

# TOWARDS SUSTAINABLE AGRICULTURE: A COMPARATIVE ANALYSIS OF ORGANIC CROP AREA IN CZECHIA, POLAND, SLOVAKIA, AND HUNGARY

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This study analyzes the trends and growth trajectories of organic farming in the Visegrad Four (V4) countries – Czechia, Poland, Slovakia, and Hungary – over the period from 2018 to 2022. Amidst increasing environmental and social challenges, organic farming has emerged as a sustainable agricultural alternative in response to climate change, pollution, and biodiversity loss. The research examines the total agricultural areas of each country, highlighting the percentage of land dedicated to organic farming and its evolution over the specified period. Findings reveal that while Czechia maintains the largest organic farming area, Hungary demonstrates the most significant growth rate, suggesting a shift towards sustainable practices. Ultimately, this study provides valuable insights into the potential for expanding organic farming within the V4 region, emphasizing its role in achieving sustainable rural development and ecological balance.

**Keywords:** organic farming, Visegrad four, sustainability, organic crop area

## Introduction

Recent social and environmental challenges, such as climate change, pollution, and biodiversity loss, have led to a significant shift in European agricultural policy towards sustainability (Gaál and Tornay, 2024). In response to these pressing issues, organic farming has emerged as a viable alternative, recognized for its environmentally friendly practices that enhance agroecosystem health by promoting biodiversity and biological cycles (Kings and Ilbery, 2012).

Organic farming emphasizes management practices that minimize reliance on chemical inputs and prioritize local adaptation. This approach not only improves health and safety by reducing contamination and pesticide residues but also supports small farms and local economies (Canwat and Onakuse, 2022). With the European Union's ambitious goals to expand organic farming to cover at least 25% of its agricultural land by 2030, organic agriculture has become increasingly integral to achieving sustainable food systems (Vergely et al., 2024).

This study aims to analyze and compare organic farming areas within the Visegrad Four (V4) countries – Czechia, Poland, Slovakia, and Hungary – from 2018 to 2022. By identifying trends and growth patterns in organic farming practices relative to the total agricultural area in each country, the analysis seeks to provide insights into the agricultural capacity and potential for organic farming expansion in the V4 region. We will assess the organic farming area and calculate its percentage share of the total agricultural area, examine changes over the observed period, and visualize these findings to highlight trends in organic farming across the V4 countries.

## Theoretical Background

In recent years, social and environmental issues such as climate change, pollution, soil degradation, biodiversity loss, and rural inequalities have prompted a notable shift in European agricultural policy towards sustainability (Gaál and Tornay, 2024). As highlighted by Mwangi et al. (2024), challenges posed by population growth and climate change have underscored the need for more intensive agricultural practices. In this context, organic farming

has emerged as a promising alternative due to its environmentally friendly production methods.

Organic farming, as defined by Kings and Ilbery (2012), is a holistic production management system that enhances the health of the agroecosystem, promoting biodiversity, biological cycles, and soil biological activity. This approach prioritizes management practices over reliance on off-farm inputs and recognizes that agricultural systems must be locally adapted to specific regional conditions. Additionally, Canwat and Onakuse (2022) emphasize that organic farming improves health and safety by minimizing contamination and pesticide residues, reducing antibiotic resistance, and mitigating occupational health risks associated with chemical pesticides. Innovations in organic farming practices are not only environmentally sustainable but also enhance soil fertility, minimize soil erosion, decrease the risk of pesticide-induced water pollution, provide superior ecosystem services compared to conventional farming, and utilize less energy.

According to Niether et al. (2023), organic farming operates under agroecological and systemic principles, fostering supportive interactions among plants, animals, soil, and the atmosphere, with each farm functioning as a systemic unit. In line with this, Puech et al. (2014) note that organic farmers implement practices such as longer crop rotations and mechanical weed removal to compensate for the restricted use of chemical inputs. Furthermore, organic farming often prioritizes biological pest control through natural predators, which is viewed as a potential method for reducing pesticide use.

Canwat and Onakuse (2022) say that the practices inherent in organic farming also address health and environmental issues linked to conventional technologies. They contribute to the preservation of small farms and local traditions, support animal welfare, and strengthen local economies by decreasing market dependency. The emphasis on diversity, soil health, and integration of various components within agricultural systems promotes greater self-sufficiency regarding agricultural inputs, thus reducing farmers' reliance on corporate agro-input suppliers.

