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Changes in sowing structure of vegetable crops in Poland in 2018–2023

In recent years, Polish agriculture, including vegetable production, has undergone significant structural changes due to numerous economic, climatic and political factors. The aim of this article is to comprehensively analyse changes in the sowing structure of vegetable crops in Poland in 2018–2023, using data from the Central Statistical Office and the latest scientific literature. The study provides a detailed analysis of changes in the cultivated area of various vegetable species, including lettuce, spinach, radish, tomatoes, peppers, onions, and carrots. Key determinants influencing the structure of sowing include evolving climatic conditions, which necessitate adaptation to prolonged droughts or periods of intense rainfall, and amendments to the European Union's Common Agricultural Policy. Additionally, rising consumer awareness of environmental sustainability and the growing demand for healthy food have driven the expansion of vegetable crops with shorter growing cycles, such as baby leaf varieties (e.g., spinach and arugula) and lettuce. The analysis further highlights the role of technological advancements in transforming vegetable production, particularly through mechanization of harvesting processes and the adoption of innovative cultivation methods, such as the use of plastic tunnels. The findings suggest future trends in the vegetable production sector, emphasizing the increasing significance of organic farming and the promotion of local production to meet domestic market demands.

Keywords: sowing structure, vegetables, Poland, Central Statistical Office, agriculture, climate change

Zmiany w strukturze zasiewu roślin warzywnych w Polsce w latach 2018–2023

W ostatnich latach polskie rolnictwo, w tym produkcja warzyw, przeszły istotne zmiany strukturalne, wynikające z licznych czynników ekonomicznych, klimatycznych i politycznych. Celem tego artykułu jest kompleksowa analiza zmian w strukturze zasiewu roślin warzywnych w Polsce w latach 2018–2023, z wykorzystaniem danych Głównego Urzędu Statystycznego oraz najnowszej literatury naukowej. Szczegółowo omówiono zmiany powierzchni zasiewu różnych gatunków warzyw, takich jak: sałata, szpinak, rzodkiewka, pomidory, papryka, cebula i marchew. Kluczowymi czynnikami mającymi wpływ na strukturę zasiewów są m.in. zmieniające się warunki klimatyczne, które wymuszają adaptację do dłuższych okresów suszy lub intensywnych opadów, a także zmieniające się zasady funkcjonowania wspólnej polityki rolnej Unii Europejskiej. Ponadto wzrost świadomości ekologicznej konsumentów oraz rosnące zapotrzebowanie na zdrową żywność, które sprzyja dynamicznemu rozwojowi upraw warzyw o krótszym cyklu wegetacyjnym, takich jak *baby leaf* (szpinak, rukola) czy sałata. Analiza ukazuje także wpływ technologicznego postępu na produkcję warzyw zarówno w zakresie mechanizacji zbiorów, jak i rozwoju innowacyjnych metod uprawy, np. w tunelach foliowych. Wnioski z analizy wskazują na przewidywane przyszłe kierunki rozwoju sektora produkcji warzywniej, w tym wzrost znaczenia rolnictwa ekologicznego i lokalnej produkcji na potrzeby rynku krajowego.

Słowa kluczowe: struktura zasiewu, warzywa, Polska, Główny Urząd Statystyczny, rolnictwo, zmiany klimatyczne

Introduction

Vegetable production in Poland occupies a pivotal position within the domestic agricultural sector, serving as a significant source of income for both small-scale and large-scale farming enterprises. The structure of vegetable cultivation is undergoing dynamic transformations driven by a range of external factors, including climate change, European Union agricultural policies, evolving consumer preferences, and advancements in agricultural technology. In recent years, Polish agriculture has encountered growing challenges stemming from global economic trends and increasing environmental pressures, which have directly influenced crop selection and planting strategies¹.

