

PROSPECTS OF THE HOPS MARKET IN ROMANIA THROUGH THE PRISM OF COMMON AGRICULTURAL POLICY STRATEGIC PLAN 2023-2027 FOR ROMANIA

Irina-Adriana CHIURCIU¹, Ana Maria MORNA², Aurelia-Ioana CHEREJI²,
Daniela TUȚUI³, Andreea-Roxana FIRĂȚOIU¹

¹University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax: +40213182888, Mobile: +40744 6474 10, E-mails: chiurciu.irina@managusamv.ro, chiurciu.andreea@managusamv.ro

²University of Oradea, Faculty of Environmental Protection, 26 Magheru Blvd, Oradea, Bihor County, Romania, Emails: amorna@uoradea.ro, aurelia.chereji@uoradea.ro

³The Bucharest University of Economic Studies, 6 Piața Romană, 010374, Bucharest, Romania, Email: daniela.tutui@cig.ase.ro

Corresponding author: amorna@uoradea.ro

Abstract

The cultivation of hops, a traditional activity in the area of Transylvania, where the plants also meet good conditions for development, experienced a pronounced decline after 1990. The lack of funds for the establishment of crops and maintenance in the first years of vegetation, the special plant support system, the old varieties, the effects of climate change and the lack of an irrigation infrastructure have negatively influenced the development of hop farms. Despite the fact that processors have increased the demand for this crop, as a result of its multiple uses, in 2022 in Romania 165 ha were cultivated and a production of 191 tons was obtained, in only three counties in the heart of Transylvania, Alba, Mureș and Sibiu. Mureș County owned 75% of the areas cultivated with hops and 44% of the harvest obtained. At the same time, in the context of the decrease in local beer production, the quantitative and value imports of Romanian hop products also decreased. In order to revitalize this sector, the Common Agricultural Policy, through Strategic Plan 2023-2027 for Romania, has introduced a special Field of Intervention for hops and table grape growers (DR-17) which joins other interventions necessary for processing, for the establishment of producer groups, farmer training and consulting. Added to this is the support granted by Pillar I of the Common Agricultural Policy: Coupled income support (PD - 15), Eco-schemes (PD - 06) and Transitional National Aid (ANT - 5), which will represent an important support for farmers and will contribute to the increase of the surfaces and the production obtained

Key words: hop areas, hop production, imports of hop products, CAP SP 2023-2027 for Romania

INTRODUCTION

Hops is an important technical plant, whose female inflorescences (cones) represent the raw material for the beer industry and for the pharmaceutical industry. Approximately 90% of the production of hops and hop products is used for brewing beer [3], and in medicine the cones are used in the form of extracts or teas [11]. Thanks to the deep root system, they have because they are perennial, hop plants can prevent erosion and increase soil fertility. Thus, they can reduce the effects of climate change by preserving biodiversity and restoring soil properties, stopping degradation and desertification. In Romania, hops meet

favorable conditions for growth, in correlation with the demands of the plants regarding temperature and humidity, in the central area of Transylvania, in the counties of Mureș, Sibiu, Alba, Cluj or Hunedoara, where the investments in the support systems for plants were also made.

In these regions, hop plantations (hameiști – Romanian language) have a history of 500 years and have become local brands, thanks to the landscape they create. This is the case of the area adjacent to the city of Sighișoara [11].

Currently, the problems facing the hops sector are: aging plantations, deterioration of crop

support systems and insufficient farm equipment.

Due to the high costs for the establishment and maintenance of the culture (harvests are obtained 2-3 years after the establishment), respectively to the large number and complexity of the maintenance works of the culture, there is a risk of abandoning the production and the emergence of social problems, having considering the fact that some of the hop plantations are located in areas affected by natural constraints, unsuitable for other agricultural crops.

Hops began to be used also in aspects related to the circular economy, in order to get rid of post-production hop residues. They can be used in food as food additives [18].