Puech et al. (2014) regard organic farming as a promising production model that effectively addresses the challenges posed by modern agriculture. Vergely et al. (2024) argue that to effectively tackle pressing environmental

and climate issues, agri-food systems must undergo significant transformations. This transformation is essential for sustainably feeding the global population, minimizing reliance on non-renewable resources, and safeguarding ecosystems. Organic agriculture (OA) has been recognized as a viable solution for achieving these objectives. The European Union's action plan (2021/2239(INI)), part of its „Green Deal“ initiative, outlines goals for establishing a sustainable food system, which includes reducing nutrient surpluses by at least 50%, cutting fertilizer usage by at least 20%, and expanding organic farming to encompass at least 25% of the EU's agricultural land by 2030, an increase from the current 9.9%. The prohibition of synthetic fertilizers in organic agriculture promotes sustainable food consumption as outlined in agricultural policies.

Zhen et al. (2024) further assert that sustainable agriculture presents a viable means of feeding the expanding global population while respecting ecological limits. Despite the environmental advantages of sustainable practices, only 9% of global agricultural land is currently dedicated to these methods. Organic agriculture, which adheres to specific standards, has emerged as a sustainable alternative to conventional practices, experiencing significant growth in recent decades. Nonetheless, in 2021, organic farming constituted only 1.6% of global agricultural land.

Borghino et al. (2024) contend that the ongoing intensification and specialization of agriculture over the past 50 to 60 years have resulted in numerous adverse environmental effects. This raises critical questions about whether the global food system can sustain food security without breaching ecological sustainability limits, particularly as the demand for calorie-dense and meat-heavy diets rises. Consequently, organic agriculture is increasingly gaining consumer attention and support from policymakers.

Bhattacharya et al. (2024) describe organic farming as a sustainable crop production approach that avoids chemical substances. Significant research in this area has been conducted over the past few decades, driven by consumer demand for organic products that are cultivated through safer and healthier practices. The Food and Agriculture Organization (FAO) defines organic agriculture as a comprehensive production management system that enhances the health of agroecosystems, including biodiversity, biological cycles, and soil biological activity.

Markuszczyńska and Kubacka (2017) characterize organic farming as a management system closely tied to the natural environment's quality. This system not only focuses on organic food production but also aims to protect various environmental components. Organic practices enhance soil fertility by increasing soil organic matter, thereby decreasing reliance on external inputs. Moreover, organic farming can provide essential ecosystem services by promoting biodiversity and positively influencing landscapes. Many European nations view organic farming as the future of sustainable agriculture, with a notable increase in organic management areas across most EU countries, likely driven by direct financial support for the sector.

Wiśniewski, Biczkowski, and Rudnicki (2021) state that the growth of organic farming is a result of environmental, social, and economic changes, particularly within the agri-food system. By employing modern agricultural practices, organic farming improves soil fertility, enhances crop biological quality, and supports biodiversity. The primary objectives of organic farming include eliminating chemical use in agriculture and achieving a balance between environmental sustainability and economic demands.

In conclusion, according to Pařšová et al. (2014), organic farming represents a promising agricultural approach that positively impacts the environment while addressing various economic and social factors, thereby supporting sustainable rural development and safeguarding all environmental components. This paradigm shift toward organic practices

highlights the potential for a more sustainable future in agriculture, aligning economic viability with ecological health.

According to Kowalska and Gurkova (2020) the countries of the Visegrad Group have very good conditions for switching their farms to organic farming. Chemization and mechanization in rural areas of these countries took place to a much lesser extent in contrast to the countries of the old European Union. Therefore, most of the land available in these areas can be quickly and easily adapted to the requirements of organic farming.

### Organic Farming in Poland

In Poland, according to Markuszczyńska and Kubacka (2017) organic agriculture began to develop in the early 1980s, when Mieczysław Górny and his team, along with experts from the Demeter Association, conducted courses on bio-dynamic and alternative farming systems in various cities. Following the fall of the Iron Curtain, the shift from a socialist to a market economy facilitated the development of ecological farms. The evolution of ecological agriculture in Poland can be divided into three key stages. The first stage was triggered by the EU accession process that began in 1997, making Poland eligible for European funds and financial assistance. During the second stage (1999–2003), legal regulations were established, and financial support for ecological farming was introduced, resulting in a substantial increase in the number of ecological farms and a fourfold expansion of cultivation areas, although by 2003, ecological farms represented only 0.11% of all farms and 0.3% of the total agricultural land. The third stage began after Poland's full EU membership in May 2004, when agri-environmental programs and support systems for organic farming were implemented, leading to further growth in the number of ecological farms due to increased financial incentives.