A notable factor is the shift in consumer preferences toward more sustainable and health-conscious dietary choices. Rising interest in healthy lifestyles and plant-based diets has led to an expansion in the cultivation of vegetables such as tomatoes, peppers, and spinach,

¹ P. Nowicka, M. Zięba, *Wpływ polityki rolnej UE na zmiany struktury zasiewów w Polsce*, „Rocznik Ekonomii Rolnictwa” 2021, no. 29(1), pp. 56–68.

while traditional root crops like carrots and parsley have experienced a decline in production².

Climate changes, such as rising temperatures, decreasing rainfall and increasingly frequent droughts, also influenced the need to adapt sowing structures to new conditions. Farmers have begun to invest in modern technologies, such as cover crops, which allow for a more controlled production environment³. Tomatoes and peppers, due to their cost-effectiveness and flexibility, are becoming an increasingly popular choice, while root vegetables are suffering the negative effects of deteriorating soil and climatic conditions⁴.

Attention should also be paid to the European Union's policies, which, as part of the Common Agricultural Policy, promote sustainable agricultural practices and support organic farming. Programs such as the European Green Deal or the farm-to-table strategy emphasize the reduction of chemicals in agriculture and promote more environmentally friendly production methods, which naturally affects the structure of vegetable sowings in Poland⁵.

Polish agriculture is currently facing the challenge of further modernization, increasing productivity while adapting to changing economic and climatic conditions. This article analyses changes in the structure of vegetable sowings in Poland in 2018–2023 based on statistical data and scientific literature.

Materials and methods

The basis for the analysis was statistical data from the Central Statistical Office on the area of sown vegetable crops in Poland in 2018–2023⁶. In addition, agricultural reports and research literature studies on structural changes in agriculture and vegetable consumption trends were used⁷. Data were analysed for such vegetables as carrots, onions, tomatoes, peppers, lettuce, spinach, radishes and other species with a smaller share in the sowing structure.

Results and Discussion

Changes in the structure of vegetable sowings in Poland

Data from the Central Statistical Office show that there have been marked changes in the sowing structure of vegetable crops in Poland between 2018 and 2023. In some cases, such as tomatoes and peppers, there has been an increase in sown area, while declines have been observed in traditional root vegetables, such as carrots and parsley⁸. There has been

² K. Bartosz, *Preferencje konsumentów a zmiany w produkcji roślinnej w Polsce*, „Journal of Polish Agriculture” 2020, no. 14(4), pp. 89–101.

³ T. Smith, R. Johnson, *Climate Change Impact on Vegetable Yields in Central Europe*, “Journal of Agricultural Science” 2019, no. 67(3), pp. 211–225.

⁴ W. Szymański, *Wpływ zmian klimatycznych na rolnictwo w Polsce*, „Raport Instytutu Rolnictwa i Żywności” 2022, no. 38, pp. 79–91.

⁵ European Commission. *The Impact of the Common Agricultural Policy on Vegetable Production in Eastern Europe*, Brussels: European Commission, 2020.

⁶ Główny Urząd Statystyczny, *Produkcja roślinna w Polsce w latach 2018–2023*, GUS, 2023.

⁷ K. Bartosz, op. cit., pp. 89–101; T. Smith, R. Johnson, op. cit., pp. 211–225.

⁸ J. Wysocki, B. Michalska, *Struktura zasiewów warzyw ekologicznych w Polsce*, „Ekologiczne Rolnictwo w Praktyce” 2022, no. 31(1), pp. 12–26.

a noticeable growth in the cultivation of other vegetable species, which have gained in importance due to changing consumer preferences and the evolution of agricultural practices. This is especially true of the increase in the area planted to lettuce, baby leaf vegetables (spinach, arugula) and radishes.

Tomatoes and peppers are vegetables that have grown in popularity in recent years. CSO data shows that the area sown to tomatoes increased by about 15% between 2018 and 2023⁹. This is a result of growing demand for these vegetables, both in the domestic and foreign markets. Poland has become one of the most important exporters of tomatoes in the region, which is due, among other things, to technological advances in greenhouse cultivation¹⁰.

Root vegetables, such as carrots and parsley, have seen slight declines in planted area. In 2018, the area planted to carrots was about 18,000 hectares, and by 2023 it had fallen to 16,000 hectares¹¹. The main reasons for this trend are the changing preferences of consumers, who are increasingly turning to less traditional vegetables, as well as increasing competition from abroad¹².

