it is easier to use the advantages of already existing agricultural techniques, ie. mechanization, sowing structures, protection measures, processing and processing of medicinal plants;
3. agricultural land resources are used more rationally, because poorer quality lands are also used; the engagement of labor needed for collection is canceled;
4. economic effects are greater compared to growing standard crops;
5. quality of the raw material can be more easily complied with pharmacological standards; rare, endemic, endangered species are protected from extinction, especially those whose collection is prohibited or strictly limited;
6. unused resources, unsuitable for other economic and agricultural activities (lands of hilly and mountainous areas, floodplains, lands prone to erosion, territories of national parks and nature reserves) are being revived.

In Serbia, crops of medicinal plants are grown on average over 3500 ha, mostly in the area of Vojvodina. Chamomile (*Matricaria chamomilla*), lemon balm (*Melissa officinalis*), valerian (*Valeriana officinalis*), hybrid mint (*Mentha h piperita*), myrrh (*Hyssopus officinalis*), thyme (*Thymus vulgaris*), coriander (*Coriandrum sativum*), cumin are mostly grown. *carvi*), selenium (*Levisticum officinale*), artichoke (*Cynara scolymus*), anise (*Pimpinella anisum*), marshmallow (*Althaea officinalis*), Echinacea and others. Directed cultivation of medicinal and aromatic plants would reduce the uncontrolled harvest of wild plants and thus prevent its extinction. It is equally important to point out that the production of medicinal plants brings higher,

faster and easier profit than other agricultural productions. Those few who are engaged in plantation cultivation of medicinal plants in our country claim that significant profits can be made by growing medicinal plants.

For example, according to the data of the Group of Producers and Growers of Medicinal Herbs, in 2016, for the production of chamomile, for example, the costs per hectare were around 600 euros, while the profit was around 900 euros. About 700 euros were needed to invest in the production of anise per hectare of land, and the positive difference was about 450 euros. For the production of marshmallow root, the costs were 2000, and the profit was 1,250 euros, while in basil, about 850 euros had to be invested in order to get 1,100. For the cultivation of coriander, which does not require much work, last year it took 530, and the positive difference was 70 euros. The production of marigold on one hectare cost 1,700, and the profit was 1,200 euros, while for mint in the first year of production, about 800 euros are needed, and in the next two years, half as much.

In the first year, about 600 euros are earned on nana, and in the second and third year, about a thousand euros. By growing and processing medicinal plants, significant amounts of waste material are obtained, which can be used as a natural fertilizer in organic agriculture (compost and various biodynamic fertilizers) or as fodder. Considering the needs of the world market, and especially the developed western market, the production of biologically pure medicinal herbs for buyers of organic food has started, that is. products obtained by applying the so-called technology. organic production. Production of medicinal and aromatic herbs according to the principles of the so-called Organic farming (application of organic fertilizers, weed control through alternative control measures, including mulching, crop rotation and other measures) has its future, especially in hilly and mountainous areas, which are fully environmentally friendly for this type of activity and, on the other hand, include key autochthonous habitats of the largest number of medicinal and aromatic species. In a word, the cultivation of medicinal and aromatic plants is completely in accordance with the principles of organic agriculture and sustainable rural development.

The constant use of plants in an area requires appropriate ecological-genetic research and selection procedures with the aim of obtaining new varieties, introducing them into culture and starting cultivation. Plantation cultivation can also produce species that do not originate from our area, which reduces the import of these raw materials. Properly applied nutrition and protection of medicinal and aromatic plants is acceptable for humans, and at the same time it ensures a good yield and economical production. Crop care is the next agro-technical work and it refers to rolling after sowing, thinning, cultivating, fertilizing, protection from weeds and pests, irrigation, mulching and pruning. When it comes time to harvest, it is done manually or mechanically, single-phase and two-phase. Two-phase is recommended for plants that mature unevenly, which easily scatter seeds. We need to know which plant will thrive best on a particular plot, and that there is demand again and that it has an economically viable price. The next condition is whether it is possible to procure quality planting or seed material. We don't need to produce even if we can't negotiate the sale. Previous cooperatives did not exist for no reason. I remember that the cooperative in MZ Ušće na Ibru contracted and sold medicinal herbs from Golija throughout the

year. The current production of medicinal, aromatic and spicy herbs cannot meet the needs of the market for products such as basil, anise, borac, chamomile, coriander, spice, mustard.

III. TYPES OF MEDICINAL PLANTS GROWN IN SERBIA

Serbia used to be the leading country in the region in this area and could very easily return to the very top, with the support of state bodies. Favorable geographical and climatic factors and diversity of land types are prerequisites for large and diverse production. The economic factor should not discourage a potential grower - for the cultivation of medicinal plants, the initial investment is not large. The engagement of human potential is much more important than capital. The choice of species for cultivation is influenced by the characteristics of the plant itself, geographical location, type of land, as well as the demand and price of individual species, which should be reported in detail to the buyer. For optimal yield, it is certainly necessary to apply appropriate agro-technical measures, with the use of appropriate mechanization, appropriate soil configuration and size of plantations. Crops whose market demand is lower generally achieve a higher price for yield per unit of arable land, and small areas also require smaller monetary investments, so small-scale production can have significant advantages. This is exactly the case with the cultivation of medicinal, aromatic and spice plants. A good selection of crops for cultivation, taking into account the biological specifics of the selected species, can ensure continuous production during most of the year, and at the same time the optimal filling of drying and finishing capacities.