In Poland, according to Nowak and Jadczyński (2020) as at December 31, 2015, there were 23,015 organic producers active in the field of organic farming. The most numerous group among all organic producers were agricultural producers engaged exclusively in plant production. 22,277 entities (i.e. 96.8% of all organic producers) were active in this area. Analyzing the data on the number of organic producers, 2015 was another year after 2014, when a decrease in the total number of organic producers was recorded, but in 2016 a reverse tendency was noted – an increase of 1.6% was recorded.

### Organic Farming in Czech Republic

As Moschitz and Stolze (2010) state, organic agriculture began to emerge in the Czech Republic in the early 1990s, following the end of the Iron Curtain, which led to a shift from socialist to capitalist political systems, establishing multi-party parliamentary democracies. The most significant catalyst for the development of organic farming policies in the Czech Republic was the EU accession process that commenced in 1997. The goals of the Czech organic farming policy are clearly outlined in the "Action Plan of the Czech Republic for the Development of Organic Farming until 2010." Through this support, the Czech government aims to ensure the sustainability of organic farms and promote organic farming as a viable source of income in rural areas. Additionally, the policy seeks to enhance the competitiveness of Czech agriculture within the EU, expand the market for organic products, and improve the efficiency of organic food production and processing. Furthermore, it aims to build public trust in organic farmers and envisions improvements in consulting, education, and research.

The importance of organic farming in the Czech Republic according to Krause and Machek (2018) can be illustrated by a quite high proportion in the whole agricultural land area. The share of organic farms in the agricultural land in the selected EU countries – Czech Republic occupies the fourth place

within the European Union (13%). Only Austria (with 18%), Sweden (with 16%) and Estonia with (15%) have a greater share of the organic farms area. Poland, despite a larger utilized agricultural area than the Czech Republic, has according to Kowalska, Gurkova and Kovárník (2020) a significantly smaller share of organic farming. In 2018, the share of organic farming area in Poland was only 3.3% of arable land, while in the Czech Republic it was nearly 15%. In the Czech Republic, a growing interest of agricultural producers in converting their holdings to organic farming is evident throughout the period 2000-2018. In the Czech Republic, both the crop area and the number of producers and processors of organic food increased, while in Poland has been visible a systematic decrease in the area of crops and the number of organic producers since 2014. In Poland, in the whole analyzed period, increased only the number of organic food processors, although for many years they were a bottleneck in the national organic food distribution channel.

### Organic Farming in Hungary

According to Organic Targets 4EU, the organic sector in Hungary has experienced significant growth over the past two decades. The development of this sector is largely driven by the opportunities presented by EU membership, such as subsidies and access to markets. Nevertheless, several critical barriers continue to impede Hungary's ability to fully realize its organic potential. These barriers include:

1. a strong export focus on organic production (primarily raw materials);
2. comparatively high political and financial support for conventional agriculture, particularly given;
3. the high costs associated with certification and relatively low income for farmers. Moreover;
4. consumer awareness;
5. domestic demand – especially for organic inputs – remain insufficiently developed.

Additionally, there is a 6. lack of coordination and collaboration among key actors in the organic sector and a general absence of a cooperative culture. Issues specific to farmers, such as aging populations and inadequate agricultural education, further exacerbate these challenges.

The number of organic farmers has, according to Alfoldi (2020), grown more than threefold during the last 15 years (from 1.551 in 2005 to 5.136 in 2019), and their cumulative area was more than doubled (from 123.536 in 2005 to 303.190 in 2019) as these are registered by the Hungarian Central Statistics Office (HCSO, 2020). The average size of an organic farm was 81.3 hectares during the 10 years lasting from 2005 to 2014 but fell considerably to an average of 57.5 hectares during the 5 years from 2015 to 2019. Hungarian farmers have positive opinions about and supportive attitudes toward organic agriculture, although only a part of them are in fact organic farmers. However, there is a considerable lack in their information and knowledge about it, which hamper a well-funded opinion to be formed. This highlights the importance of better and more widely distributed reliable information about the wide-scale scientific results of organic agriculture in general and its diverse methods in particular.