Onions and cabbage hold significant cultural and culinary value within Polish gastronomic traditions; however, their cultivation patterns have also undergone notable transformations. The sown area of onions has decreased by about 10%, which may be related to difficulties caused by unfavourable climatic conditions and increasing competition from other European Union countries, such as Spain¹³.

Head lettuce, including butterhead lettuce, is gaining in importance, driven by growing demand for products that are easy to prepare quickly and often used in health-promoting and vegetarian diets. In Poland, the area planted to lettuce increased by about 15% between 2018 and 2023, which is related to the demand for fresh produce, especially for restaurants and the food service industry¹⁴. Lettuce is also increasingly grown in hydroponic systems and in plastic tunnels, which allows for quality control and increased crop yields¹⁵. There is also a trend of increasing popularity of packaged lettuce, which drives agricultural production of this vegetable.

Baby leaf vegetables such as spinach and arugula are gaining popularity in the Polish market due to their high nutritional value and wide use in cooking. Spinach, especially in the form of young leaves, and arugula are often used in salads, sandwiches and as a side dish, responding to the needs of consumers looking for healthy yet easy-to-prepare products¹⁶. Over the 2018–2023 period, the area planted to these vegetables increased by about 20%, mainly due to their growing popularity in both domestic and export markets¹⁷.

⁹ Główny Urząd Statystyczny, op. cit.

¹⁰ P. Dobrowolski, H. Gajewska, *Technologiczne innowacje w produkcji warzyw szklarniowych w Polsce*, „Journal of Horticultural Science” 2018, no. 22(3), pp. 98–112.

¹¹ Główny Urząd Statystyczny, op. cit.

¹² P. Nowicka, M. Zięba, op. cit., pp. 56–68.

¹³ W. Szymański, op. cit., pp. 79–91.

¹⁴ Ibidem.

¹⁵ P. Dobrowolski, H. Gajewska, op. cit., pp. 98–112.

¹⁶ K. Bartosz, op. cit., pp. 89–101.

¹⁷ T. Smith, R. Johnson, op. cit., pp. 211–225.

Changes in sowing structure of vegetable crops in Poland in 2018–2023

The growth of spinach and arugula crops is also being driven by the development of growing technologies under controlled conditions, such as cover crops and vertical systems¹⁸. This allows year-round production, which is important due to the seasonality of demand for these vegetables, as well as reducing the impact of adverse weather conditions on yields.

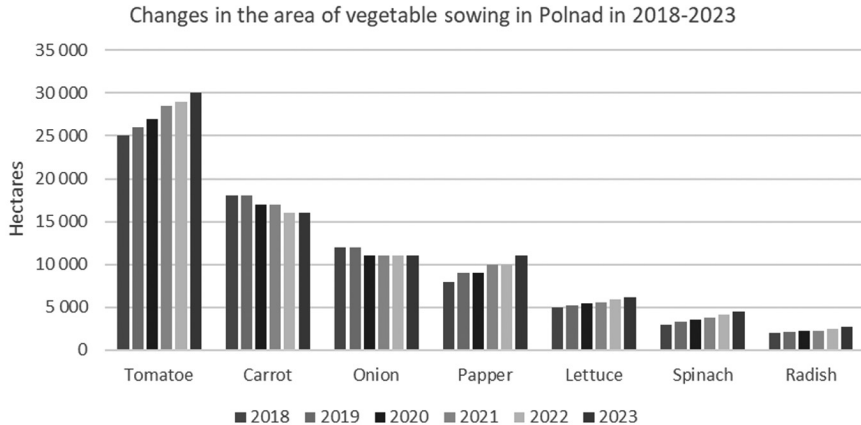


Figure 1. Changes in the area sown to tomatoes, carrots, onions, peppers, lettuce, spinach and radishes in 2018–2023¹⁹.