At the same time, there was an increased interest at the European level for the expansion of hop cultures outside the traditional areas. Thus, a series of attempts were identified to increase the cultivation of hops in the Mediterranean basin, a fact that put increased pressure on the funds available at the European level [17]. The demand for hops has increased recently and as a result of the increasingly numerous uses of these plants, not only in the beer industry but also for other types of drinks, as a result of their properties. This growth was also felt in Romania, which in 2016 was on 20th place in the world in terms of areas and production of hops [19]. Although in Romania there is an increased demand for technical crops, including hops, domestic production ensured about 10% of the needs of the beer industry [10]. In the hop-growing counties and in their neighboring ones, there are microbrewery businesses, which produce craft beer according to traditional methods, known in those regions. Small brewers have an important role to play in this industry by influencing demand increasing the harvest of hops produced locally.

There is an increased national interest in local products, small producers being thus advantaged from this perspective [1].

The importance of hops domestically also results from the allocation of payment schemes for hop production, subject to the fulfillment of certain technical requirements.

These aids led in the period 2014-2019 to an average increase of 0.7% in the area cultivated with hops in Romania, from 243 ha in 2014 to 252 ha in 2019. However, the number of farmers who accessed the available support was reduced - only 3 farmers [7].

The new Common Agricultural Policy 2023-2027 required each member state to develop a Strategic Plan, starting from the analysis of the strengths and weaknesses, the opportunities and threats of the agri-food sector. This plan combines both market measures and financing for rural development projects [5].

The paper aims to identify the areas cultivated with hops, the average production and the total production of hops in Romania, as well as the quantitative and value imports of hops and hop products of Romania, in the period preceding the Common Agricultural Policy (CAP) Strategic Plan 2023-2027 for Romania, (PS PAC 2023-2027) and at the same time to present the forms of support that the mentioned program will grant, for the recovery of this sector and the preservation of traditional activities in the areas suitable for the cultivation of hops.

MATERIALS AND METHODS

To obtain the data presented in this article, the bibliographic method was used, and the authors studied specialized materials on the chosen topic, which were presented in the References section.

In order to highlight some aspects related to the hops market in Romania, the article analyzed the total areas cultivated with hops at the country level as well as in the main counties where there are plantations (Alba, Mureş and Sibiu), as well as the total and average productions of hops obtained in Romania and in hop-growing counties. The statistical data available on the National Institute of Statistics (NIS) website were used, for the year 1990 and for the period 2017-2022. The information regarding the quantitative and value imports of hops and hop products was taken from the International Trade Centre (ITC) website. At the same time, the Interventions from Pillar II, as well as the

Eco-schemes, Coupled Income Support and Transitional National Aids, from Pillar I of the CAP, were analyzed within the PS PAC 2023-2027 version 3.1 from 13.12.2023, to identify all the forms of support that the hops sector will benefit from in the new Multiannual Financial Framework.

RESULTS AND DISCUSSION

In 1990, 2,346 ha were cultivated with hops in Romania, most of the plantations being

located in the Macroregion One (2,130 ha), and especially in the Center Region (1,956 ha). In the year 2022, only 7.03% of the surfaces were still under cultivation.

During the analyzed period, 2017-2022, the size of the plantations decreased by 27.31%, the decline starting from 2018.

Compared to the year 1990, acknowledged counties disappeared from the map of hop growers: Cluj, Braşov and Hunedoara, and also 490 ha (Table 1).

Table 1. Areas cultivated with hops in Romania, in the period 1990-2022 (ha)

Specification	1990	2017	2018	2019	2020	2021	2022	2022/2017 %	2022/1990 %
TOTAL, of which:	2,346	227	255	252	246	171	165	72.69	7.03
Macroregion ONE, of which:	2,130	227	255	252	246	171	165	72.69	7.75
1. NORTH-WEST Region, of which:	174	-	-	-	-	-	-		
Cluj County	174	-	-	-	-	-	-		
2. CENTER Region, of which:	1,956	227	255	252	246	171	165	72.69	8.44
Alba County	203	33	66	68	66	33	28	84.85	13.79
Braşov County	100	-	-	-	-	-	-		
Mureş County	990	154	154	149	145	123	123	79.87	12.42
Sibiu County	663	40	34	34	34	14	14	35.00	2.11
Macroregion FOUR, of which:	216	-	-	-	-	-	-		
1. WEST Region, of which:	216	-	-	-	-	-	-		
Hunedoara County	216	-	-	-	-	-	-		

Source: own calculation after [12].