### Organic Farming in Slovakia

According to Palšová et al. (2014), organic farming has been practiced in Slovakia since 1991, with a notable increase in activity following the country's accession to the EU. This was due to commitments to expand the area of land used for organic farming and the availability of subsidies for establishing and maintaining organic production. These financial incentives played a crucial

role, particularly in 2004 and between 2008–2009, significantly influencing the number of active organic farmers. Although Slovakia has favorable natural conditions for organic farming, factors hindering the transition from conventional to organic farming still exist. The study found that financial incentives, supported by the EU's funding framework, remain the primary motivator for farmers. Additionally, it is important for Slovakia to enhance state support for marketing organic products, provide better advisory services, and improve the promotion of organic farming.

According to European Commission (2023) the Slovak Rural Development Programme (RDP) was officially approved by the European Commission on February 13, 2015, with its most recent revision occurring on April 27, 2023. This program primarily aims to enhance the competitiveness of the agriculture and forestry sectors. Additionally, it seeks to promote organic farming practices, providing support for 150,000 hectares, while also sustaining agricultural activities in regions facing natural and other specific farming constraints.

### Aim, Material and Methods

The aim of this study is to analyze and compare the organic farming areas within the Visegrad Four (V4) countries – Czechia, Poland, Slovakia, and Hungary – from 2018 to 2022. This analysis seeks to identify trends, variations, and growth patterns in organic farming practices in relation to the total agricultural area available in each country. By examining these trends, the study aims to provide insights into the agricultural capacity and potential for organic farming expansion in the V4 region.

We will compare the total agricultural area and the organic farming area for each country. Calculate the percentage share of organic farming in relation to the total agricultural area for 2018, analyze the changes in organic farming areas from 2018 to 2022, identify absolute and relative growth rates for each country, and create tables and graphs to visualize the data and highlight trends in organic farming practices across the V4 countries over the observed period. The results of the analysis will be summarized, and recommendations will be made based on the findings.

### Results and Discussion

The following table shows the total agricultural area for the Visegrad Four countries (Czechia, Poland, Slovakia, and Hungary) in 2018, measured in hectares. For tracking organic farming areas from 2018–2022, data for the total agricultural area in these countries was only available for 2018 from Eurostat. However, for the purposes of this contribution and to give a general understanding of each country's agricultural land, this information is considered sufficient.

**Table 1** Agricultural area of V4 countries in 2018 (ha)

	2018
Czechia	3,873,900
Poland	15,725,300
Slovakia	1,994,600
Hungary	5,658,800

Source: own processing, according to Eurostat

The table above is showing the total agricultural area in hectares for four Central European countries, countries of Visegrad Four in year 2018. According to this, Poland has the largest agricultural area with 15,725,300 hectares, followed by Hungary with 5,658,800 hectares. Czechia's agricultural area

**Table 2** The share of organic crop area in agricultural area in 2018

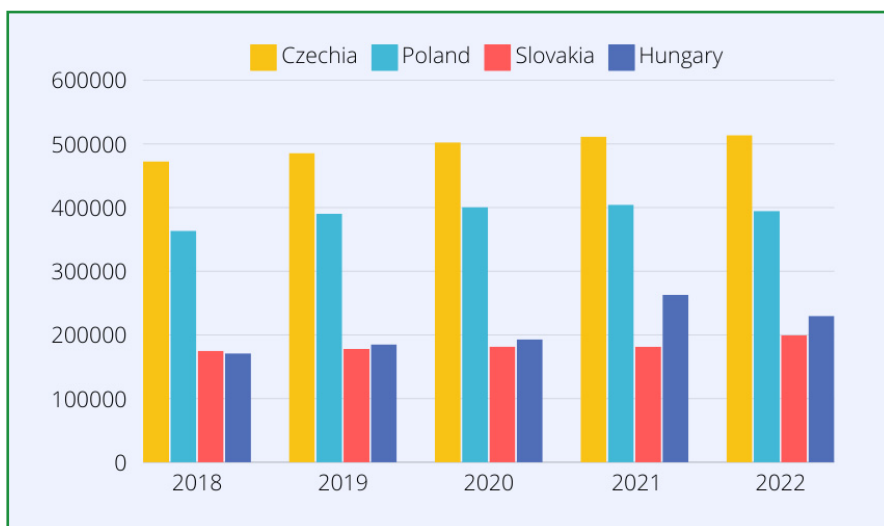
	Agricultural area (ha)	Organic crop area (ha)	Organic crop area (%)
Czechia	3,873,900	472,783	12.20
Poland	15,725,300	363,564	2.31
Slovakia	1,994,600	175,099	8.78
Hungary	5,658,800	171,112	3.02

