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Original Scientific paper

PREPARATIONS BASED ON MEDICINAL PLANTS USABLE IN URBAN AGRICULTURE

Abstract

The paper presents the possibilities of using different types of preparations prepared from certain types of medicinal plants, which can be used in plant nutrition and protection, as well as in the composting process for the needs of plant cultivation in urban agriculture. The trend of importance of urban agriculture, both in terms of food safety and innovative practices, is increasingly present in highly developed countries as well as developing countries. This type of agriculture can play an important role in justice and fairness in terms of food distribution, but also in improving air quality, biodiversity and ecosystem services. In this regard, the application of preparations based on medicinal plants introduces innovative methods of urban agriculture that can be considered a tool to ensure future food safety.

Key words: *preparations of medicinal plants for plant production, plant nutrition and plant protection products, compost, urban agriculture.*

INTRODUCTION

It is estimated that 68% of the world's population will live in cities by 2050. For the same year, it is estimated that the world population will reach 9.7 billion (United Nations, 2019). According to the Agenda for Sustainable Development, by the end of 2030, it will be necessary to double agricultural productivity and income of small food

producers, especially women, indigenous people, family farmers, livestock and fishermen, among other things through safe and equal access to land and other productive resources and inputs, knowledge, financial services, markets and opportunities for added value, i.e. for employment outside agriculture (United Nations, 2015). Considering that industrial agriculture is responsible for 11-15% of global carbon emissions, it is concluded that intensive production processes contribute to climate change (Açıksöz et al., 2021). In this regard, one of the possible tools for achieving the above goals is active work on the promotion and faster introduction of urban agriculture in this area.

The aim of the paper derived from the need to present one of the possible bioagrotechnical solutions (preparations based on medicinal plants) that can be used in the cultivation of plants in urban agriculture.

URBAN AGRICULTURE

According to the general definition, urban agriculture is a type of agriculture that develops in cities or very close to them, but can be more precisely defined as a system that serves the needs of the city using urban resources and supporting the cultivation, processing and distribution of agricultural products in cities (Mougeot, 2000). The concept of urban agriculture is developed as a solution to environmental and socioeconomic problems caused by rapid and unplanned urbanization policies due to excessive and unplanned population growth. It is a complex system that encompasses a wide range of interests, from activities related to production, processing, marketing, distribution and consumption of food, to opportunities for recreation and leisure, economic sustainability of the community, and renewal, rehabilitation and beautification of the environment.

Urban agriculture can also be a significant way to reduce unemployment in cities. In Detroit (USA), a large industrial centre that experienced bankruptcy, was offered urban agriculture as one of the solutions to reduce unemployment (Mogk et al., 2010, Colasanti et al., 2012, Walker, 2016), while in Paris (France) in June 2020, the largest roof garden in the world was opened, financed through a crowd funding campaign. In addition, due to the incidence/outbreak of the COVID 19 virus, the transport and delivery of food is greatly hindered, so local food production, whose distribution chains are shorter, can be seen as a new and more suitable production model. The examples from Sarajevo (Bosnia and Herzegovina) and Zagreb (Croatia), where urban agriculture was promoted as a measure to mitigate the effects of the COVID 19 virus pandemic, show that the region also monitors these changes in production, with the aim of providing food in every currently available. Similar initiatives to form urban gardens have been launched in cities in other countries in the region, such as Pula (Cro), Skopje (NM), Ljubljana (Slo), Maribor (Slo) and others.

It is important to distinguish between urban agriculture and other similar activities such as community gardening or growing plants for one's own needs. These other activities are primarily related to meeting different types of individual needs (food, decoration, landscape or ecological aspect), while urban agriculture is usually focused

on the production of plant raw materials for sale. The most common type of crop production in urban agriculture is vegetable production and spice plant production (Frazier, 2018), which most often takes place on unused parts of urban or suburban land, backyards, balconies, roofs, parts of existing parks, walls or parts of interiors. FAO supports the recognition of urban agriculture as a type of urban land use and economic activity integrated into national and local agricultural development strategies, nutrition and nutrition programs, improvement of production, processing and marketing systems, and urban planning, and also helps national and regional administrations optimize their policies and support services for urban agriculture (Umesha, 2018). Another positive phenomenon related to urban agriculture is its "closeness" to organic production. In general, the population is paying more and more attention to environmental issues, health, social and ethical issues and is looking for more value than ever in food, despite increasing urbanization. Consumers are mostly looking for fresh, less processed food from sustainable sources and are very aware of the importance of the quality of the food they consume and are interested in foods that can provide them with safety when it comes to risks related to certain food products, such as pesticides, additives in food, as well as the presence of antibiotics, hormones and steroids in meat (Simić, 2020). The methods of urban agriculture are closest to the methods used in organic and biodynamic production. One of these methods is mulching, which has proven to be environmentally justified in larger cities of the Republic of Serbia, and from the point of view of cost, mulching uses only about 50% of funds per m^2, compared to the classic model of growing greenery in cities (Popović, 2017). Another method that is used in organic production, and is also used in the cultivation of plants in urban agriculture, is composting (Filipović and Ugrenović, 2013). In urban production, as well as in organic production, the so-called "eco-corridors" or "flower belts" comprising strips 1-2 m wide containing different mixtures of annual and/or perennial cultivated and/or wild flower plant species (Filipović et al., 2011). Some of the flowering medicinal and aromatic species are especially suitable for the establishment of the so-called "isolation belts", which primarily serve as isolation between organic and conventional production or sources of potential contamination, and secondarily as a habitat for many species of pollinators, predators and parasitoids of harmful insects, which is of particular importance in improving ecosystem services and biodiversity in agro ecosystems (Ugrenović et al., 2012, Dainese et al., 2019).