It is important, especially at the beginning, to make the costs as low as possible. Hiring additional labor requires additional investment and reduces one's own earnings. Small areas can be served by labor within a single household, which makes this production an extremely promising family business. In order to achieve better yield and quality, it is important to sow or plant in a timely manner, hoeing, weeding, thinning, fertilizing ... This is always easier to achieve on smaller areas. On large areas, due to the application of mechanization, plants are planted in a rarer group than required by their shape and size. Production on small areas is done manually, which makes it possible to grow a larger number of plants per unit area, and filling the missing plants is far easier. At the very beginning, large investments in drying capacities are not necessary. The problem of drying can be solved, with a significant increase in production capacity, with less investment in existing facilities. At the same time, maximum use should be made of solar energy and other cheap alternative sources, which certainly reduces production costs. Organic production is a system of sustainable agriculture based on high respect for ecological principles:

1. rational use of natural resources,
2. use of renewable energy sources,
3. conservation of natural diversity and
4. environmental protection.

Organic production in Serbia is becoming increasingly popular and economically important, and thanks to the potentials, primarily fragmented land and land that is not polluted with harmful substances, this type of agriculture can significantly contribute to the development of rural areas and agriculture in general. Therefore, organic production is set as one of the priorities of agricultural development and is an integral part of the strategy for the development of agriculture and rural areas of Serbia.² Below we will list some of the plants that are grown in Serbia with more or less success. The following six species are grown on the largest areas in Serbia:

1. sage (*Salvia officinalis* L),
2. lavender (*Lavandula officinalis* Chaix),
3. chamomile (*Chamomila recutita* (L) Rauch)
4. thyme (*Thymus vulgaris* L),
5. coastal immortelle (*Helichrysum italicum* (Roth) G. Don)
6. rosemary (*Rosmarinus officinalis* L).
7. Marigold (*Calendula officinalis*)
8. Fennel or sea buckthorn (*Foeniculum vulgare*)

IV. AGROECOLOGICAL AND SOIL CONDITIONS IN THE REPUBLIC OF SERBIA

The analysis of agroecological and soil conditions in the Republic of Serbia in the past 30 years shows that global climate change is affecting the wider region of Southeast Europe and our agro-ecological area. This is observed by an increase in air temperature during the vegetation period of spring sowing crops by about 2 ° C. In the summer months, the relative humidity has less and less values, it is often accompanied by dry winds and air temperatures above 35 ° C. Such weather conditions in the long run cause great damage to all arable plants. Uneven precipitation distribution with a deficit of up to 300 mm during the summer months significantly affects the yields of most crops. All available agro-technical measures that have a preventive character should be included in the fight against drought. These are cultivation adapted to the storage of water in the soil, plant nutrition, selection of genotypes, sowing, care and protection of crops during the vegetation period. When cultivating the soil, preference should be given to conservation and reduced tillage, with as little machine passage and drying of the surface layer as possible. Varieties with a shorter vegetation period and hybrids more tolerant to drought should be chosen.

In areas with low summer rainfall and high air temperatures, winter crops or drought-tolerant crops should be grown more. These drought control measures should be started as soon as possible in areas with limited crop irrigation. Respect and adequate application of agrotechnical measures increases seed germination and significantly helps in the fight against weeds, which leads to savings on plant protection products. It is the right time to apply contemporary knowledge and find out what of the agro-technical measures is recommended before spring sowing in order to achieve maximum yields.

² Law on Organic Production, www.mpt.gov.rs/introduced/123/3920-09.pdf- Zakon o organskoj proizvodnji, www.mpt.gov.rs/postavljen/123/3920-09.pdf

V. SOIL PREPARATION, CARE MEASURES AND FERTILIZATION

Basic processing is performed in the fall to a depth of 30 cm. Before the basic processing, 30-40 t / ha of well-burned manure and 500 kg / ha of NPK 15:15:15 are evenly distributed on the plot surface. It can be sown in the same place after at least 3-4 years. There are 200-300 of them in a gram of seeds. If a precision seed drill is used for fine seed, 3-4 kg / ha goes, while manual sowing should use 6-10 kg / ha of seed. 1-2 g per square meter is consumed in the funnels. In early spring, when the machines can enter the plots, it starts in well-prepared soil with sowing. The row spacing is 60-70 cm, and 20 cm in a row. Depth of sowing is 1-2 cm. Seedlings are transplanted when the height is 10-15 cm. They are transplanted to the same depth as they were in the bed. Before transplanting, the leaves are shortened. The head is formed above the ground.

Analysis of agroecosystem dynamics implies complex interactions between plants, animals, humans and the environment and agroecological impacts.^{3 4 5} Agroecological studies from the statistical perspective of the research take into account spatial scales that are larger than the plot, or from the agricultural area because the effects of agricultural practice on the environment and the impact of environmental conditions on agricultural areas cannot represent local phenomena from an agroecological point of view. they could be well analyzed at the regional level.⁶ Additionally, even if a relatively small system was analyzed, crop and animal production in such a small system would be influenced by both local and regional environmental conditions; that is, even a small area of agricultural land can be viewed as a complex ecosystem from an agroecological perspective. Thus, multivariate and multifactorial statistical approaches may be necessary to model and describe small systems accurately.

VI. CONCLUSION

Serbia is suitable for growing medicinal and aromatic plants. Since demand for medicinal plants in recent years has

shown growth in the world market. Works in spices, aromatic and medicinal herbs do not coincide with other works in the countryside. Production can also be organized on land of lower credit rating classes. Earnings are achieved with a certain risk in the initial phase, and later it becomes much safer when experience is gained. The cultivation of medicinal plants achieves a uniform quality and a safe amount of raw materials and enables compliance with deadlines, which is a great advantage in relation to the collection of raw materials from nature. By growing medicinal plants, it is possible to protect a large number of wild, endangered species whose collection is prohibited or restricted, which contributes to the preservation of the natural resources of our country.

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AUTHORS

First Author – Adel Moafa Phd,candidate

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