Source: own processing, according to Eurostat

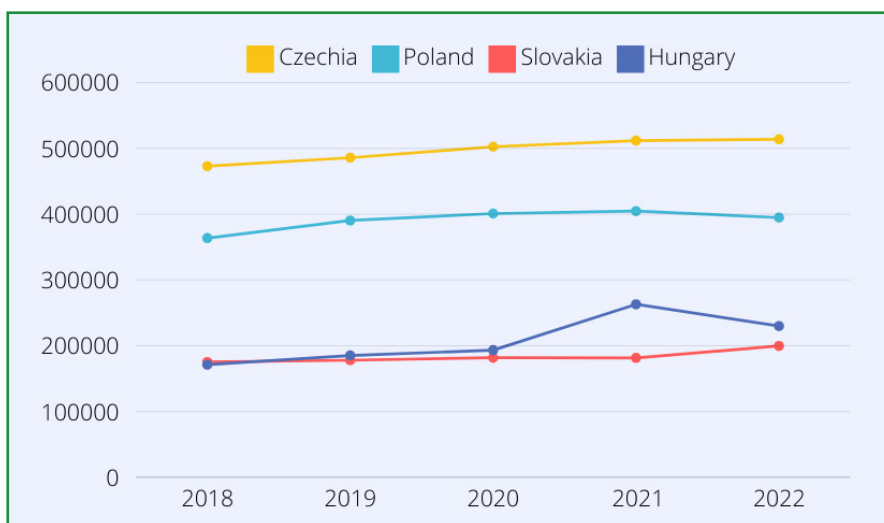
**Table 3** Organic crop area in V4 countries, 2018 – 2022

	2018 (ha)	2019 (ha)	2020 (ha)	2021 (ha)	2022 (ha)	2022 vs 2018 (ha)	2022 vs 2018 (%)
Czechia	472,783	485,794	502,513	511,701	513,773	40,990	8.67
Poland	363,564	390,274	400,849	404,554	394,744	31,180	8.58
Slovakia	175,099	177,921	181,742	181,475	199,675	24,576	14.04
Hungary	171,112	185,227	193,215	262,906	229,870	58,758	34.34

Source: own processing, according to Eurostat

**Figure 1** Organic crop area in V4 countries, 2018 – 2022 (ha)

Source: own processing, according to Eurostat

**Figure 2** Organic crop area development in V4 countries, 2018 – 2022 (ha)

Source: own processing, according to Eurostat

is 3,873,900 hectares, while Slovakia has the smallest area, 1,994,600 hectares. This data provides a snapshot of the extent of agricultural land in each country, which is essential for understanding their agricultural capacity and potential for organic farming expansion.

To better understand the organic farming areas in each Visegrad Four country throughout the observed period of 2018–2022, we will first compare the total agricultural area of these countries in 2018 with the organic farming area presented in the table below.

As we can see in the table above and as mentioned previously, the largest amount of agricultural land in 2018 was found in Poland, followed by Hungary, the Czech Republic, and finally Slovakia. However, when it comes to the area farmed organically, the most hectares in 2018 were in the Czech Republic, followed by Poland, Slovakia, and then Hungary. For objectivity, we compared the area farmed organically with the total agricultural area and found that the highest share of organic farming was in the Czech Republic, at 12.20%, followed by Slovakia with 8.78%, Hungary with 3.02%, and finally Poland with 2.31%.

In the table above, we can see the number of hectares using organic methods in the V4 countries, namely the Czech Republic, Poland, Slovakia, and Hungary, for the period from 2018 to 2022. As we can see, overall, all countries showed positive growth in organic farming area over this period.

The organic crop area in the Czech Republic increased from 472,783 ha in 2018 to 513,773 ha in 2022, which is an absolute increase of 40,990 hectares. In relative terms, this represents an 8.67% growth.

