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Conference Paper

Trends in area and production of vegetables, future projections in Romania

Provided in Cooperation with:

The Research Institute for Agriculture Economy and Rural Development (ICEADR), Bucharest

Suggested Citation: Sterie, Cristina Maria (2023) : Trends in area and production of vegetables, future projections in Romania, In: Rodino, Steliana Dragomir, Vili (Ed.): Agrarian Economy and Rural Development - Trends and Challenges. International Symposium. 14th Edition, The Research Institute for Agricultural Economy and Rural Development (ICEADR), Bucharest, pp. 195-200

This Version is available at:

<https://hdl.handle.net/10419/301781>

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TRENDS IN AREA AND PRODUCTION OF VEGETABLES, FUTURE PROJECTIONS IN ROMANIA

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Abstract: *This study analyzes the state of vegetable cultivation and production in the European Union, with a focus on Romania. In 2022, Romania ranked 6th in the EU in terms of vegetable acreage but experienced a significant decline, and using SPSS, we forecast vegetable production and cultivation trends. Projections for 2030 suggest varying scenarios, reflecting the challenges and uncertainties in agriculture. This research underscores the need for innovation and sustainability to navigate the evolving agricultural landscape.*

Keywords: *agriculture, vegetable, SPSS, Romania.*

JEL classification: Q1, Q13.

INTRODUCTION

Horticulture is the branch that focuses on the cultivation of fruits, vegetables, flowers and trees, which in itself is an ancient discipline that focuses on cultivation on small and medium-sized plots (Andreica & Roman, 2023). Horticulture, in history, represents the practice that has played a key role in feeding the population, providing food as well as plants that contribute to the aesthetics of the environment.

Vegetables play a basic role in nutrition, supporting the health and functioning of biological systems, The nutritional balance that vegetables provide brings various benefits to our diet, supplying minerals, vitamins and antioxidants essential for the functioning of human body processes (Maxim et al., 2020). In addition to the nutritional components, vegetables contribute to the diversification of the diet, giving taste to food (Ana Ruxandra et al., 2018).

Vegetable farming involves complex techniques, starting from soil preparation, cultivation, protection against diseases and pests, to harvesting and distribution. From an ecological perspective, vegetable farming can be considered a sustainable and responsible method of agriculture, through which both the environment and natural resources can be protected (Ladaru et al., 2020).

Today, the agricultural sector faces various challenges in the context of ensuring food security and protecting the environment.

Climate change is the main major challenge farmers face and have to adapt to, encountering extreme weather events (Jankelova et al., 2018). Disease and pest resistance is another challenge, so insecticides and pesticides have become ineffective in the fight to keep plants healthy (Tudor et al., 2023).

Changes in food preferences as well as product quality are demands that consumers have become increasingly concerned with and to which farmers need to respond and adapt (Boca, 2021; Dumitru et al, 2023), Thus, that the vegetable sector, is in a continuous transformation, where new agricultural practices need to be adapted to ensure a suitable environment and high quality vegetables (Giuca & Petre, 2022).

Romania's vegetable supply chain requires a total reorganization in order to reach its true potential, i.e, to cover consumption needs and become competitive not only at national level but also at EU level (Drigă, 2018).

MATERIALS AND METHODS

The research is based on statistical information provided by Eurostat and NSI, on the basis of which estimates are made using SPSS statistical software.

SPSS is a data processing application and one of the most popular among researchers, assisting in organizing data, calculating statistical indicators, checking hypotheses and performing advanced statistical analyses.

The forecasting capabilities included in SPSS involve advanced methods that overcome the limitations of other traditional methods, allowing the use of advanced statistical techniques to generate forecasts.

The aim of this work is to provide an overview of the evolution of vegetable areas and production in the European Union and Romania and to make forecasts up to 2030.

RESULTS AND DISSCUSION

Romania ranks 6th in terms of the area cultivated with vegetables in 2022 in Europe, being ahead of countries such as Italy (385 thousand ha), Spain (366 thousand ha), France (274 thousand ha), Poland (160 thousand ha) or Germany (122 thousand ha) (Table 1).