In 2022, 30,030 ha were cultivated with hops in the European Union. More than half of these surfaces (66.27%) were found in Germany, 19,900 ha. Other important growers were the Czech Republic 4,940 ha, Poland 1,730 ha and Slovenia 1,620 ha [8].

Romania was in 8th place and for the period 2017-2022, the largest decrease in surfaces was noted in Sibiu County - 65%, well below the average of 27.31 as recorded at the country level.

In 2022, hop plantations were concentrated in 3 counties: Alba, Mureş and Sibiu, from the Center Region - Figure 1.

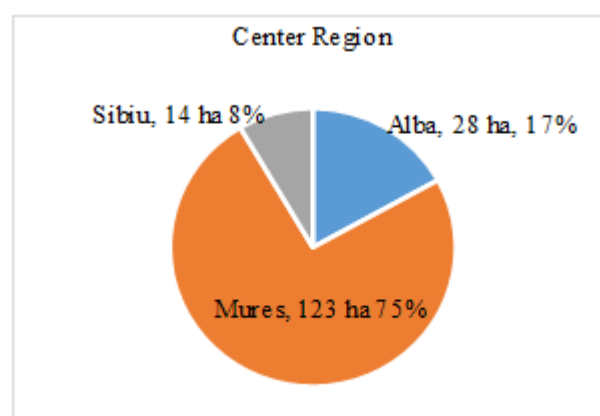


Fig. 1. The distribution of the hop cultivated surfaces in 2022, in Romania

Source: own representation after [12].

It should be mentioned that the form of ownership of the plantations is private, and Mureş County totaled three fourths of the country's hops area.

A study conducted by the authors, from 2015, showed that in 2013, the country's hop plantations were also found in the 3 counties (Mureş County - 76%, Alba County - 16% and Sibiu County - 8%), with approximately the same percentages, although in 2013 the area cultivated with hops was 239 ha [6].

Farmers believe that the main cause of the decline of hop plantations in Romania is the deterioration of the infrastructure necessary for the development of the plants (Photo 1), caused by the negligence of the state or of the new owners resulted from privatization [14].



Photo 1. Hop plantation
 Source: [14].

Another reason for the decrease in areas is climate change, which Romanian hop growers have to face, collaborating with research institutes to find drought-resistant varieties [16]. At the same time, the development of irrigation infrastructures can ensure the success of these businesses in the future, because it is known that hops are a big consumer of water. The decrease in hop areas is also caused by the existence of old hop varieties, which are over 25 years old and are approaching the end of their optimal production period [11]. The reluctance of farmers to establish new plantations starts from the fact that an investment of 60,000 euros is necessary for one hectare of hops. The plantation bears fruit only from the third year after its establishment, and the annual maintenance expenses should not be neglected either, which for one hectare of hops represent 6,500-7,000 euros [16].

In terms of production, 47,580 tons of hops were harvested in the European Union in 2022, and the main producers were: Germany - 34,400 tons, Czechia - 4,450 tons, Poland - 3,420 tons and Slovenia - 2,280 tons. Romania took the 8th place again [8].

Despite the fact that the areas cultivated with hops have decreased, there is an increase in total production by 154.03% in total per country, in the period 2017-2022 - Table 2. However, the production obtained in 2022 represented approximately 8% of the harvest the year 1990.

Table 2. Hops production obtained in Romania, in the period 1990-2022 (tons)

Specification	1990	2017	2018	2019	2020	2021	2022	2022/2017 %	2022/1990 %
TOTAL,	2,451	124	219	218	213	208	191	154.03	7.79
of which:									
Alba County	245	20	40	53	45	26	63	315.00	25.71
Mureş County	1,263	79	118	99	96	93	85	107.59	6.73
Sibiu County	569	25	61	66	72	89	43	172.00	7.56

Source: own calculation after [12].

All 3 counties where hops were cultivated recorded increases in production, a special situation being noted in Alba County, where the increase was the highest - 315%.