The chart above shows changes in the sown area of selected vegetables (tomatoes, carrots, onions, peppers, lettuce, spinach, radishes) in Poland in 2018–2023. It can be seen that the sown area of tomatoes, peppers, lettuce, spinach and radishes increased steadily, while the sown area of carrots and onions gradually decreased.

Below is a table that illustrates the increase in the sown area of tomatoes, peppers, lettuce, spinach and radish, and the decreases for carrots and onions in 2018–2023 (tab. 1).

Table 1. Increases in the area sown to tomatoes and peppers and decreases for carrots and onions over the past five years¹⁸

| Years | Tomatoes (ha) | Carrots (ha) | Onions (ha) | Peppers (ha) | Lettuce (ha) | Spinach (ha) | Radish (ha) |
|-------|---------------|--------------|-------------|--------------|--------------|--------------|-------------|
| 2018 | 25 000 | 18 000 | 12 000 | 8 000 | 5 000 | 3 000 | 2 000 |
| 2019 | 26 000 | 18 000 | 12 000 | 9 000 | 5 200 | 3 300 | 2 100 |
| 2020 | 27 000 | 17 000 | 11 000 | 9 000 | 5 400 | 3 500 | 2 200 |
| 2021 | 28 500 | 17 000 | 11 000 | 10 000 | 5 600 | 3 800 | 2 300 |
| 2022 | 29 000 | 16 000 | 11 000 | 10 000 | 5 900 | 4 100 | 2 500 |
| 2023 | 30 000 | 16 000 | 11 000 | 11 000 | 6 200 | 4 500 | 2 700 |

¹⁸ J. Kuś, P. Sikorski, *Nowoczesne technologie upraw warzyw w Polsce – Perspektywy rozwoju*, „Inżynieria Rolnictwa” 2019, no. 54(3), pp. 67–80.

Główny Urząd Statystyczny, op. cit.; P. Nowicka, M. Zięba, op. cit., pp. 56–68.

¹⁹ Główny Urząd Statystyczny, op. cit.; P. Nowicka, M. Zięba, op. cit., pp. 56–68.

*Factors affecting changes in sowing structure**Climatic changes*

Poland's climate has changed significantly in recent years, affecting the ability to grow some vegetable species. Droughts and periods of heavy rainfall have become more frequent, forcing farmers to adapt to the new conditions by choosing more hardy species²⁰. Vegetables with a short growing season, such as lettuce and radishes, gained ground, while traditional root species were more susceptible to changing weather conditions²¹. Developments in cover crop technology (tomatoes, peppers, lettuce, radishes) allow for increased productivity and production stability even under more difficult climatic conditions²².

European Union agricultural policy.

The European Union's agricultural policies, including direct subsidies and programs to support sustainable agriculture, have influenced farmers' decisions on sowing structure [European Commission 2020]. Support for organic farming and programs to promote a reduction in the use of agricultural chemicals have contributed to the growing popularity of organically grown vegetables, which has also influenced changes in sowing structure²³.

Consumer preferences.

The changing eating habits of Poles have also had a significant influence on the sowing structure. The growing popularity of vegetarian and vegan diets has contributed to an increase in demand for leafy vegetables such as lettuce and spinach, which in turn has increased their sowing area²⁴.

Radish is another vegetable whose cultivation has seen growth in Poland in recent years. The area sown to radish increased by about 10% between 2018 and 2023²⁵. Radish is relatively easy to grow and has a short growing cycle, making it an attractive choice for farmers, especially those with smaller acreage. Due to its nutritional and low-calorie properties, radish is valued by consumers concerned with a healthy diet, which translates into a growing demand for this product²⁶. Radish is also readily grown under cover, allowing for an earlier start to the season and a longer harvest period. This makes it available on the market for most of the year, which contributes to its growing popularity in retail and wholesale²⁷.

Analyzing changes in the sowing structure of vegetable crops in Poland in 2018–2023, we can see several important trends that have long-term implications for domestic agricul-

²⁰ T. Smith, R. Johnson, op. cit., pp. 211–225.