Table 1. Evolution of areas under vegetables in Europe 2010-2022 (1000 ha)

| Country | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Italy | 487,6 | 412,09 | 403,77 | 349,31 | 426,63 | 422,9 | 430 | 418,38 | 418,12 | 420,86 | 413,74 | 413,86 | 385,56 |
| Spain | 326,96 | 316,01 | 318,22 | 318,51 | 355,81 | 354,68 | 373,77 | 380,08 | 372,88 | 380,22 | 380,98 | 396,57 | 366,85 |
| France | 245,5 | 243,5 | 243,19 | 186,53 | 243,11 | 235,53 | 249,5 | 259,14 | 257,82 | 256,18 | 277,36 | 288,32 | 274,63 |
| Poland | 199,5 | 238,4 | 235,3 | 187,8 | 184,40 | 188,8 | 217,44 | 191,98 | 190,39 | 190,10 | 175,80 | 172,90 | 160,00 |
| Germany | 107,82 | 108,61 | 111,46 | 109,06 | 111,26 | 110,9 | 117,39 | 124,96 | 122,69 | 123,86 | 123,04 | 128,47 | 122,68 |
| Romania | 169,96 | 174,14 | 170,66 | 166,06 | 149,76 | 150,57 | 141,5 | 138,56 | 140,35 | 143,31 | 113,02 | 113,15 | 93,10 |

Source: Eurostat,eu database, accessed July 2023.

An analysis of the areas cultivated with vegetables in Romania shows that in the year 2022, it will decrease compared to 2014 by 37,8% and compared to 2021 by 17,7% (Table 1).

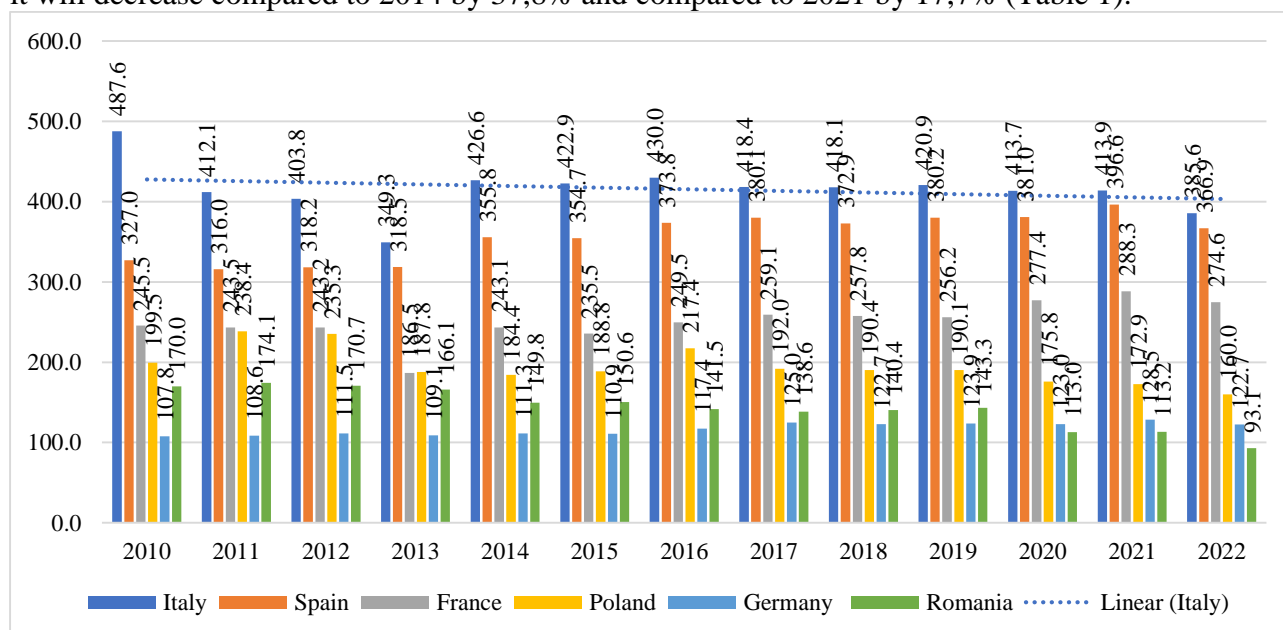


Figure 1. Evolution of areas under vegetables 2010-2022

Source: Eurostat,eu database, accessed July 2023.

At the regional level, it can be seen that in 2014, the South-Muntenia, North-East, South-West Oltenia and South-East regions each have a share of more than 15% of the total area under vegetables. In 2021, this ranking changes, with the North-East Region taking first place with a share of 20% of the total area under vegetables, In 2022 there is a decrease of 11,28% in the area under vegetables compared to the previous year, with the highest shares in the North-East Region with 20%, followed by the South-Muntenia Region with 19% (Table 2).