Figure 2 shows that Mureş County obtained 44% of the total hop harvest of 2022, while Sibiu had 23%.

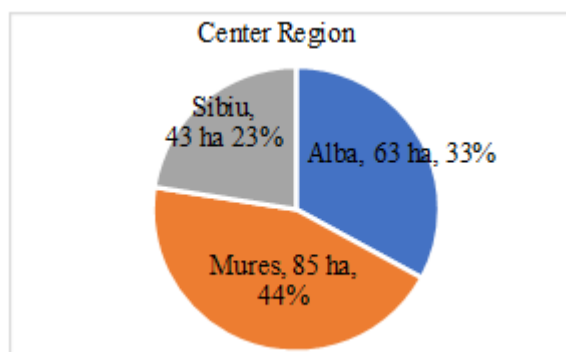


Fig. 2. The distribution of the hop production in 2022, in Romania

Source: own representation after [12].

According to Chiurciu, 2015 [6], in 2013 the hop production of 172 tons was distributed as follows: Mureş 77%, Sibiu 17% and Alba 6%. Therefore, after 9 years, Sibiu and Alba

counties recorded an increase in the share of the country's total hop production, and Mures county a decrease from 77% to 44%.

The average production of hops at the country and county level registered spectacular increases both compared to 1990 (110.62%), and during the period under study - 211.72% (Table 3). Sibiu County recorded the highest increase - 477.44% in 2022 compared to 2017, and Mureş County is the exception, where compared to 1990 the average production decreased by approximately 45%.

The average production of hops (kg/ha) placed Romania in the 8th place in the European Union, but this time the first place was occupied by Italy – 3,130 kg/ha [8].

Table 3. Average production of hops obtained in Romania, in the period 1990-2022 (kg/ha)

Specification	1990	2017	2018	2019	2020	2021	2022	2022/2017 %	2022/1990 %
TOTAL,	1,045	546	860	866	867	1,217	1,156	211.72	110.62
of which:									
Alba County	1,207	606	605	775	678	778	2,266	373.93	187.74
Mureş County	1,276	513	764	663	662	756	691	134.70	54.15
Sibiu County	858	625	1,789	1,937	2,095	6,176	2,984	477.44	347.79

Source: own calculation after [12].

The value (Figure 3) and quantitative (Figure 4) imports of Romania, in the category mentioned by ITC "Hop cones, fresh or dried, whether or not ground, powdered or in the form of pellets; lupulin" recorded decreases in the period 2018-2022, by 35.24% and 34.87%, respectively.

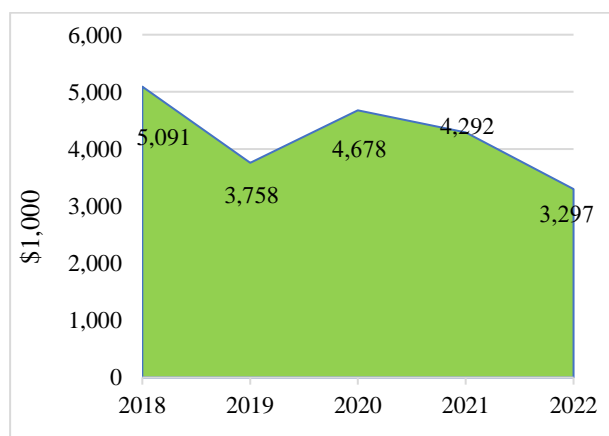


Fig. 3. Value imports of hop products of Romania in the period 2018-2022 (\$ 1,000)

Source: own representation after [9].

The main partners, from which Romania imported in 2022 "Hop cones, fresh or dried, whether or not ground, powdered or in the form of pellets; lupulin" were: Germany (\$ 2,564 thousand), Czech Republic (\$ 365 thousand) and Slovenia (\$ 347 thousand) [9], the main growers and producers of hops in the European Union.