The situation regarding urban agriculture in the Republic of Serbia has been improving in the last few years as evidenced by several projects implemented mostly by non-governmental organizations such as "Urban gardens are important", "Urban gardens from children's imagination", "Do you remember the court gardens?" and others, whose goal is to conduct training on the proper cultivation of various plant species in urban and suburban areas. The National Association for the Development of Organic Production "Serbia Organika", together with the Novak Đoković Foundation, have been implementing the "Alphabet of Good Habits" project since 2018, where children, parents, educators and other employees in preschool institutions in urban areas acquire knowledge about environmental protection, methods of organic production, collection of seeds in organic gardens, storage and preparation for sowing, interactions between plants in organic gardens and flower belts, composting and com-

post formed from plant residues from gardens and making preparations that can be used in nutrition and protection of plants in organic gardens and during composting.

PREPARATIONS BASED ON MEDICINAL PLANTS

One of the aspirations of work in urban agriculture is the reuse of different types of natural resources and urban plant waste, giving importance to the biological diversity (biodiversity) of plants and animals on land, water and air quality that contribute to food health and community preservation. One of the segments of such an approach is the use of different types of plants for the purpose of making preparations that are used as plant protection and nutrition and as soil improvers.

In addition to the well-known use of medicinal herbs in traditional (folk) and official medicine, medicinal herbs are increasingly used in the production of herbs. At the beginning of the twentieth century, the introduction of unknown production methods (biodynamic and organic) intensified work in the field of use of this type of plants in various types of plant production (field, vegetable, fruit and vineyard and others), but also in the production of various preparations i.e. natural means for plant nutrition and protection, compost and similar products (Filipović et al., 2021). For the preparation of preparations based on medicinal herbs, the most suitable moment for their picking, for the purpose of making these biological products, is from the beginning to full flowering, because in that period the listed species are richest in their active substances, and micro- and macroelements.

The application of preparations based on medicinal plants, in urban agriculture, satisfies the principles by which it is defined. For this purpose, there are several types of preparations that differ in the method of preparation. The most commonly prepared types of herbal preparations are as follows:

- Tea is made from fresh or dried plant parts over which boiling water is poured and left to stand for about 20 minutes. Then it is filtered and cooled, and depending on the type used, it is used immediately or first diluted with water (the most desirable rainwater or stagnant well water).
- Broth is prepared when cold water is poured over the chopped parts of the appropriate plant and left for 24 hours. After that, it is cooked for 15-30 minutes, then cooled and strained, and the liquid is used for treatment (spraying – usually diluted).
- Macerate is formed by pouring cold water (preferably rainwater) over the chopped parts of the plant and leaving it to stand for 24 hours. The macerate is filtered and liquid is used.
- Fermented extract is formed when cold water is poured over fresh (best) or dry plant parts and left outside until fermentation begins. The mass is stirred occasionally for 7-12 days. The fermentation is completed when the plant parts fall to the bottom of the vessel and the liquid clears. The extract must be diluted with water before treating the plants (usually it is a ratio of one part of the extract and 10 (20, 50) parts of water).

In production practice, mainly preparations made from one plant species are used – monocomponent preparations (Table 1).