Table 2. Evolution of areas under vegetable cultivation in Romania by Development Regions in the period 2010-2022 (ha)

| Development regions | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| TOTAL | 262,692 | 263,359 | 258,910 | 259,029 | 239,474 | 239,494 | 228,124 | 224,571 | 226,328 | 227,720 | 200,501 | 197,677 | 177,632 |
| NORTH-WEST Region | 23,651 | 22,840 | 22,298 | 23,965 | 23,293 | 21,887 | 23,015 | 22,736 | 22,994 | 22,909 | 21,420 | 21,342 | 18,524 |
| CENTRAL Region | 17,418 | 17,765 | 17,171 | 18,786 | 17,566 | 19,951 | 18,623 | 18,502 | 18,703 | 18,561 | 16,139 | 16,410 | 14,561 |
| NORTH-EAST Region | 45,439 | 46,605 | 45,378 | 46,160 | 43,122 | 43,811 | 40,222 | 40,212 | 42,330 | 42,526 | 37,249 | 39,452 | 35,334 |
| SOUTH-EAST Region | 43,936 | 43,462 | 42,638 | 42,900 | 36,267 | 35,798 | 34,600 | 32,474 | 31,937 | 31,505 | 29,275 | 27,487 | 24,688 |
| SUD-MUNTENIA Region | 51,058 | 50,710 | 50,183 | 48,224 | 45,569 | 45,396 | 41,778 | 41,157 | 41,327 | 43,430 | 33,600 | 35,632 | 34,387 |
| Bucharest - Ilfov Region | 5,443 | 5,916 | 5,645 | 6,004 | 5,495 | 5,425 | 5,337 | 5,491 | 5,416 | 5,287 | 5,262 | 5,596 | 4,150 |
| SOUTH-WEST OLTENIA Region | 46,565 | 45,439 | 45,181 | 40,318 | 37,786 | 37,334 | 35,271 | 35,506 | 35,022 | 34,685 | 28,280 | 28,391 | 24,704 |
| WEST Region | 29,182 | 30,622 | 30,416 | 32,672 | 30,376 | 29,892 | 29,278 | 28,493 | 28,599 | 28,816 | 29,275 | 23,367 | 21,284 |

Source: NSI, accessed July 2023;

In 2022, Spain will have the highest vegetable production with 8,8 thousand tones, followed by Italy with 8,5 thousand tones and Poland with 2 thousand tons. In Greece there is a decrease of about 31% in 2022 (1,6 million tons) compared to the production in 2010 (2,4 million tons).

Romania ranks 8th in total vegetable production, with a production of 726 thousand tons in 2022, down 50% compared to 2010 (1,4 million tons) (Table 3).

Table 3. Evolution of vegetable (including melon) production in Europe 2010-2022 (1000 t)

| Country | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|--------|-------|
| Spain | - | - | - | - | - | 9,285 | 9,767 | 9,885 | 9,485 | 10,088 | 9,616 | 10,309 | 8,799 |
| Italy | - | - | - | - | - | 8,668 | 8,807 | 8,320 | 8,161 | 8,200 | 8,707 | 9,115 | 8,544 |
| Poland | 568 | 579 | 630 | 623 | 1,549 | 1,498 | 1,652 | 1,705 | 1,735 | 1,697 | 1,702 | 1,988 | 2,078 |
| Netherlands | 1,675 | 1,642 | 1,629 | 1,649 | 1,647 | 1,729 | 1,708 | 1,784 | 1,770 | 1,842 | 1,883 | 1,871 | 1,720 |
| Portugal | - | 1,459 | 1,606 | 1,411 | 1,680 | 1,641 | 1,938 | 2,005 | 1,577 | 1,752 | 1,733 | 2,094 | 1,673 |
| France | - | - | - | - | 1,485 | 1,502 | 1,591 | 1,537 | 1,429 | 1,452 | 2,196 | 2,171 | 1,663 |
| Greece | 2,422 | 2,374 | 2,147 | 2,387 | 2,365 | 2,291 | 2,185 | 2,052 | 1,997 | 1,652 | 1,858 | 1,879 | 1,661 |
| Romania | 1,465 | 1,723 | 1,401 | 1,540 | 1,431 | 1,360 | 1,228 | 1,353 | 1,438 | 1,313 | 1,259 | 1,303 | 726 |