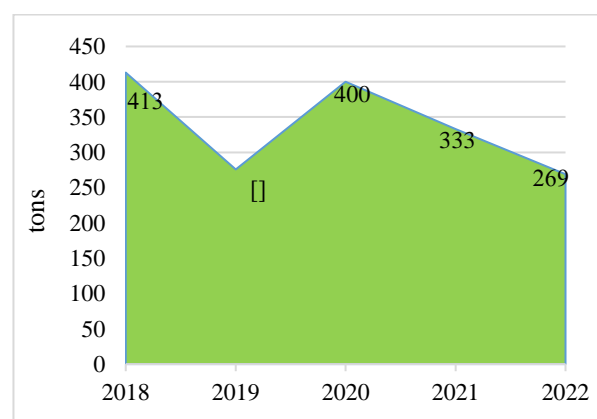


Fig. 4. Quantitative imports of hop products for Romania in the period 2018-2022 (tons)

Source: own representation after [9].

Romania is not a top importer and in 2022 it ranked 31st worldwide in terms of quantitative imports and 33rd in terms of value imports. The first places were occupied by United Kingdom, USA and Germany [9].

These decreases in imports are the result of the decrease in Romania's beer production, which in 2022 was 15.8 million hectoliters, 5% less than in 2021. 97% of the demand was covered by local factories [15]. This situation was due to the closure of some factories known for beer and the reduction of average beer consumption, from 1,673 l monthly/person in 2021 to 1,609 l monthly/person in 2022 [13].

In order to preserve the biodiversity and vocation of the Transylvanian areas, for the first time since the implementation of the National Rural Development Programs, after the accession to the European Union, an intervention addressed to hop growers was introduced within the PS PAC 2023-2027: DR-17, *Investiții în sectoarele hamei și/sau struguri de masa / Investments in the hops and/or table grape sectors*. This concerns the necessary investments for the reconversion, establishment and modernization of holdings, including conditioning, and 45 million euros have been allocated for this. It has the following provisions:

-The investment must be made within a farm with an economic size of at least 4,105 SO for hops. Considering the fact that 1 ha cultivated with hops has a SO value (Standard output coefficient) of 2,863.09 euro/ha, the economic agent that will access the funds must own at least 1.45 ha, to exceed the requested threshold of 4,105 euros [2].

-The maximum amount of public support is 1,000,000 euros/project, with the exception of projects that only purchase machinery and agricultural equipment and which will receive a maximum of 300,000 euros/project.

-The intensity of the non-reimbursable public support will represent 65% of the eligible costs [4].

DR-17 is included in Pillar II of the PAC, Rural Development, where there are also other useful interventions for hop growers, intended for:

-hop processing - DR-22 and DR-23,

-increasing the resilience of farms and stabilizing incomes - DR-31 and DR-32,

-creation of producer groups and cooperation - DR-33, DR-34 and DR-35,

-training of farmers - DR-37,

-counseling - DR-38.

Farmers who grow hops will also receive other support schemes, related to Pillar I of the CAP:

-Young farmers (*Sprijin complementar pentru venit pentru tinerii fermieri / Supplementary income support for young farmers*), up to 40 years

-CRISS 1 - 50 Ha (*Sprijin redistributiv complementar pentru venit în scopul sustenabilității / Complementary redistributive support for income for the purpose of sustainability*)

-BISS (*Sprijin de bază pentru venit în scopul sustenabilității / Basic Income Support for Sustainability*)

-Eco-schemes:

PD-06 - *Înierbarea intervalului dintre rânduri în pepiniere, plantațiile viticole, pomicele și hameiști / Planting the interval between rows in nurseries, vineyards, orchards and hop plantations* (hameiști – Romanian language) -

will contribute to the conservation and increase of the biodiversity of plantations, the protection of the environment, as well as the protection and reconstruction of local habitats.

It provides that at least 75% of the plantation surface must be kept grassed or will be grassed, between June 15 and October 15, without carrying out any agricultural works.

The unit amount planned for the period 2023-2027 is 85.5 euros/ha.

-CIS - *Sprijin cuplat pentru venit / Coupled income support*:

PD-15 - *Sprijin cuplat pentru venit – Hamei / Coupled income support – Hops* - involves the granting of a single payment per eligible hectare, linked to plant production, and requires the farmer to have a contract with a hop processing unit which provides the raw material for the production of beer or with a processing unit for pharmaceutical purposes.