In Poland, there was also growth in the number of hectares under organic farming throughout the entire period, from 363,564 hectares in 2018 to 394,744 hectares in 2022. This is an increase of 31,180 hectares, which in relative terms represents a growth of 8.58%. Compared to all the other monitored countries during the observed period, this is the lowest increase compared to other countries of Visegrad's four.

The area of agricultural land managed organically in Slovakia increased during the observed period from 175,099 hectares in 2018 to 199,675 hectares in 2022, representing a rise of 24,576 hectares, or 14.04%.

The largest increase in the area managed organically during the observed period among the V4 countries is recorded in Hungary, where the organically managed area grew from 2018 to 2022 by 58,758 hectares to reach 229,870 hectares, representing an increase of 34.34%.

The graph illustrates the organic crop area (in hectares) for four Central European countries – Czechia, Poland, Slovakia, and Hungary – over the period from 2018 to 2022.

The analysis of organic crop areas in the V4 countries – Czechia, Poland, Slovakia, and Hungary – reveals distinct trends and variations in organic farming practices over recent years.

Czech Republic consistently maintains the largest organic crop area among the four countries throughout the observed period. The area has exhibited slight fluctuations, peaking around 2019 and again in 2021, before stabilizing in 2022.

Poland holds the position of having the second-largest organic crop area, the country experienced a steady increase in organic land from 2018 to 2021, indicating a positive trend toward organic farming practices. However, this growth was followed by a slight decrease in 2022, suggesting potential challenges or shifts in agricultural focus.

Slovakia, on the other hand, has the smallest organic crop area compared to the other countries, remaining relatively stable throughout the period, showing a slight decline in 2019 but recovering slightly in 2022.

Hungary demonstrates a noticeable increase in organic crop area from 2018 to 2021. Although there was a minor decline in 2022, the organic area remains above the initial values from 2018, reflecting a growing emphasis on organic farming in the country.

## Conclusion

Despite a significant increase in the area of organic farming in Poland, according to Kowalska and Gorkowa (2020) the share of the area of these crops in relation to the total area of agricultural crops in the country is small. In this respect, organic farming is developing very dynamically in the Czech Republic, where organic farming accounted for almost 15% of the agricultural area in 2018. The largest farms (in 2018 that was on average 350 ha) were in Slovakia, but a significant reduction in the average size of a farm took place mainly in the Czech Republic. In the Czech Republic, the area of organic farms decreases annually by almost 14 ha. Due to the requirements for organic farms, among others regarding biodiversity, the right proportions between plant and animal production, as well as the lack of chemical fertilizers and limitation of mechanization makes smaller farms easier to manage.

In summary, organic farming has emerged as a vital strategy in addressing the social and environmental challenges facing European agriculture today, including climate change, pollution, and biodiversity loss (Gaál and Tornay, 2024; Mwangi et al., 2024). By emphasizing sustainable practices that enhance soil health, promote biodiversity, and minimize reliance on chemical inputs, organic farming not only supports ecological

integrity but also addresses public health concerns related to pesticide use (Kings and Ilbery, 2012; Canwat and Onakuse, 2022).

The comparative analysis of organic farming areas within the Visegrad Four (V4) countries – Czechia, Poland, Slovakia, and Hungary – between 2018 and 2022 reveals significant growth trends across the region. Notably, the Czech Republic leads in organic farming area and percentage share of total agricultural land, while Hungary exhibits the most substantial relative growth over the observed period. In contrast, Poland, despite having the second-largest organic area, experienced a slight downturn in 2022, indicating potential challenges in maintaining momentum (Zhen et al., 2024).

These findings underscore the potential of organic farming to contribute to sustainable rural development and strengthen local economies while mitigating the environmental impacts of conventional agricultural practices. As the demand for organic products continues to rise, the support from EU policies, such as the „Green Deal“ initiative, will be crucial for expanding organic farming across the V4 countries (Vergely et al., 2024).

Ultimately, the success of organic agriculture in the V4 region will depend on continued investment in research, education, and infrastructure to address the barriers that hinder its growth, as well as fostering collaboration among stakeholders. The insights drawn from this analysis can inform future policy decisions and strategies aimed at promoting organic farming as a cornerstone of sustainable agriculture in Europe.

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