Source: Eurostat.eu database, accessed July 2023

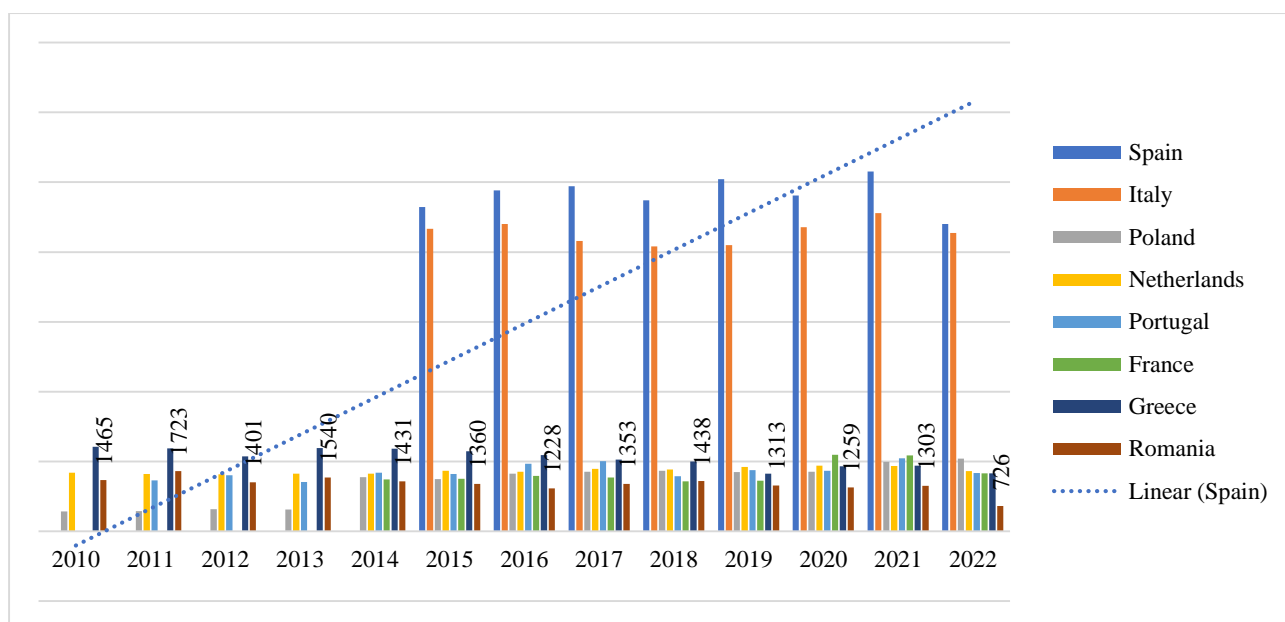


Figure 2. Vegetable (including melon) production in Europe 2010 - 2022 (1000 ha)

Source: Eurostat,eu database, accessed July 2023;

Table 4. Evolution of vegetable production in Romania by development regions in the period 2010-2022 (thousand tonnes)

| Development regions | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| TOTAL | 3,863.6 | 4,176.3 | 3,535.3 | 3,961.0 | 3,802.5 | 3,673.5 | 3,358.4 | 3,638.4 | 3,797.4 | 3,529.6 | 3,483.0 | 3,495.1 | 2,426.1 |
| NORTH-WEST Region | 342.7 | 354.0 | 314.1 | 352.5 | 358.2 | 339.3 | 344.1 | 366.5 | 368.1 | 341.3 | 381.5 | 342.4 | 246.2 |
| CENTRAL Region | 247.4 | 273.1 | 230.3 | 266.2 | 267.1 | 277.6 | 267.5 | 280.0 | 288.7 | 269.9 | 268.3 | 274.1 | 187.5 |
| NORTH-EAST Region | 610.4 | 665.2 | 571.7 | 666.7 | 644.0 | 596.7 | 498.2 | 534.5 | 602.6 | 557.8 | 583.4 | 646.1 | 440.4 |
| SOUTH-EAST Region | 750.9 | 791.2 | 605.3 | 726.0 | 636.1 | 623.1 | 581.1 | 611.4 | 624.0 | 577.9 | 567.8 | 564.0 | 373.7 |
| SUD-MUNTENIA Region | 769.3 | 813.0 | 703.0 | 755.8 | 781.1 | 776.3 | 681.9 | 724.1 | 732.4 | 712.9 | 605.9 | 625.1 | 489.3 |
| Bucharest - Ilfov Region | 90.3 | 122.2 | 89.9 | 108.3 | 91.1 | 91.2 | 72.6 | 81.5 | 87.7 | 74.9 | 92.9 | 102.5 | 54.7 |
| SOUTH-WEST OLTENIA Region | 675.8 | 722.8 | 644.3 | 633.5 | 601.7 | 565.6 | 528.6 | 614.3 | 645.0 | 587.7 | 515.3 | 565.0 | 343.0 |
| WEST Region | 376.8 | 434.8 | 376.7 | 451.8 | 423.3 | 403.8 | 384.4 | 426.1 | 449.0 | 407.1 | 468.0 | 376.0 | 291.3 |