Table 1. Different types of herbal preparations for plant protection and nutrition, soil improvement and for use as so-called "compost teas" in the composting process

Common name	**Plant species**	**Part used**	**Type of preparation**	**Purpose***
chamomile	*Chamomilla recutita* L.	flower	Tea	PPP, PPNSI, CT
stinging nettle	*Urtica dioica* L.	aboveground part; leaves	Macerate, fermented extract	PPP, PPNSI, CT
comfrey	*Symphytum officinale* Wallwort	leaves	Fermented extract	PPNSI, CT
dandelion	*Taraxacum officinalis* Weber	aboveground part; root	Tea, macerate, fermented extract	PPP, PPNSI, CT
garlic	*Allium sativum* L.	aboveground part	Tea, fermented extract	PPP, CT
horsetail	*Equisetum arvense* L.	aboveground part	Tea, broth, fermented extract	PPP, CT
tansy	*Tanacetum vulgare* L.	flower	Tea	PPP
yarrow	*Achillea millefolium* L.	aboveground part	Broth, macerate	PPP, PPNSI, CT
pot marigold	*Calendula officinalis* L.	flower	Macerate	PPP, CT
valerian	*Valeriana officinalis* L.	flower, aboveground part	Macerate	PPNSI, CT
marigolds	*Tagetes* sp.	flower	Tea, macerat	PPP
burdock	*Arctium lappa* L.	leaves	Macerate	PPP, CT

* Note: PPP – preparation for plant protection, PPNSI – preparation for plant nutrition and soil improvement and CT – "compost tea".

There are examples in practice where preparations are made using parts of multiple species – multicomponent preparations. Most often, nettles and garlic, nettles and common comfrey, nettles and field horsetail, etc., are mixed. In practice, preparations

are usually made depending on the purpose (presence of certain diseases and pests, the need for a certain mineral nutrition for certain plants or in the process of composting). An example of one of the recipes for making herbal preparations that is (can be) used in urban agriculture:

Fermented nettle and common comfrey extract. Chop 1 kg of above-ground mass of nettle and comfrey and immerse them in 10 litres of water (rainwater or stagnant water from the water supply) in PE barrel of 20 to 50 litres volume. When it stops foaming, i.e. in a few days, the preparation is filtered and diluted in a ratio of 1:10 with rainwater or stagnant tap water. During the application, the soil around the plants is watered, once a week, i.e. four times a month. It is used for plant protection and nutrition. In protection against plant lice, and in the nutrition as a preparation rich in nitrogen and potassium (Oljača et al., 2019).

In the previous research work, using different types of preparations based on medicinal plants, significant results have been achieved, both in terms of reducing the presence of economically important diseases and pests, and in terms of mineral nutrition of treated crops, which significantly increased productivity and quality of cultivated plants (Filipović et al., 2014, Filipović et al., 2016, Stoyanova, 2020). In the wheat crop, the highest mortality of aphids was obtained after the application of tobacco extracts (57.9%) and garlic (57.91%) (Iqbal et al, 2011). Preparations based on garlic and burdock, in a group of 24 botanical extracts, have shown satisfactory antifungal properties on the incidence of the fungus *Fusarium oxysporum f.sp. lycopersics* (Rongai et al., 2015). The content of plant-available forms of nutrients in the liquid preparation of nettle is 0.015% K_2O, 0.0019% P_2O_5 and total N 0.005%, while the content of these nutrients in the liquid preparation is similar (0.013% K_2O, 0.0024% P_2O_5 and total N 0.002%) (Garmendia et al., 2018). A significant number of scientific papers have been published with application in plant protection with the so-called botanical pesticides, whose experiences and results can be greatly used in the further development of the application of herbal preparations.

CONCLUSION

The application of preparations based on medicinal plants, in urban agriculture, satisfies the principles by which it is defined. By applying various methods such as flower belts, insulation belts, composting, mulching, by introducing a large number of different plant species in the production conditions of urban agriculture, and by applying such preparations, sustainable food is obtained and the environment in which it is performed is preserved. As urban agriculture is constantly growing, it is necessary to conduct research, i.e. develop but also promote methods such as the use of herbal preparations.

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Оригинални научни рад

ПРИПРАВЦИ НА БАЗИ ЛЕКОВИТОГ БИЉА КОЈИ СЕ МОГУ КОРИСТИТИ У УРБАНОЈ ПОЉОПРИВРЕДИ

Апстракт

У раду се приказују могућности употребе различитих врста приправака припремљених од појединих врста лековитог биља, а који се могу примењивати у исхрани и заштити биља, као и у процесу компостирања за потребе гајења биља у урбаној пољопривреди. Тренд значаја урбане пољопривреде како у погледу безбедности хране, тако и у иновативним праксама је све више присутан како у високоразвијеним, тако и државама у развоју. Ова врста пољопривреде може играти важну улогу у правди и правичности у погледу хране, али и унапређењу квалитета ваздуха, биодиверзитета и еко-системских услуга. С тим у вези, применом приправака на бази лековитог биља уводе се иновативне методе урбане пољопривреде које се могу сматрати алатом за осигуравање будуће сигурности хране.

Кључне речи: *приправци на бази лековитог биља за биљну производњу, средства за исхрану и заштитут биља, компост, урбана пољопривреда*