The indicative plannable amount in 2023 was of 599.91 euros/ha.

In this way, the beer processing industry in Romania is also supported, a sector which is currently in difficulty.

-Transitional National Aid (ANT) will be an important component of support:

ANT - 5, Hops - provides the financial packages for the period 2023-2027 showed in Table 4,

Table 4. The annual financial package for hops, in the period 2023-2027 allocated through ANT – 5, decoupled payment for hops (Euro)

Specification	2023	2024	2025	2026	2027
Financial package	84,000	75,600	67,200	58,800	50,400

Source: [11].

According to Surca, 2018 [19], hops is a profitable crop even without subsidies, and the average income-cost ratio is 1.0531:1 (without subsidies) and 1.1256:1 (when grants are given). In order to obtain these results, farmers must overcome the problems related to the establishment of crops and the maintenance of the plantations until the bearing of the fruit.

With the support granted by PS PAC 2023-2027, this culture could bring significant gains to farmers and the production obtained could be easily capitalized on the national market.

CONCLUSIONS

The multiple uses of hops are likely to lead to an increase in the cultivated area, the internal potential being still far from being reached.

Hop culture is a culture with high potential both at European and national level. and it is suitable in certain favorable areas of the country, where cereals are less cultivated.

The challenge is given by the need for good harmonization between current or potential producers and other relevant actors in the field. Greater attention is thus required to the infrastructure specific to the hop culture, infrastructure often affected by the lack of interest of the new owners.

Another challenge that needs to be solved is that of climate change, which has a disproportionate effect on hop crops and requires specific adaptations.

Mureș county was the main grower and producer of hops in Romania, owning in 2022 - 123 ha of hops and obtaining a production of 83 tons.

The decrease in beer consumption also influenced the decrease in production, which led to a decrease in the value and quantity of imports of hop products, by 35.24% and 34.87%, respectively, in the period 2018-2022.

At the same time, the positive impact of European funding on hop crops is noted. The funds allocated under the Common Agricultural Policy have the role of stopping the decline and implicitly increasing the areas with hops.

PS PAC 2023-2027 will support this sector through forms of support related to both Pillar I and through interventions from Pillar II, of which DR - 17 stands out, for the recovery of traditional activities in the center of Transylvania and microbrewery businesses, which will contribute to the development of the rural area.

REFERENCES

- [1]Agro-Business, 2021. Micile afaceri românești cu bere, reale șanse de reușită/ Small Romanian beer businesses, real chances of success. In press, : <https://www.agro-business.ro/micile-afaceri-romanesti-cu-bere-reale-sanse-de-reusita/2021/08/26/>, Accessed on 09.01.2024.
- [2]Agency for Financing Rural Investments/ AFIR, 2024. Calculul SO/ SO Calculation, <https://so.afir.info/SOVegetal/Index2017>, Accessed on 12.01.2024.
- [3]Bober, A., Liashenko, M., Protsenko, L., Slobodyanyuk, N., Matseiko, L., Yashchuk, N., Gunko, S., Mushtruk, M., 2020, Biochemical composition of the hops and quality of the finished beer. *Potravinarstvo Slovak Journal of Food Sciences*, vol. 14, 2020, no. 1, 307-317, <https://doi.org/10.5219/1311>.
- [4]Chereji, A.I., Chiurciu, I.A., 2022, Dezvoltare rurală post 2020. Oportunități și provocări/ Rural development post 2020. Opportunities and challenges, Estfalia Publishing House, Bucharest, 2022, 89-90.
- [5]Chereji, A.I., Maurescu, C.M., Tutui, D., Chereji, I.J., Chiurciu, I.A., 2023, Rural development from policy to politics. National Strategic Plans and their potential impact on social structural transformations. Comparative overview. Case study Romania between the European and National context. *Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development"*, Vol. 23(1), 103-110.