Source: NSI, accessed October 2023;

Total vegetable production in Romania has been variable over the years, peaking in 2011 (4176,3 thousand tonnes) and decreasing significantly by 2012 (3535,3 thousand tonnes). A slight increase followed, but production levels were generally lower in the period 2012-2022.

In 2010, the South-Muntenia region ranked first in total vegetable production with 769,3 thousand tonnes, followed by the South-East region with 750,9 thousand tonnes and the North-East with 610,4 thousand tonnes. In the year 2022, the first places in vegetable production were occupied by the South-Muntenia region with 489,3 thousand tonnes, the North-East with 440,4 thousand tonnes

and the South-East with 373,7 thousand tonnes, It is worth mentioning that in 2022, all regions recorded decreases compared to the production recorded in 2010 (Table 4).

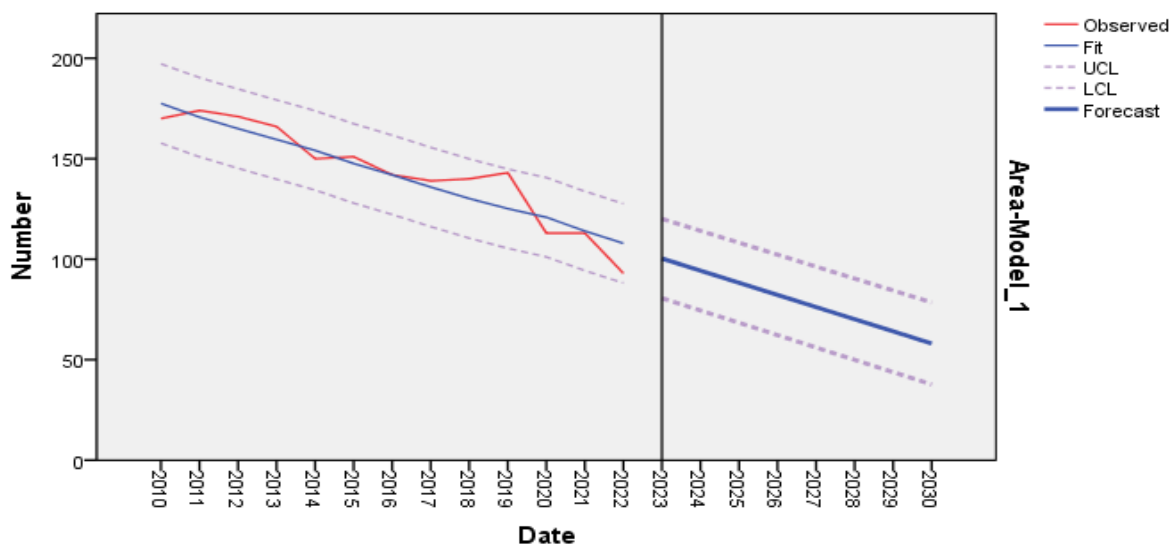


Figure 3. Estimated area under vegetables in Romania

Source: own processing based on Eurostat 2023;

In 2010, Romania cultivated 170 thousand hectares of vegetables, reaching 93 thousand hectares in 2022. According to estimates made in SPSS, the area under vegetable cultivation will reach 60 thousand hectares in 2030, while the optimistic variant estimates a production of 75 thousand hectares and the pessimistic variant estimates 40 thousand hectares (Figure 3).