²¹ T. Małecki, *Ekologiczne rolnictwo warzywne w Polsce: Trendy i wyzwania*, „Polska Agronomia” 2019, no. 11(3), pp. 45–60.

²² P. Nowicka, M. Zięba, op. cit., pp. 56–68.

²³ J. Wysocki, B. Michalska, op. cit., pp. 12–26.

²⁴ K. Bartosz, op. cit., pp. 89–101.

²⁵ Główny Urząd Statystyczny, op. cit.

²⁶ T. Małecki, op. cit., pp. 45–60.

²⁷ W. Szymański, op. cit., pp. 79–91.

ture. The increase in the sown area of some vegetables, such as tomatoes and peppers, versus the decreasing sown area of traditional root vegetables, is due to a combination of factors, including climate change, changes in consumer preferences, technological advances and European Union agricultural policy.

Impact of climate change

Changing climatic conditions in Poland are increasingly influencing agriculture. An increase in the frequency of extreme weather events, such as prolonged droughts and intense rainfall, is prompting farmers to change their production strategies. Traditional root vegetables such as carrots and parsley, which require regular irrigation and are sensitive to changes in soil moisture, are losing ground²⁸. In contrast, vegetables grown under cover, such as tomatoes and peppers, which are less dependent on weather conditions, are seeing an increase in popularity²⁹.

Greenhouse crops are resistant to climatic extremes, making them more predictable and profitable. The example of increasing tomato planting area (from 25,000 hectares in 2018 to 30,000 hectares in 2023) shows that Polish farmers are successfully adapting to changing conditions³⁰. Tomatoes, due to their short growing cycle and ability to be grown under controlled conditions, can be considered a more stable agricultural investment in unstable times²⁶.

Technological advances and structural changes

Modern technologies, especially in the cover crop sector, have played a key role in shaping the current structure of vegetable planting in Poland. The introduction of advanced irrigation systems, precision agriculture, and automated climate control systems in greenhouses allows for more efficient use of resources and minimization of weather-related risks³¹. Investments in modern technologies have enabled farmers to increase the productivity and profitability of crops such as peppers, which explains the 30% increase in their sown area during the period under review.

Structural changes in Polish agriculture also contribute to shifting priorities in vegetable production. The reduction in the number of small farms and the concentration of production in larger, mechanized farms has influenced greater specialization and optimization of crops³². Such changes favor crops that require more advanced technologies, resulting in an increase in the importance of cover crops.

Consumer preferences and the domestic market

Over the past few years, Poland has seen an increase in the popularity of vegetarian and vegan diets and healthy lifestyles. Changes in dietary habits have significantly affected the demand for various types of vegetables, which has directly translated into the structure of sowings³³. Increasing demand for leafy vegetables, such as spinach and lettuce, and vita-

²⁸ T. Smith, R. Johnson, op. cit., pp. 211–225.

²⁹ P. Nowicka, M. Zięba, op. cit., pp. 56–68.

³⁰ Główny Urząd Statystyczny, op. cit.

³¹ P. Dobrowolski, H. Gajewska, op. cit.

³² J. Wysocki, B. Michalska, op. cit., pp. 12–26.

³³ K. Bartosz, op. cit., pp. 89–101.

min-rich vegetables, such as tomatoes and peppers, is causing farmers to decide to expand the sowing area of these crops.

Changing consumer demand also affects export destinations. As a large producer of vegetables in Central and Eastern Europe, Poland is benefiting from the growing interest in healthy food on international markets, especially in Western European countries³⁴. Exports of vegetables such as tomatoes, onions and peppers are growing steadily, which also encourages Polish farmers to increase their planting of these crops.

European Union agricultural policy

The actions of the European Union's Common Agricultural Policy have also had a significant influence on changes in sowing patterns. Direct subsidies and support for organic farming promote more sustainable forms of production³⁵. Current policies encourage farmers to invest in modern technologies that reduce the negative impact of crop production on the environment, which in turn promotes vegetable crops with less use of chemical fertilizers and pesticides. In addition, the European Union's policies are aimed at increasing energy efficiency in agriculture and support for environmentally friendly technologies, which has led to an increase in organic farming in Poland. This phenomenon explains the growing interest in growing organic vegetables, which have gained popularity both in the domestic market and for export³⁶.