- [6]Chiurciu, I.A., 2015, Study on the evolution of the hop market in Romania during the period 2007-2014. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", Vol. 15(2), 53-56.
- [7]Dumitru, E.A., Stoica, D.G., 2020, Impact of Coupled Support on Surfaces and Productions of Main Crops that Benefit from This Type of Support. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol. 20(4), 153-160.
- [8]Eurostat, 2024, Database, : <https://ec.europa.eu/eurostat/data/database>, Accessed on 09.01.2024.
- [9]International Trade Centre / ITC, 2024. Import of goods, available at: <https://intracen.org/resources/data-and-analysis/trade-statistics>, Accessed on 11.01.2024.
- [10]Ministry of Agriculture and Rural Development / MADR, 2020. Analiza SWOT Planul Național Strategic 2021- 2027 / SWOT Analysis of the National Strategic Plan 2021-2027, version 3, https://www.madr.ro/docs/dezvoltare-rurala/PAC_dupa_2020/2021/analiza_swot_pns-versiunea_III.pdf, Accessed on 13.01.2024.
- [11]Ministry of Agriculture and Rural Development / MADR, 2024. PS PAC 2023-2027 / CAP Strategic Plan 2023-2027 for Romania, version 3.1 of 13.12.2023, <https://www.madr.ro/docs/dezvoltare-rurala/2023/Plan-Strategic-PAC-2023-2027-versiunea-3.1.pdf>, Accessed on 13.01.2024.
- [12]National Institute of Statistics/NIS, 2024, Area and vegetable agricultural production, www.insse.ro, Accessed on 10.01.2024.
- [13]National Institute of Statistics/NIS, 2024, Average monthly consumption of food products per person, by social category, macro-regions and development regions, www.insse.ro, Accessed on 10.01.2024.
- [14]Nițu, F., 2019, Cultura de hamei a scăzut de nouă ori de la Revoluție până în prezent, de la 2.300 ha la 250 ha / Hop culture has decreased nine times since the Revolution until now, from 2,300 ha to 250 ha. In press: Ziarul financiar 10.10.2019, <https://www.zf.ro/companii/cultura-de-hamei-a-skazut-de-noua-ori-de-la-revolutie-pana-in-prezent-de-la-2-300-ha-la-250-ha-18448040>. Accessed on 10.01.2024.
- [15]Panaete Dedi, M., 2023, Producția de bere a cunoscut două vârfuri de consum, în 2008 și 2012, însă între timp s-a întors în zodia scăderilor / Beer production experienced two consumption peaks, in 2008 and 2012, but in the meantime, it returned to the sign of decline. In press: Ziarul financiar 16.10.2023, available at: <https://www.zf.ro/zf-25-years/zf-25-years-economic-indicators/zf-25-years-beer-production-has-known-two-peaks-of-consumption-in-22157942>. Accessed on 10.01.2024.
- [16]Panaete Dedi M., 2023, Cât costă să înființezi o cultură de hamei: investiția la hectar este de 60.000 de euro, iar întreținerea 6.500-7.000 de euro / How much does it cost to establish a hop culture: the investment per hectare is 60,000 euros, and the maintenance 6,500-7,000 euros. In press: Ziarul financiar 08.05.2023, <https://www.zf.ro/zf-agropower/zf-agropower-cat-costa-sa-infiintezi-o-cultura-de-hamei-investitia-21854444>. Accessed on 10.01.2024.
- [17]Rossini, F., Virga, G., Loreti, P., Iacuzzi, N., Ruggeri, R., Provenzano, ME, 2021, Hops (*Humulus lupulus* L.) as a Novel Multipurpose Crop for the Mediterranean Region of Europe: Challenges and Opportunities of Their Cultivation. Agriculture, Vol. 11, Issue 6, 484, <https://doi.org/10.3390/agriculture11060484>.
- [18]Salanta, L.C., Fărcas, A.C., Borsa, A., Pop, C.R., 2023, Current strategies for the management of valuable compounds from hops waste for a circular economy. Food Chemistry: X, Vol. 19, 100876, <https://doi.org/10.1016/j.fochx.2023.100876>.
- [19]Surca, E., 2018, Evolution of the economic and technical indicators for hops culture in Romania. A retrospective of the last decade, 2006-2016. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", Vol. 18(3), 449-454.