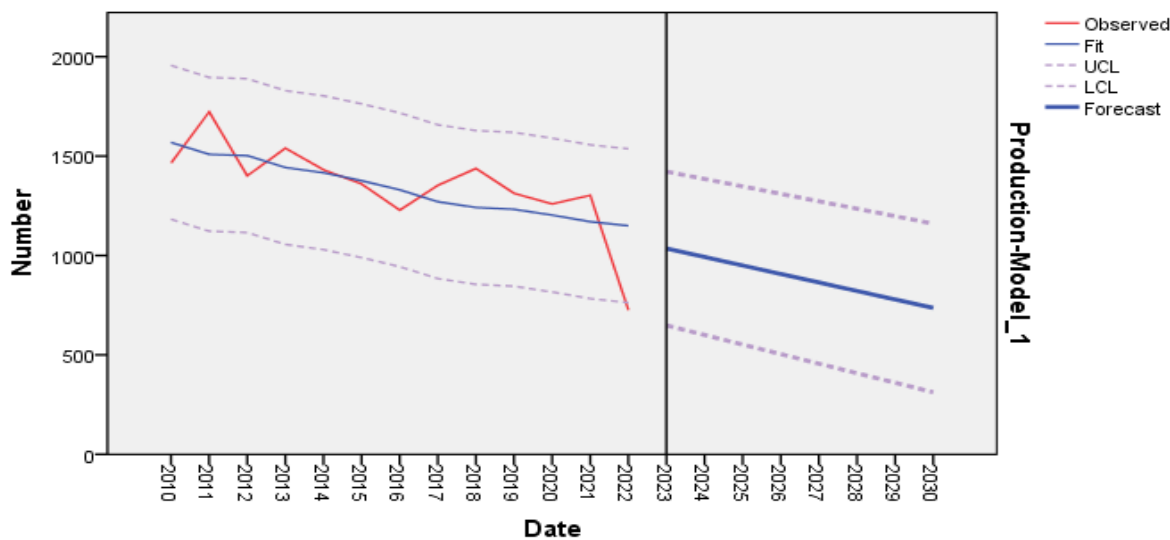


Figure 4. Estimated vegetable production in Romania

Source: own processing based on Eurostat 2023;

In 2010, Romania produced 1465 thousand tons of vegetables, reaching 726 thousand tons in 2022. According to estimates made in SPSS, vegetable production will reach 750 thousand hectares in 2030, while the optimistic variant estimates a production of 1200 thousand tonnes and the pessimistic variant estimates 400 thousand tonnes (Figure 4).

CONCLUSIONS

At the European Union level, according to data provided by Eurostat, Romania ranks 6th in 2022 in terms of the area cultivated with vegetables, being outranked by countries such as Italy, Spain, France. In 2022, there will be a decrease of 11,28% in the area cultivated with vegetables compared to the previous year, with the highest shares in the North-East Region with 20%, followed by the South-Muntenia Region with 19%.

In the case of EU vegetable production, Spain, Italy and Poland are in first place, with Romania in 8th place with a production of 726 thousand tonnes of vegetables in 2022. In the case of vegetable production by development regions of Romania, in 2022, the first places for vegetable production were occupied by the South Muntenia region with 489,3 thousand tonnes, North-East with 440,4 thousand tonnes and South-East with 373,7 thousand tonnes. In 2010, Romania's vegetable production reached 1465 thousand tonnes, but by 2022, it had fallen to 726 thousand tonnes. According to projections made using SPSS software, vegetable production is expected to develop as follows: in 2030, production is expected to reach 750 thousand tonnes in the baseline scenario, 1200 thousand tonnes in the optimistic scenario and 400 thousand tonnes in the pessimistic scenario. As for the area under vegetables, in 2010, this totalled 170 thousand hectares, and by 2022, it has been reduced to 93 thousand hectares. According to the projections made in SPSS, the following figures are projected for the area under vegetables: in 2030, an area of 60 thousand hectares is estimated in the baseline scenario, 75 thousand hectares in the optimistic scenario and 40 thousand hectares in the pessimistic scenario. Agriculture faces continuous challenges and transformations, which require technological innovations and sustainable practices to adapt to the changing market.

ACKNOWLEDGEMENT

The work is part of the project, Grants Market Analysis Of The Vegetable Sector`, Phase 3/2023 of the Research Institute for Agricultural Economics and Rural Development.

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