Conclusions

The structural changes in vegetable sowing patterns in Poland from 2018 to 2023 were influenced by both climatic and economic factors. The observed increase in the cultivation of tomatoes, peppers, lettuce, spinach, and radishes, alongside a decline in the production of carrots and onions, reflects shifting consumer preferences and the necessity to adapt to evolving environmental conditions. Enhanced mechanization, increased production specialization, and the rising demand for high-value vegetable varieties highlight the trajectory of Polish vegetable agriculture in the coming years. Looking ahead, a critical challenge for the vegetable production sector in Poland will be the continued adaptation to the dual pressures of changing climatic conditions and dynamic market demands, ensuring sustainable and resilient agricultural practices.

REFERENCES

- Adamczyk Z., *Analiza ekonomiczna zmian w produkcji warzyw w Polsce*, „Ekonomia i Zarządzanie Rolnictwem” 2021, no. 40(2).
- Bartosz K., *Preferencje konsumentów a zmiany w produkcji roślinnej w Polsce*, „Journal of Polish Agriculture” 2020, no. 14(4).

³⁴ M. Grabowski, *Wzrost eksportu warzyw z Polski do krajów Unii Europejskiej*, „Przegląd Rolniczy” 2020, no. 8(2), pp. 47–59.

³⁵ European Commission, *The Impact of the Common Agricultural Policy on Vegetable Production in Eastern Europe*, Brussels: European Commission, 2020.

³⁶ J. Wysocki, B. Michalska, op. cit., pp. 12–26.

Changes in sowing structure of vegetable crops in Poland in 2018–2023

- Dobrowolski P., Gajewska H., *Technologiczne innowacje w produkcji warzyw szklarniowych w Polsce*, „Journal of Horticultural Science” 2018, no. 22(3).
- European Commission, *The Impact of the Common Agricultural Policy on Vegetable Production in Eastern Europe*, Brussels: European Commission. 2020.
- Grabowski M., *Wzrost eksportu warzyw z Polski do krajów Unii Europejskiej*, „Przegląd Rolniczy” 2020, no. 8(2).
- Główny Urząd Statystyczny, *Produkcja roślinna w Polsce w latach 2018–2023*, GUS, 2023.
- Kowalski J., Nowak A., *Zmiany w strukturze zasiewów warzyw w Polsce*, „Studia Agronomiczne” 2020, no. 45(2).
- Król M., *Wyzwania ekologiczne w produkcji rolniczej – Przykład Polski*, „Polska Ekologia Rolnictwa” 2020, no. 29(3).
- Kuś J., Sikorski P., *Nowoczesne technologie upraw warzyw w Polsce – Perspektywy rozwoju*, „Inżynieria Rolnictwa” 2019, no. 54(3).
- Małecki T., *Ekologiczne rolnictwo warzywne w Polsce: Trendy i wyzwania*, „Polska Agronomia” 2019, no. 11(3).
- Nowicka P., Zięba M., *Wpływ polityki rolnej UE na zmiany struktury zasiewów w Polsce*, „Rocznik Ekonomii Rolnictwa” 2021, no. 29(1).
- Smith T., Johnson R., *Climate Change Impact on Vegetable Yields in Central Europe*, „Journal of Agricultural Science” 2019, no. 67(3).
- Szymański W., *Wpływ zmian klimatycznych na rolnictwo w Polsce*, „Raport Instytutu Rolnictwa i Żywności” 2022, no. 38.
- Wysocki J., Michalska B., *Struktura zasiewów warzyw ekologicznych w Polsce*, „Ekologiczne Rolnictwo w Praktyce” 2022, no. 31(1).
- Zieliński R., *Analiza opłacalności upraw warzyw w Polsce w latach 2018–2021*, „Ekonomia Rolnictwa” 2021, no. 56(2).